Integration and the disunity of the social sciences

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1. Introduction

There is a plurality of theoretical approaches, methodological tools, and explanatory strategies in the social sciences. Different fields rely on different methods and explanatory tools even when they study the very same phenomena. We illustrate this plurality of the social sciences with the studies of crowds. We show how three different takes on crowd phenomena--psychology, rational choice theory, and network theory--can complement one another. We conclude that social scientists are better described as researchers endowed with explanatory toolkits than specialists of some specific social domain. Social scientists' toolkits are adapted for identifying and specifying the role of specific causal factors among the multiple factors that produce social phenomena. These factors can be, in a non-exclusive way, economic incentives, psychological processes, the ecology or aspects of the social and cultural environment.

The plurality of methods and theories in the social sciences flies in the face of the project to unify the sciences associated with the positivists of the 19th and 20th centuries. Yet, the compatibility and consilience of theories and practices still have epistemic value: they enable the development of more powerful and robust theories and they allow the advent of interdisciplinary studies. We present the integrative stance as the will to improve compatibility and consilience across fields, yet recognise that the plurality of causes of social phenomena invite a diversity of methodological and theoretical tools. We

conclude by characterizing naturalism as an integrative stance applied to fields that belong to the social science *and* to the natural sciences.

2. The unity of the social sciences: a failed project

The strong unity model, associated to positivists such as Carl Hempel, and Ernst Nagel holds that social facts reduce to facts about individuals, which in turn can be reduced to biological, chemical, and ultimately physical facts. Disciplinary boundaries do not necessarily correspond to the organization of nature; they are arbitrarily drawn by scientists. Furthermore, the methods and aims of the social sciences should be modelled on those of the natural sciences, as ultimately everything could be explained in physical terms. Although this view has generally fallen into disrepute, its specific answers to the ontological, disciplinary, and methodological objectives remain hotly debated. For instance, some social scientists would advocate methodological individualism in the social sciences, arguing that social phenomena should be explained in terms of individual behaviours and their aggregation. But some other social scientists recommend methodological holism—social facts can appear in scientific explanations (Zahle, 2016).

In spite of these attempts to single out the specificity of the social sciences, explanations of social phenomena remain very diverse. For instance, an explanation in economics relies on modelling an economic agent as a rational individual maximizing her own expected utility. Such assumption is at odds with standard explanations in sociology, which appeal to the social milieu as a determinant of individuals' behaviours. It is hard to find a methodological principle and/or a theoretical claim that would characterize or unify all explanations in the social sciences. What is in fact striking is the diversity of methods and theories in the social sciences compared to the relative unity of other scientific disciplines. Given the lack of consensus, the social sciences have *de facto* followed a generally pluralistic philosophy: Different social sciences develop their own methods for studying the social world, yet often with their disciplinary boundaries overlapping in such a way that the very same social phenomena are investigated and explained in radically different ways.

Contrary to this stance of "default pluralism", we argue in favour of a methodological pluralism: make the most of different approaches, as they can bring explanatory insights, and yet strive for integration. Successful integration makes apparent the complementarity of different theories and methods for explaining a given social phenomenon. We argue that a plurality of methods and theories for studying, understanding, and explaining some social phenomena are deployed to ask different questions is often justified because social phenomena result from a multiplicity of causal factors. Different methodologies and theories might be needed for identifying and describing these causal factors. When that is the case, the methods and theories are complementary to one another, giving a richer, deeper understanding of the social world. We illustrate this diversity with explanations of crowd phenomena.

3. Explanations of crowds

How, why, and when do crowds form and dissipate? Crowds are the archetype of social phenomena. At first glance, it seems that crowds would form a well identified and characterized object of scientific investigation—a social kind, so to speak. It turns out, however, that there is no satisfactory scientific characterization of crowd. There are no constitutive factors or defining traits for identifying a category of social phenomena whose extension would cover our intuitive notion of crowds. The notion of crowd is, in that respect, similar to the notion of tree. One is very able to recognize a tree, but there is no scientific category for trees. In spite of this, scientists can well describe why a birch or an oak is the way it is. Likewise, social scientists can investigate the causes of a specific crowd formation. In this section, we show that an understanding of any specific crowd is likely to require drawing on very diverse explanatory tools. In section 4 and 5, we examine how different approaches studying a same phenomenon yet with different tools and theories can be integrated and provide a richer understanding of the phenomenon.

