A New Ontology for the Social Sciences.

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One of the most important contributions which the philosophy of science can make to sociologists, economists, and anthropologists is to help them elucidate the types of entities which their theories postulate as existing. In other words, philosophers can help to make clear the ontological commitments of a particular theory of society. In addition, given that the philosophy of science must also deal with the worlds of physics and biology, it can bring to the analysis of social ontology resources developed in other branches of science. This may be, of course, a mixed blessing given the danger of reductionism inherent in any transfer of concepts from one branch of science to another. This danger, however, can be minimized by blocking in advance the possible reductionist arguments which would make borrowings from biology and physics unacceptable to social scientists. The crucial idea in this blocking strategy is to construct an ontology around the basic notion of emergent property, that is, a property of a whole that is more than the sum of its parts, hence irreducible to those parts. Once it becomes clear that chemical properties cannot be reduced to the underlying physical processes from which they emerge, or that biological properties cannot be reduced to chemistry, the temptation to reduce psychological, sociological or economical properties to those of biology can easily be avoided.

Having said that, let me describe the theoretical resources I will use. The first step in the construction will be to eliminate certain entities as candidates for a serious materialist ontology. These unacceptable entities include first of all transcendental essences, eternal archetypes existing in disembodied form in some Platonic heaven. This move is, I am sure, fairly unobjectionable given the strong anti-essentialist mood that has prevailed in the last few decades in many intellectual circles. But in addition to essences there are other closely related types of being which also need to be eliminated as potential candidates. A good example is general categories, or as philosophers refer to these, abstract classes. To say that there is no room in a materialist ontology for abstract general entities is not, of course, to suggest that there is not a legitimate role for generalizations within a particular field of science. It is rather to oppose the reification of these categories into actual beings, as opposed to consider them merely useful conceptual devices playing a legitimate role in practices of classification. Let me give a concrete example of what would replace essences and abstract classes in my proposed ontology.

For centuries biological species were one of the main examples of a general category. Whether one thought of these categories as defined by a transcendental essence, as Plato did, or by an immanent "natural state" as did Aristotle, animal and plant species provided the exemplar of what an abstract general entity was supposed to be. {1} Charles Darwin, of course, broke with this tradition by showing that species, far from being eternal archetypes, are born at a particular historical time and die through extinction in an equally historical way. In the twentieth century this break with the traditional view became even more pronounced when some biologists realized that species may be considered to be individuals, not kinds. {2}

Although the term "individual" is normally used to refer to organisms, its application to species is not metaphorical. Used in its ontological sense the term applies to any entity which is the

product of a historical individuation process. In the case of species, for instance, this individuation involves the double process of natural selection and reproductive isolation. That is, a species accumulates the anatomical and behavioral traits that constitute its identity as part of a contingent historical process of selection, in which mates, predators, parasites, climate and topographical patterns all play a role. In addition, a new species is born when a portion of an old species becomes unable to mate with the rest, thus guaranteeing the durability of the accumulated traits and their stability against genetic flows from the outside. The genetic closure effected by reproductive isolation is as contingent as the multiple factors that constitute selection pressures: anything that breaches the genetic, mechanical or geographical barriers maintaining this isolation will compromise the enduring genetic identity of a species. However, despite the fact that the term "individual" can be thus correctly applied to species it still carries with it a host of connotations which must be eliminated. Besides its association with organisms, it also carries connotations of individual personhood, with its linkages to problems of consciousness, free will and the like. It may therefore be clearer to speak of "individual entities" instead of "individuals", using the term not as a noun but as an ontological qualifier.

The contingent historical origin of the traits that give a species it identity, as well as the contingency of the barriers which maintain this identity, distinguish the Darwinian concept from the Platonic and Aristotelian views. There simply isn't any core set of properties, any essence, which all the organisms which compose a species must have in common. Some philosophers have argued that DNA could constitute this essence but this ignores the basically statistical nature of the distribution of genes in a reproductive community. There does not have to be a set of genes that every organism member of this community must have. Although there are, of course, many shared genes and overlaps between sets of genes, the degree to which the gene pool of a species displays homogeneity is a contingent historical fact about the uniformity of the selection pressures which yielded that gene pool as a product.