3.1. Crowd psychology: imitation and contagion

The classical accounts of crowding developed at the turn of the 19th century (Tarde 1903, Tarde, 1901, Le Bon, 1896, Freud 1989, Trotter 1916). These accounts appeal to psychological concepts like contagion, herd instinct, imitation, and group mind. Each of these concepts has been invoked to explain the commonality of sentiment and behaviour that seem to be at the root of crowding. For instance, 'contagion' is a metaphor for the transmission of ideas or behavioural inclinations among agents, much as disease is transmitted through a population. But how? Through what mechanism? Some authors appeal to the effect of facial expressions on others, some to chants; some appeal to the herd instinct, which purportedly drives humans to cluster together into ever larger groups. These psychological notions point to the relevance of mental phenomena in producing the behaviour that eventually constitutes a crowd. Crowds appear when people do the same things at the same time--marching, chanting, having aggressive or fearful behaviours. The similarity can arise because of similar reaction to a single event: for instance, a fire might cause people to flee from the burning building independently of the fact that others similarly flee. In many cases of crowds, however, the behaviours are interdependent: the choices and emotions of one individual influence the choices and emotions of the others. This strong social influence has been grasped by the authors mentioned above.

While studies of crowd behaviour started at the beginning of the 20th century with thought provoking speculations on its psychological bases, current studies of the relevant psychological underlying mechanisms involve laboratory experiments testing hypotheses specified with the technical vocabulary of cognitive science. The specification of the herd instinct and dispositions to imitate, as psychological traits shared by all humans, has led to numerous work in psychology, especially when investigating what, in human psychology, allows for the emergence of culture (e.g. Tomasello, 2009; Mesoudi, 2016). The existence of a herd instinct and ``compulsive imitation'' has, however, been largely challenged by other authors working on cultural evolution and its psychological foundations (e.g. Morin, 2015). Crowd behaviours such as marching or breaking things together are some type of joint actions. Recent

cognitive studies investigate to what extent these can be caused by processes of 'entrainment', simultaneous affordance, simulation mechanisms, joint attention, etc. (see, e.g., Knoblich, G., & Sebanz, N., 2008). Crowd behaviour might also involve the rapid spread of emotions. Cognitive science, again, investigates with laboratory experiment how and why emotions can spread in crowd contexts: the emotions can result from the social connectedness of doing things together (Marsh et al. 2009) and it can be rapidly transmitted through face perception (Dezecache et al. 2013). The investigations are enabled by the methodological tools of behavioural experiments, but also by conceptual and interpretive tools from larger psychological theories, such as theories of embodied cognition and social cognition. For instance, Dezecache et al. (2015) use evolutionary psychology to interpret results and formulate hypotheses about emotional contagion.

Although enlightening, there are several limits to explanations of crowd phenomena on the basis of contagion of emotions and automatic imitation of others' behaviours. For one, participation to crowd might be motivated by reasons rather than induced by spontaneous cognitive processes such as compulsive imitation. For another, the environmental factors are neglected in the merely psychological explanations. We now turn to these other factors, which can contribute to the formation of crowds.

3.2. Rational choice: unintended and intended crowd formation

Rational choice theory remains one of the main tools of the social sciences. It includes a set of assumptions about how agents make decisions: they are rational, which means that they make the best choices for achieving their goals, given their limited knowledge. Sometimes, the rationality assumptions are supplemented with the presumption that economic agents' goal is to maximize material gains. Rational choice theory is strongly criticized by both sociologists and psychologists on the ground that it includes false assumptions about human decision making: Contrary to the model of rational choice, humans are often not able to select the best means for achieving their goals. Kahneman and Tversky's work in behavioural economics provided strong evidence that people's choices often depart from what the theory of rational

choice would predict (see, e.g., Gilovich et al. 2002). Still, there remains several ways to use rational choice theory as a tool for explaining social phenomena. One way is to interpret rational choice models of specific phenomena as 'as if' models. This interpretation favours predictive power over explanatory value, since it does not identify the actual causes of the phenomena.