Besides this physical argument against viewing organisms belonging to the same species as sharing an essence, there are logical arguments against viewing them as forming an abstract type or category. Unlike the relation between a general category and its members, which is one of exemplification or instantiation, the relation of individual species to individual organisms is one of whole to parts, much as the relation between an organism and the individual cells that compose it. Moreover, unlike the relation between a particular instance and a general type, the relation of parts to whole is causal: the whole emerges from the causal interactions between the component parts. {3} Although the resulting whole has the same ontological status as its parts, that is, both are individual entities, the whole will usually operate at larger scales than its parts. Spatially, a species has a much larger extension than an organism since it is typically comprised of several reproductive communities inhabiting geographically separate ecosystems. Temporally, a species also operates at much larger scales, its average life span being much greater than the life cycles of organisms. But the fact that species are constructed through a historical process suggests that they are, in fact, just another individual entity, one which operates at a larger spatio-temporal scale than organisms, but an individual entity nevertheless.

One philosophical consequence of this new conception of species must be emphasized: while an ontology based on relations between general types and particular instances is hierarchical,

each level representing a different ontological category (organisms, species, genera), an approach in terms of interacting parts and emergent wholes leads to a flat ontology, one made exclusively of unique, singular individual entities, differing in spatio-temporal scale but not in ontological status. Another important philosophical consequence is that in order to arrive at this new view of species biologists had to eliminate certain way of thinking associated with both typological and essentialist ontologies and replace them with a new approach, an approach which has come to be known as population thinking. What makes this form of thinking different from essentialist and typological thought is expressed in a famous quote by one of the creators of the modern synthesis of evolutionary and genetic ideas, Ernst Mayr:

"[For the typologist there] are a limited number of fixed, unchangeable 'ideas' underlying the observed variability [in nature], with the eidos (idea) being the only thing that is fixed and real, while the observed variability has no more reality than the shadows of an object on a cave wall....[In contrast], the populationist stresses the uniqueness of everything in the organic world....All organisms and organic phenomena are composed of unique features and can be described collectively only in statistical terms....The ultimate conclusions of the population thinker and the typologist are precisely the opposite. For the typologist the type (eidos) is real and the variation an illusion, while for the populationist, the type (the average) is an abstraction and only the variation is real. Not two ways of looking at nature could be more different." {4}

When one views species as general categories whose members share a common set of identical properties, the observed variation among the members of a type or class is indeed quite unimportant. For population thinkers, on the other hand, variation, genetic variation that is, far from being unimportant is the fuel of evolution: without adaptive differences between organisms natural selection would be incapable of yielding any improvements in the population, let alone allow novel forms to emerge. Put differently, for population thinkers heterogeneity is the state we should expect to exist spontaneously under most circumstances, while homogeneity is a highly unlikely state which may be brought about only under very specific selection pressures, abnormally uniform in space and time. {5} Moreover, while the typologist thinks of the genesis of form in terms of the expression of single types, for the populationist the forms of organisms always evolve within collectivities as selectively advantageous traits with different origins propagate through the population.

These ideas from evolutionary biology have, in fact, already found their way into social science in a non-reductionist way. I am referring here to the relatively new branch of economics known as "evolutionary economics" where commercial firms are viewed as forming part of a population of institutions and as being capable of replicating themselves whenever a new branch is opened and the informal routines and formal procedures which define the day-to-day activities of the firm are passed to its newly created branch. In this essay, however, I would like to take a different approach, borrowing from biology only those ideas which have deep ontological consequences and which are therefore not exclusive to evolutionary thinking. To illustrate what I mean by this I will give one more example from the hard sciences before turning to the main business of this essay which is social ontology. The example comes from the branch of physics known as condensed matter physics. While traditional philosophers may grant that the members of a biological species do not share an essence or common set of properties, they may argue that other abstract categories do. In particular, chemical species such as gold or carbon, do seem to fit the

essentialist or typological model. After all, all samples of gold must have certain atomic properties (such as having a specific atomic number) which, it can be plausibly argued, constitute the essence of gold.