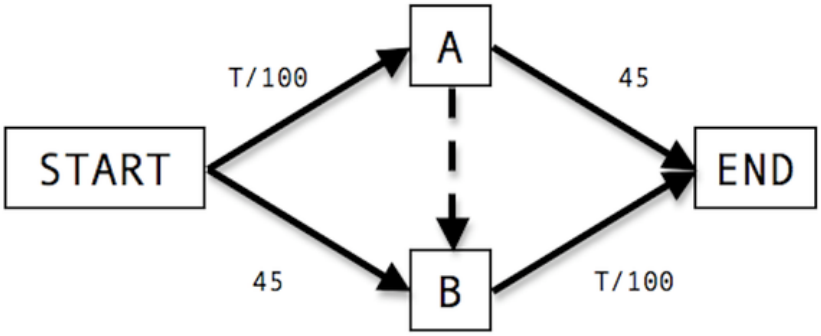
A second way is to use rational choice theory as providing a well justified baseline for the study of human behaviour because animal cognition, human or not, is adaptive. Cognition is a function of some organisms that consists in processing information so as to produce behaviour that increases fitness. It is therefore likely to select the best means for achieving goals that are themselves proxy for maximizing fitness (sexual desires, for instance). In that sense, rational choice theory can be a useful tool for the study of non-human behaviour as well as human behaviour. It is not necessarily a good description of the psychological mechanisms, but it is likely to be a good first approximation.

A third way to interpret and use rational choice theory consists in making the minimal assumption that, in the specific case at hand, the choices of agents are motivated. The choices are sensitive to incentives. The use of rational choice theory is, in such case, not a set of axioms for formalizing social phenomena, but a heuristic way to formulate empirical hypotheses, which are then put to the test. This heuristic is justified because of the second point mentioned above: cognition is adaptive. So far, a minimal core of rational choice theory has often proved to be true: Economics has provided a rich set of cases showing that people's choice are best explained as being sensitives to incentives and risk. The popular book *Freakonomics* (Levitt and Dubner, 2005) provide beautiful illustrations of such explanations, enabling to uncover the surprising effect of some incentives.

For this chapter, we will focus on the insights that Rational choice theory brings for explaining crowd formation. One such illustration is the crowd forming in one restaurant, while the restaurant next door remains empty. The cognitive and social processes go as follow: passers-by want to eat in a good restaurant but have no knowledge about whether the restaurant on the right is

better than the restaurant on the left. The first group decides at random; it goes to the restaurant on the right. The second group then decides on the basis of the fact that the restaurant on the right has clients while the one on the left has none. Without further information, the best bet is to rely on the choices of others and go to the restaurant on the right. This is what the second group does. The same thing happens again and again, so that the restaurant in the right becomes crowded and the one of the left remains empty. People end up all doing the same thing and forming a crowd, in spite of the fact that they have no interest in doing so. Still, people make the best decision given that the information they have is only, or mainly, derived from their observation of the choice of others. Such phenomena, called information cascade, provide an example of crowding because of the rational choice of people who do not want to create a crowd. It is based on the testable hypothesis that people take these specific decisions (going to a restaurant in our illustration, but other actual phenomena) on the basis of information that they derive from observing the behaviour of others. There are other conditions where crowds appear as unintended consequences of people making the best choice for themselves. The Braess paradox, for instance, describes the conditions in which traffic jams are caused by actually improving on the available roads and creating highways. One situation for this to happen is pictured in figure 1: there are 4000 people commuting from one city (start) to the other (end) every morning, and these two cities are connected by two roads. The traveling time is 45 minutes for covering one trunk of the road (a small road) plus the number of users of travellers on the other trunk, divided by 100. Because of rational choice, half of the population takes one road, while the other half takes the other road. It thus takes 65 minutes to go from start to end. However, one improvement in the road structure—building a highway between A and B—leads commuters to take one path and neglect the alternatives, which are now comparatively longer. They do so because they want to minimize their commuting time, but the unintended consequence is that the road is crowded. With all people taking the same road, the travel time is now 80 minutes.

FIGURE 1: Illustration of the Braess paradox



There are also cases where a crowd is formed because people do actually want to form a crowd. In such cases, Rational Choice Theory helps specifying the cognitive problems that need to be solved in order to coordinate for forming a crowd. The problems occur when many people are motivated to participate to a crowd, yet these people know that there is no such crowd to participate to. Thus, in spite of their desire to come together to form a crowd, they fail to do so. How is this problem solved in real life? An example is provided by the Arab Spring, a set of revolutions that took place in North Africa in the years 2010-12. One key event of the Arab Spring is the crowd that gathered in Tahrir Square, in Cairo. This crowd formed for expressing their preferences for a change of regime. Yet, the preference for changing the regime of Mubarak and the willingness to express this preference did not come from one day to the other. The motivation for participating to a demonstration and forming a crowd was present throughout the Egyptian population for some time, but the coordination problem prevented the formation of a crowd. Indeed, expressing one's disagreement with the regime was not without danger; yet it could be done with more safety as a collective action. A first problem, in collective action, is to agree on a time for action. When people cannot talk and agree on this matter, this is a hard task. One salient event can provide the required information: now is the good time! This salient event enables solving the coordination problem--it is a Schelling point (Cronk and

Leech, 2012). In the Arab Spring, the salient event was provided by the events in Tunisia, who was the first of the North African countries to undergo a successful uprising, with the fall of Ben Ali in 2011. The action of Mohammed Bouazizi, a Tunisian street vendor who self-immolated, might also have provided the first coordinating signal that it was now time to demonstrate (Howard & Hussain 2011).

The crowd in Tahrir square was first and foremost caused by a desire, shared by many, to express their dissatisfaction with the Mubarak regime. However, an analysis of coordination problem with the tools of rational choice theory points out that this desire is not enough. Beliefs about what others will do are crucial, as revealed by a rational choice theory analysis.

3.3. Network science and the ecology of crowd formation

The above explanations make one causal factor of crowd formation apparent: the means of communication and how they connect people. The Arab Spring has often been qualified as Twitter or Facebook revolutions. Some have argued that one key feature of the Arab Spring was the reliance of the demonstrators on New Information Technology (Howard & Hussain 2011, and Stepanova 2011). Some others have argued that social media had a modest impact, while television and word of mouth were the most important source of information (Williams Associates 2011; Friedman 2011). The penetration of Twitter in Egypt around the time of the revolution was low: about 12,000 subscribers out of a population of 80,000,000. At the same time, there were 3.5 million Facebook users: a 4.5 percent penetration rate (Dunn 2011). Still, the penetration of Internet users in Egypt had skyrocketed in the decade leading up to the Arab Spring, with 17 million users online by May of 2011, about 21 percent of the population (Stepanova 2011).

Le Bon and Tarde did, in their time, already mention the role of mass communication (LeBon 1896, 137; Tarde 1901, 7-11) but the recently developed field of network science makes its systematic study possible. Network science applies mathematical analysis for describing patterns of interconnections among a set of things. Relying on the mathematics of graph

theory, it conceives connections as vertices in a graph and the connected things as nodes of that graph. Network science can be used for the analysis of diverse phenomena, such as the modelling of the spread of disease in an epidemic and the spread and containment of forest fire (e.g. Potrerie et al., 2007). For us, however, the relevant applications of network science concern the 'connectedness' of social agents and the spread of specific behaviour. In this context, connections might be communications links, "friend" relation in Facebook, or physical connections.

We saw in the previous section that crowds might arise when a coordination problem that involves a large number of people is being solved. Coordination can be achieved when the same action triggering information is distributed to many people in a short time. Network science shows that it is possible when the network of communication allows for rapid spread of coordinating information. What types of network allows for this rapid spread? This is made possible when a few nodes are extremely popular, and thus able to distribute the information at once to many other nodes. In other words, the existence of hubs--highly connected nodes--can play a crucial role in crowd formation and maintenance. Thus, during the Arab Spring, the Facebook account of Wael Ghonim played the role of a hub for distributing coordinating information. In a demonstration, this role of distributing coordinating information can be taken by the person who holds the megaphone: the network, in that case, is constituted of nodes that represent members of the demonstration and links that represent who hears whom.

One observation made by early scientists of crowd (LeBon 1896, 34-5), was that crowds seemed to be answering the will of one single individual--the leader--or at least one "idea". We interpret this intuition about crowds as related to the coordinated action of people forming a crowd. Network science can therefore specify this intuition: the leader, if any, is not necessarily an individual with official leadership. It is the individual that is a hub. Also, the ideas that seem to belong to the crowd, because it holds it together are coordinating ideas that are shared by the participants of the crowd.