There are several ways to avoid this conclusion. First of all, all atoms, not only gold atoms, need to be individuated in processes occurring within stars, a process known as stellar nucleosynthesis. These processes are also fully historical and, it may be argued, may be used to specify what gold is instead of, say, giving its atomic number.{6} But a more compelling reason to reject essentialism here would be to deny that a given sample of gold large enough to be held in one's hand can be considered a mere sum of its atoms, hence reducible to its atomic properties. In particular, much as between individual cells and the individual organisms which they compose there are several intermediate structures bridging the two scales (tissues, organs, organ systems) so between individual atoms of gold and an individual bulk piece of solid material there are intermediately scaled structures that bridge the micro and macro scales: individual atoms form crystals; individual crystals form small grains; individual small grains form larger grains, and so on. Both crystals and grains of different sizes are individuated following specific causal processes, and the properties of an individual bulk sample emerge from the causal interactions between these intermediate structures. There are some properties of gold, such as having a specific melting point, for example, which by definition do not belong to individual gold atoms since single atoms do not melt. Although individual gold crystals may be said to melt, in reality it takes a population of crystals with a minimum critical size (a so-called "microcluster") for the melting point of the bulk sample to emerge. {7}

This example illustrates that despite the fact that population thinking was born in one particular field of science, its ontological lessons are not confined to its place of origin. Although chemical species are not subject to evolutionary processes, in order to understand the nested set of structures which form a piece of bulk material we need to think not only in terms of collectivities (e.g. populations of crystals or grains) but also we must include the crucial role of heterogeneity. Much as genetic variation consists in the first place of mutations or copying errors, so grains of different scales are considered imperfections in an otherwise perfect arrangement of crystals. But condensed matter physicists have become aware of the architectural importance of these imperfections in the stabilization of bulk material, much as biologists are fully aware that without errors in replication one basic source of genetic variation would not exist. Thus, despite the fact that we are dealing with two completely different realms of reality here, the lessons of population thinking apply to both.

Before turning to the question of how to apply these ideas to human societies let me summarize what I take these lessons to be. First, the universe is populated exclusively by historically constituted individual entities operating at different spatio-temporal scales, forming a nested set in which smaller entities are embedded, and form the working parts, of larger ones. In other words, this ontology does not contain eternal essences or abstract categories. Second, although postulating the existence of wholes that are more than the sum of their parts is legitimate in this view, for this postulation to be coherent one must account for the historical origin of such wholes in terms of interactions between the population of individual entities that form their component parts. In other words, this ontology does not contain totalities, overall wholes that are merely postulated to exist but whose historical origins are not clarified. Finally, the emphasis in this

view is on objective process, the objective individuation processes which yield as their product specific individual entities with a more or less well defined identity, as well as the objective processes which maintain this identity through time. In other words, this ontology does not use social conventions as the main device to get rid of essences, and certainly does not fall back on any kind of subjectivism to explain reified categories away. Indeed, I would argue that uncritical use of social conventions and/or subjective beliefs and desires, at least when used to replace objective processes, may degenerate into a kind of "social essentialism".

How would these ideas apply to social ontology? As I just said, in a flat ontology of individual entities there is no room for reified totalities. In particular, there is no room for entities like "society" or "culture" in general. Social scientists sometimes justify speaking of "society as a whole" by invoking Hegelian totalities, some other times by using the organism as a metaphor and viewing society as a functional totality. In either case they tend to simply assume the existence of a society-wide systematicity. An ontology of individual entities, on the other hand, demands to know in each case what specific historical process has given rise to a whole or, what amounts to the same thing, it demands to know the source of a whole's systematicity. Roughly, in this approach one explains the emergence of institutional organizations by describing interactions among individual decision-makers; the emergence of urban centers is, in turn, explained in terms of interactions among institutions; and the emergence of nation states in terms of the interactions among cities. Once a new whole has emerged it immediately reacts back on the entities serving as its substratum, either to constrain their prior interactions or to enable new ways of interacting.