Another property of networks can provide insights in the formation and maintenance of crowds. When links in a network express hyperlinks in the

Web, friendship, or any type of social connection, the number of links connecting a node provides a measure of popularity of that node. For instance, there are many more links towards the pages of Wikipedia than to the ResearchGate homepages of this chapter's authors. The former is more popular than the latter. Networks that express popularity evolve: new links are created, and some are deleted. One factor for the creation of a new link towards a node is how much this node is already connected. Indeed, an individual with many friends is more likely to meet new people, by means of his existing friends, than someone with few friends. Likewise, well connected websites are more likely to be visited than others. Thus, the very structure of the network--who is connected to whom--partially determines how this network evolves, in such a way that the nodes already rich in connections, get richer. The consequence of this type of evolution is that the popularity is distributed following a power law, which means that very few nodes are extremely popular while the rest of the nodes have very little popularity.

Such process can cause the advent and maintenance of crowds. For instance, if people prefer to go to a disco where there already are people, then they will crowd in one disco and let the other empty (note that this is different from the restaurant story, where people did not want to be together but did end up doing so deriving information from the presence of others). Likewise, crowds can happen on the Internet, when people visit the same webpage at the same time. An illustration of this effect is the crowd of 80 million YouTube users who, on December 7th, 2009, chose to watch Britney Spears video 'Womanizer'. A key factor of the rush was its appearance as the first recommendation for the YouTube users watching 'Toxic', an already popular video. Being already rich of this very valuable link, Womanizer gathered more links and references. As with the disco example, there is a process of preferential attachment, where past success determines future success. The analogy between crowds on the Internet and crowds in public spaces makes sense because similar principles--features of the network driving the influence of a behaviour on others--can lead to both types of 'crowds'. Interestingly, the evolution of unequal distribution of popularity can be boosted or moderated by hugely popular nodes, which regulate access to other nodes. The best

illustration of this fact is search engines: insofar as answers to queries are ordered list of websites which is determined by popularity (this is what Google's algorithm PageRank does), it will boost the rich-get-richer effect of networks. On the other hand, the rich-get-richer effect is moderated by the role given to key-words and by the personalization of results implemented by search engines: these processes promote websites that might not be so popular but which respond to specific interests.

The management of crowd during mass gathering, and the prevention of crushing deaths during evacuation is a problem that city and building architect have to face. Indeed, dramatic events can be avoided with good egress design. A historical example is the Italian Hall disaster of 1913 (described in Tubbs and Michan, 2007): the evacuation of partygoers directed to inward-swinging doors, which could not be opened due to the physical pressures exercised by the evacuating occupants. The crowd formed making it impossible to open the door and causing the death of 72 people by crushing and suffocation. This provide dramatic examples of the role of the environment on crowd formation, which are now studied with several tools, including models about how crowd are most likely to behave given external constraints such as fire escape route.

4. Diversity of explanatory tools and the integration of theories

The above illustrations show that diverse methods, theoretical resources, and conceptual tools can be fruitfully used for explaining crowd formations. In general, social scientists benefit from using a rich toolkit of explanatory techniques. This is because social phenomena, including crowd formation, arise from diverse causes, ecological or psychological, related to motivations or to other cognitive processes. Thus, a different selection of tools will be appropriate for identifying the role of different causes of social phenomena.

4.1. Fields in the social sciences as explanatory toolkits

In some mythical academic world, each discipline corresponds to a well specified domain of study, which is best explained on the basis of a unified theory and investigated with some dedicated methods. In that world, all

studies happen within a paradigm. The above examples--explanations of crowds--show that the social sciences do not resemble this mythical world. A first difference with the mythical academic world is that there is rarely any agreement about how to define the domain of investigation. Crowds, for instance, might seem to form a rather well defined social kind. They are the subject of many books and papers, and are being modelled with computer simulation. Yet, there is no necessary and sufficient condition for a social phenomenon to qualify as a crowd. The archetypical crowd is a gathering of a large number of people at the same location and at the same time. But the sorites paradox applies when looking for specific criteria: how many people does it take to make a crowd? Also, people packed in a place do not make an archetypical crowd if they do not influence each others' behaviours. Conversely, the folk notion of crowd can be extended to cases where people are not physically next to each others but influence each others at a very rapid rate: that is the case of the crowding on the Internet mentioned above.