Let me give some simple illustrations. The stock market of Venice, an individual institutional organization, may be said to have emerged sometime in the fifteenth century from the interactions of rich merchants who used to gather around at a particular place in the city to exchange early forms of "debt on paper". At first the rules of interaction and membership were rather informal, but as these rules became formalized and the group was given an official charter, an individual institution was born. Similarly, the city of Venice may be said to have emerged from the interactions of the institutions that governed the villages occupying those islands, since it was through specific institutional agreements that these villages fused and formed an individual city. As these examples illustrate, the idea is to view both institutional organizations and urban centers not as abstract totalities but as concrete social individuals, with the same ontological status as individual human beings but operating at larger spatio-temporal scales. Like individual humans, institutional organizations and urban centers are unique and singular, and are referred to by a proper name.

These examples are, of course, much too simple. First of all, many institutions do not emerge spontaneously but are created as the result of a deliberate act by other institutions, like the creation of individual regulatory agencies by the United States Congress. Similarly, cities may be born not through spontaneous institutional interactions but as a result of deliberate plans by the governments of other cities. The birth of Versailles, for example, planned to the last detail by the government of Louis XIV, is in this respect quite unlike the birth of Venice which was not centrally planned. Clearly, the details of an individuation process are important and must be discussed case by case since for any given social individual the process of its emergence may include interactions among entities from a variety of levels. Additionally, once a social individual has emerged, it must maintain its identity through time and in this process too entities at different scales may intervene.

For example, the coherence of a nation state depends, in part, on the cities which organize and give structure to the territory it occupies, but also on the continuous functioning of the institutions which inhabit those cities, and in some cases, on the decisions and actions of particular individual persons.

Nevertheless, despite this added complexity, the picture of a nested set individual entities (persons-institutions-cities-nation states), captures the gist of the social ontology I am proposing. As I said before, the only sense in which we may speak of levels here is in terms of differences in scale. That institutions operate at longer temporal scales than persons is, I believe, quite uncontroversial given that it is hard to imagine a serious institution which lasted less than a person's life time. Similarly, urban centers typically outlive many of the institutional organizations which are born and die within their borders. A little more counterintuitive is the claim that these social individuals also operate at larger spatial scales. Cities do, of course, have a larger spatial extension than the institutions that inhabit them. Similarly, when institutional organizations acquire their own building it becomes evident that they are a social entity larger in spatial extension than individual persons. But in a more indirect way all institutions have this larger spatial scale: any institutional norm that applies to all members of a population may be said to have the same spatial extension as the population itself.

To summarize, we might say that an ontology which simply assumes the existence of wholes follows a top-down approach (from the taken-for-granted whole to the parts that it constitutes) while the new approach is bottom-up, that is, it approaches the emergence and maintenance of entities at any given level of scale in terms of populations of interacting entities at the levels below it. While the ethnic, linguistic or economic diversity which characterizes many cities or nation states is hard to capture in top-down models, given that they assume a certain overall systematicity from the outset, bottom-up models can handle as much heterogeneity as is necessary by simply including it as part of the make up of a population at a given scale. But even in those cases where, as a matter of empirical fact, the degree of homogeneity at different scales is high enough to suggest the existence of a single "culture" or "society", the temptation to postulate such totalities must be resisted, and the degree of homogeneity which motivated such postulation must be given a concrete historical explanation. Besides the way in which uniformity and variation are handled, these two approaches lead to very different conceptions of human history. In a top-down approach it is easy to imagine society as a whole developing though a series of stages, such as feudalism, capitalism and socialism (or the agricultural, industrial, and informational ages). In the bottom-up approach, on the other hand, each level of scale is assumed to have its own history, occurring at its own tempo, even if these histories interact. Thus,
rather than a single flow broken into distinct ages or periods we have a bundle of parallel histories, each characterized by its own breaks and continuities.