The problem of circumscribing domains is pervasive in the social sciences. Social and cultural anthropologists, for instance, disagree on the very notion of culture (e.g. Boyer, 2014) and other key notions (e.g. religion). This is not a weakness of the social sciences compared to the 'natural sciences': notions that supposedly identify fields in natural sciences, such as genes and life, are also hotly debated. Most scientific fields do not carve the world at its joints. Still, social scientists do specialise. The specialisation is, however, more a question of focus on different aspects of the same phenomena than the study of different phenomena that would presumably belong to different domains. Most importantly, social scientists differ from field to field in that they have at their disposal different explanatory tools. During training and practice, they come to master methodologies and theories, which they diligently put to work for explanation. Thus, fields are not defined in terms of a domain of explananda, but rather through means of explaining and type of explanantia. This raises an important challenge: checking that for a given explanandum, social scientists do not provide incompatible explanations. This does not imply unifying the social science in the sense specified in the first section, but it does imply some interdisciplinary work.

When explaining crowds, social scientists are, thanks to a sufficiently rich explanatory toolkit, able to identify a set of diverse factors that will influence the causal processes that lead to crowd phenomena. The tools put to work for explaining that we mentioned above include the cognitive studies of transmission and imitation, the study of motivated behaviours and how they aggregate, with rational choice theory, and the description of infrastructure for transmission--network science. Each explanatory tool provides means to identify causes of crowd formation and maintenance and describe their specific effects. Each explanatory tool provides elements of explanation that are not necessarily incompatible with the other explanations. The fact is that crowds result from the conjunction of multiple causes.

Network science is an explanatory tool for identifying ecological factors of crowd formation: they allow the description of structural elements that will direct the distribution of information. But of course, the content of the distributed information will make a difference. To what extent, for instance, is it a coordinating information? Answering this question might require the tools of rational choice theory (including game theoretical notions such as the Schelling point). Likewise, the rich-get-richer structural process might need to be complemented with other factors to explain why one rather than the other item or node became hugely popular. Bianconi and Barabási have talked about cultural fitness or a node's fitness, which is ''its ability to compete for links at the expense of other nodes'' (Bianconi & Barabási 2001)**.** Invoking cultural or node's fitness itself does not provide a causal explanation, but it calls our attention to what needs to be further explained: the residue that is not predicted by structural aspects of the network. These further factors are mainly psychological factors. These might involve different types of preferences and motivations, as specified in subsection 2.2. or this might involve psychological mechanisms of transmission, as specified in subsection 2.1. Thus, combinations of the tools for analysing the diversity of causal factors will be called for in the study of plausible causal mechanisms and for identifying their causal role in each particular case.

4.2. Integration and pluralism

As the case studies described above show, there is a plurality of methods and explanatory strategies that can be relied upon to understand the different aspects of crowd phenomena. One way to react to such plurality is to take it as a defect of a field which needs to be fixed. This was the goal set by advocate of the unity of science that we mentioned in the introduction. We saw, however, that the disunity does not arise from a lack of understanding of the relations between well defined domains. Rather, it arises from the multiple means for investigating different causal factors. The causal roles of the factors are best explained with psychology, rational choice theory, network science, etc. In the face of a plurality of causal factors contributing to a phenomenon, and with factors that are best studied by different approaches, we seem to be left with scattered and possibly incompatible explanations. One could be tempted to stop here: acknowledge the diversity and disunity of the social sciences and resign to their apparent incommensurability as an inevitable outcome of the social world. In contrast, an integrative stance approaches explanatory plurality in the social sciences as raising questions of compatibility and interactions: the goal, then, is not unity and reduction, but the search for more integration, enabling interdisciplinary research.

The integrative stance is an epistemic *attitude* that involves investigating how the plurality of causal factors interact and differentially contribute to some phenomenon. The integrative stance involves allowing multiple apparently incompatible perspectives to cohabit, interact, and enrich one another by offering tools to study different aspects of a same phenomenon. We advocate adopting the integrative stance because it is a way to pursue three epistemic values: consistency, consilience, and complementarity.

Consistency refers to the fact that two different approaches to a same phenomenon are not contradicting one another.

Two approaches are **consilient** when they can identify, and agree on, the role of the causal factors that each of them study. For instance, in the Braess paradox, the psychological factor is the willingness to shorten as much as possible one’s commuting time. The ecological factor is the size of the road, determining how many cars can go at what speed. These two approaches, one

analysing the psychology of drivers and the other analysing the flow of cars, are consilient because one can identify the causal role of each factor in forming traffic jams. Consilience consequently implies that there exists a set of terms common to the consilient approaches and describing the explanandum. In the Braess paradox, for instance, both approaches agree on one way to describe the explanandum, viz. the time it takes to commute. Note that consilience does not imply commensurability in the classical use of the term: there does not need to be a single overarching theory, a unifying language or common criteria for assessing the scientific validity of an explanation. The diverse explanantia, which identify psychological or ecological causal factors need not rely on common terms and measures. The commensurability is local: just at the points where the approaches can fruitfully interact and be combined.

Finally, an integrative pluralism celebrates the division of scientific labour so long as **complementarity** is pursued. Complementarity means that what serves as a blackbox for one approach is an explanandum for another. As each approach focuses on specific causal factors and using special methods devised to understand the causal roles of these factors in bringing about some phenomenon, it is inevitable that other aspects of the phenomenon are either ignored or simplified. However, by dividing the study of the causal factors of some phenomenon, the blind spots of one approach can productively be complemented by the tools of another, thus leading to more comprehensive explanations of the phenomenon. For instance, Barabasi analyses the causal factors leading to success or popularity that are in the network, but he identifies one variable that network science cannot explain. This variable is black boxed under the term 'cultural fitness'. A successful complementarity approach would have another approach—a psychological one in that case—taking over and specifying the causes of cultural fitness. What is likely to happen, however, is that the approach called in specifies what it is that they can and cannot explain. Thus, a preliminary work improving consilience might be needed to achieve complementarity.

Adopting an integrative stance does not imply a reductionist perspective where one approach would have to be modified in order to become coherent with the other (e.g., making the social sciences coherent with the natural

sciences, which suggests a directionality in the coherence assessment). Instead, an integrative attitude aims at developing better interfaces between the different approaches in order to allow their mutual enrichment and a co-development of their respective research methodologies. Note that we are not describing principles of the scientific method aimed to ground the reliability of science. We are more modestly emphasizing the epistemic value of consistency, consilience, and complementarity and drawing consequences on interdisciplinarity. Likewise, Popper's falsificationism is better understood as an attitude of scientists towards possible refutations, rather than as a principled characterization of "the scientific method" or an order to abandon theories in view of data incompatible with the theories' predictions. Adopting an integrative stance is thus to open the investigation of a particular phenomenon to the possibility that its constitutive elements and causes may be better understood by interdisciplinary efforts. This does not mean that interdisciplinarity should be pursued at all cost. Integration is worth pursuing when and because a richer understanding of a phenomenon benefits from conciliating different approaches together.

Here are examples of the problem of integration involved in the studies of crowd.

- First example: sociological studies of crowd, especially early ones, have often attributed ideas and emotions to the crowd itself. However fruitful this metaphor might be, it prevents consilience with psychology. One field is using the term in one sense, and the other is using the term with another sense. Consilience can be improved by either avoiding the attribution of mental states to sets of people, or by redefining the concepts of ideas and emotions, to the satisfaction of both sociologists of crowds and psychologists. So far, it seems that the best option is the former rather than the latter. In this case, the effort for consilience has to be done by sociologists. Yet, the other option might also be fruitful: for instance, Chalmers and Clark (1998) have been advocating a notion of cognition that is not limited to the bounds of the skull. Memory for instance, could be ascribed to a system that include both a human agent and his notebook containing some relevant information. In that case, the

effort for consilience has to be done by both cognitive scientists and sociologists.

- Second example: Economists, including behavioural economists, have been keen to develop models that rigorously describe the observed behaviour and have some predictive value--this is rational choice theory. The models can be interpreted in at least two ways. In one interpretation, the models are precise mathematical redescription of observed patterns of behaviours. In another interpretation, the models describe some psychological processes. Thus, an essential variable of models in rational choice theory refer to individual preferences, which is quantified in terms of 'utility'. The variable can be either used to describe behavioural data assuming that agents are rational, or it can be used to make empirical claims about the actual motives that cause people to make the choices they do. Both usage are consistent with psychology, which can either develop independent theories of motivation or theories that are compatible with, and building upon, findings in experimental and behavioural economics. The interpretation of preferences as psychological facts might be the solution for making economics consilient with current cognitive psychology. Since the 1970's the field of behavioural economics has worked on the consilience between economics and psychology. This effort was celebrated with the prize in economic sciences in the memory of Alfred Nobel delivered to Kahneman and Smith in 2002. In our example of the crowd gathering at Tahrir square, we do really want to talk about underlying motives as having a causal role in crowd formation.
- Third example: the network science analyses of popularity explicitly state that they identify one factor in the growth of popularity and the consequent distribution. Features of the socio-cultural phenomena that cannot be explained with the structure of the network are residual and in need of some other type of explanation. In this way, network science is striving for compatibility with other scientific approaches. But there remains more work to be done for consilience: we want to know how the ecological factors related to the network interact

with the psychological factors. For instance, why and when are people led to use and trust the results of search engines?