This is, in a nut shell, the social ontology I am proposing. Clearly, such a proposal needs to be elaborated in much more detail to be convincing. I will return in a moment to the question of what resources we can use in order to enrich it. But before doing that let me compare this picture to those which prevail in sociology and economics. I must say at the outset that a detailed comparison, examining the different schools of economic and sociological thought, is out of the question here. So I apologize in advance for speaking of economics in general (when in fact I am only referring to classical micro-economics) , or of sociology in general (when in fact I am only referring to functionalist sociology). It is clear that counter-examples can immediately be given (macro-

economics and micro-interactionist sociology to cite only the two most obvious ones) but the point of my argument would remain the same in a more detailed breakdown of these disciplines. (In a nutshell, the more general argument is that all the varieties of social science seems to assume a dichotomous relation between micro and macro levels, between agency and structure, phenomenological lifeworld and social system, whereas I am proposing a multi-scale nested set of structured agents.)

Roughly, we may say that orthodox micro-economics begins its analysis at the bottom of society, at the level of the individual decision-maker. Yet, this does not make it a bottom-up approach because these individual persons are atomized, that is, they do not constitute a population of interacting agents from which larger wholes may emerge. Individual persons are assumed to make economic choices by simply maximizing their expected satisfaction (marginal utility) in isolation from others, and it is further assumed that the decisions in question are made on a case-by-case basis, constrained only by budgetary limitations, leaving out of consideration the question of norms and values that constrain individual action in a variety of ways. Thus, despite the fact that the methodological individualism of economics is correct from a bottom-up perspective, its ontological atomism is not. Orthodox sociology, on the other hand, takes as its point of departure society as a whole, and to this extent it may be said to be characterized by a methodological holism. This is clearly incompatible with a bottom-up perspective, particularly when the historical processes which generated such a social totality are not explained But even when they are explained, as in the case of Hegelian dialectics, the explanation of the process is derived from abstract theory (a synthesis of opposites, or "the negation of the negation") not from empirical research. More importantly, in some cases methodological holism denies individual subjects an ontological status of their own, viewing them instead as constituted by the totality within which they are inscribed. The Marxist idea that the individual decision-makers of classical micro-economics are a product of a burgeois ideology is a good example of this. Viewing the parts as constituted by the whole, as opposed to the whole emerging from the parts, is a clear indication of a top-down perspective.

The approach I am trying to sketch here would, in a sense, preserve the advantages of each two methodologies while rejecting their problematic assumptions. On the one hand, it would reject the ontological atomism of micro-economics but preserve its methodological individualism. That is, this approach would begin its analysis with individual persons, who are considered to be real not mere byproducts of some ideology or mere occupants of a formal role, but it would reject the idea that these subjects make decisions following their own internal optimizing calculations. Instead, it would model them as rule-followers subject to different types of normative and institutional constraints that apply collectively, as well as decision-makers endowed with a bounded form of rationality allowing them to pursue their self-interest in a limited way. On the other hand, it would reject methodological holism but it would preserve sociology's ontological holism, that is, the idea that even though collective institutions emerge out the interactions among persons, once they have formed these institutions have "a life of their own". In other words, institutions are not just reified entities but real social beings capable of constraining and enabling individual decision-making in a variety of ways. While some branches of microeconomics, the institutional and neo-institutional schools, do subscribe to this ontological holism, and while some sociologists, those studying the sociology of organizations, for example, do study intermediately-scaled entities and not just society as a whole, I think it is fair to say that very few social scientists use the bottom-up approach. {8}

Moreover, urban centers as individual entities seldom appear in these analyses as concrete historical actors, despite the fact that they play, relative to the complex institutional ecologies that inhabit them, the same constraining and enabling role which institutional organizations play relative to individual persons. So ontological holism needs to be extended up in the direction of cities, and even further up to the scale of individual nation states, being careful not to endow any of these larger entities with a distinct ontological status.

This comparison with existing approaches in social science points to the way in which a bottom-up social ontology would have to be enriched to add some flesh to this bare bones account. In particular, much as resources from both economics and sociology need to be combined, several other apparently divergent disciplines must be meshed together preserving some of their strong insights while discarding their weaknesses. At the bottom level, for example, it is important to avoid the extreme views of both sociobiology and
social constructivism, while at the same time using some of their insights to model humanity as composed of both individual biological organisms as well as individual social persons. Another way of putting this is to say that we must avoid both the under-socialized subjects of economics, which seem to pursue only their biological self-interest, as well as the over-socialized subjects of sociology, which are assumed to be perfectly obedient rule-followers.

Some insights from sociobiology may be preserved as long as we are careful to apply to them population thinking in a rigorous way. This implies thinking about inherited behavioral characteristics as a statistical, not a deterministic, phenomenon. For example, we may allow that there are inherited sexual behavioral differences as long as these are viewed as realized in a given population as two overlapping probability distributions. Many attempts to justify gender roles as biologically determined depend on ignoring the statistical nature of a distribution of traits and on reifying average differences into two sharply differentiated essences of masculinity and femininity. Similarly, the insight that many aspects of human behavior are socially constructed may be preserved as long as we avoid the social determinism implicit in the idea that institutional norms command instant obedience. Here too we must view the effects of acculturation as being mostly statistical and depending for their efficacy on factors other than the possession of shared beliefs. In particular, the work of Michel Foucault has made it clear that obedience is something that must be constantly produced, and that disciplinary work on the human body is as important in this respect as shared mental representations. The techniques used in Taylorism, for example, in which flexible bodily skills are replaced with rigid routines, are a means of increasing the power of the body in economic terms of utility while at the same time decreasing it in political terms of obedience. Furthermore, the evolution of Taylorism itself cannot be described simply as a process in which a certain discourse on efficiency developed, but must also include the large variety of non-discursive practices which, as Foucault has argued, characterize the interactions between hospitals, prisons, schools, factories and barracks in the seventeenth and eighteenth centuries. {9}

The need to consider the complex institutional ecologies which inhabit urban centers as part of an explanation of the production of obedience brings me to the next level of scale, that of institutional organizations. At this level the dangers of essentialist thought become evident when we speak of abstract entities like "the state" or "the market". Instead, the emphasis must be on the concrete historical processes which have yielded individual governmental and economic institutions, as well as on the interactions between these institutions. Here, the work of economic

historian Fernand Braudel and his many followers is an important resource. Braudel, for example, has described one of the strands in the evolution of Western economic institutions as starting with the marketplaces which inhabited almost every medieval urban center, that is, the concrete places in town where people gathered on a weekly basis to exchange humble goods. When several of these urban marketplaces became linked together on a regular basis a larger institution emerged, the regional market. Both of these concrete entities emerged in a process combining spontaneous interactions among individual persons as well as specific interventions by governmental institutions, some supplying protection or security, others making sure that weights and measures remained homogenous from one week to the next. Then, in eighteenth century England, a larger entity emerged, the first national market, involving a more direct form of governmental intervention to eliminate tolls and tariffs, and to promote the building of roads and canals. In the nineteenth century, the railroad allowed countries like France and the United States to create their national markets and catch up with England. Finally, the last few decades of the twentieth century witnessed the creation of several international markets, a process also involving complex interactions between individual institutional organizations. {10}

At the next level up, that of urban centers, Braudel's followers have stressed the crucial role which different types of cities have played in western and non-western history. In their work one finds a distinction between the role played by regional capitals, which in many cases were landlocked, from the role played by maritime metropolises. A landlocked city playing the role of political capital for a given region may encourage a certain degree of uniformity in its own culture and that of the hierarchy of smaller towns under its command. Here one could mention Paris, Vienna or Madrid as examples, all three landlocked capitals which over time synthesized a more or less homogeneous culture which was later exported to smaller provincial towns. On the other hand, a city may act as a gateway to foreign cultures, as was the case of many maritime metropolises in the past, like Venice, Lisbon or Amsterdam, forming not hierarchies but networks with other such gateways, and promoting the entry and diffusion of heterogeneous materials that increased their diversity and that of the cities in close contact with them. {11} Clearly, at this point it is important not to introduce essentialist or typological thought through the back door by simply taking these two types of cities as given. On the contrary, the contingency of the historical factors leading to the distinction must be emphasized. In particular, it was the difference is speed between terrestrial and maritime transport prior to the nineteenth century that led to the two different urban structures. The relative slowness of land transportation favored hierarchies of towns at definite distances from one another, while the rapidity of transportation by sea meant that port cities were in closer contact with one another than they were with landlocked cities in their own backyard. When railroads eliminated this speed difference they basically eliminated the distinction leading, for example, to the creation of landlocked gateways such as Chicago.

As I said before, one of the advantages of a flat ontology of individual entities is that all the different social actors, persons, institutions, cities and so on, may be viewed as coexisting on the same ontological plane, capable of interacting with each other despite the fact that each has its own historical rhythm. Moreover, this coexistence of entities evolving at different speeds also extends to other social entities which I have not mentioned in this presentation: local dialects and global standard languages; different species of technological artifacts, such as clockworks, motors and networks; enduring rituals and passing fads. Grasping human history as composed of multiple temporal flows may reduce the temptation to periodize it in a simple manner, as well as the

tendency to view these periods as forming a teleological succession of ages. We may acknowledge, for example, the importance of the steam motor at the start of the nineteenth century or of computer networks at the end of the twentieth, without being tempted to speak of the Industrial Age or the Information Age. Instead, we should examine how motors, computers and other technologies emerged in a world already populated by older artifacts and how instead of replacing them they added themselves to an already complex mixture, changing and being changed by their interactions with older technologies.

Giving up the idea that human history is composed of ages which leave each other behind may also help us understand that social historical processes were never sharply separated from their natural counterparts, but always coexisted with them. When modern Europe witnessed its first period of rapid urbanization, between the years 1000 and 1300, it s territory was mostly occupied by a dense temperate forest. This complex ecosystem was mostly destroyed to make room for the new cities which mushroomed everywhere, but it did not disappear. Each city became an ecosystem, one in which complex food chains had been artificially simplified and greatly shortened, not to mention focused on one species, humanity. But this simplification had to be maintained constantly, in agricultural fields by fighting weeds, which are nothing but plant species attempting to get the process of ecosystem succession started again, as well as by increases in population within urban centers. In periods of population decline, the excluded plants and animals returned.

Moreover, far from leaving older species behind as a previous stage of evolution, we have always fully coexisted with them. The best example here is that of micro organisms, particularly those involved in contagious diseases. Medieval urban centers not only housed a complex mixture of humans and their domesticated plants and animals, but also a myriad of micro-organisms outside of human control. In fact, as several historians have pointed out, cities became epidemiological laboratories where specifically urban diseases, such as measles and small pox, could evolve new strains. {12} Although the advent of antibiotics in World War II seemed to signal the triumph of humanity over these ever changing micro populations, today we know that all we achieved was to produce new strains of anti-biotic resistant organisms, and that we have no choice but to continue to coexist with these representatives of an earlier "biological technology".

In conclusion, I would like to say that the more complex picture of human history that emerges from this ontology calls for a more interdisciplinary approach at all levels. The 1990's witnessed the creation of many centers for interdisciplinary research around the world, propelled in part by advances in mathematical and computer modeling technologies that seemed to indicate a certain commonality of interests among previously non-interacting
fields. But this recent wave of cooperation between anthropologists and evolutionary biologists, of economists and physicists and mathematicians, may prove to be transitory. Adopting a flat ontology of individual entities, together with its emphasis on material and social process, and of coexistence of material and social products, may one day help turn these interdisciplinary efforts from a passing fashion into an enduring tradition.

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