5. Naturalism as an integrative stance

The integration advocated above has focused on integration among fields in the social sciences. However, the integrative stance can be applied to fields coming from both the social and natural sciences. As a case of integration in the natural science, Mitchell (2002) documents explanations of the division of labour in social insects. She shows how different approaches -- such as evolutionary theory, behavioural genetics, behavioural ecology, and animal learning -- are not understood as competitive explanations but can be integrated together to explain both the patterns of division of labour together with their plasticity and apparent self-organization. Closer to the social sciences is the case of archaeology and explanations of site formation, which often involves articulating theories and methods from anthropology, geology, taphonomy, nuclear chemistry, osteology, and many more (Renfrew & Bahn 2008).

We think of naturalism in the social science as the stance of valuing consilience between the social and the natural sciences. It is thus an integrative stance, but one that goes against the historical divide between the social and natural sciences. Naturalism is therefore different from reductionism. For instance, neuro-economics, insofar as it aims to explain economic behaviour with the sole means of brain science, is a reductionist project. But it is not consilient with psychology. It bypasses it and thus loses the ability to describe how multiple causes such as beliefs, evolved and learned skills, individual history, motivation, etc. might interact for producing a given behaviour. Reductionist projects run the risk of making oversimplification because social phenomena are likely to result from multiple causes of different types. Naturalistic projects, not so much.

Naturalism does not consist either in mimicking or drawing on the methods of natural science. For instance, theories of cultural evolution have made an analogy between the processes of biological evolution and cultural

changes (Mesoudi et al. 2006). This motivated some authors to draw on the models of biological evolution (Boyd and Richerson, 1985). The analogy might be justified and fruitful, but it does not make the project a naturalistic one. It does not make biological and cultural theories consilient because it does not matter to theories of evolutionary biology that their models might work for explaining culture and, reciprocally, it does not matter to theories of culture that the model they use comes from evolutionary biology or from elsewhere.

Dan Sperber (1996) is explicitly aiming at developing a naturalistic approach in the social science. He presents a framework theory that allows distributing questions across several fields: to psychology, as a most relevant field, but also to any other relevant field able to describe the causes of cultural phenomena. For instance, the chemistry of chert explains its hardness and brittleness, which in turn explains aspects of the production of arrowheads in the Neolithic (Charbonneau, 2015). Likewise, crowd formation often results from both intentions, such as the intention to escape, and non-psychological factors, such as inward rather than outward swinging doors--as illustrated by the Italian Hall disaster. Sperber has especially worked on ways to make cultural anthropology consilient with cognitive psychology. For this, he specified how and when mental representations are causally involved in social and cultural phenomena. He then points out the work that the cognitive revolution and evolutionary psychology have done for making psychology consilient with the natural sciences--investigating respectively the material implementation of cognitive processes and the biological evolution of cognitive capacities.

6. Conclusion

Following the failure of the unificationist program of the logical positivists and of the reductionist approach, it seems that the social sciences are to remain divided and their different approaches and disciplines insulated. In this chapter, we have argued in favour of an integrative pluralistic stance, where the specificity of the different approaches in the social sciences is celebrated, but where interdisciplinary cohesion and cooperation are strived for. Indeed, the best ways to promote integration and naturalism as we characterized it in this

chapter is to focus on causal explanations. Since social phenomena result from multiple causes, the best explanations will make use of the relevant explanatory tools of the fields and disciplines, whether they come from the social or natural sciences.

The integrative pluralism developed here is based on the toolbox metaphor: since social phenomena result from many different causal factors, it is worth having a set of explanatory tools that best afford the production of satisfactory explanations. In our illustrations, we mentioned the following causal factor of crowd formation and maintenance: the psychology of crowd behaviour such as the transmission of emotions, incentives for making the choices that lead to crowding, the network and a multitude of ecological factors. For each of these causal factors, one approach was best endowed for analysing its role in producing the crowd phenomenon. Our approach to pluralism is a pragmatic one: there exist a set of explanatory tools, let the scientists use the ones that better fit their specific explanatory purposes.

Integrative pluralism promotes an active cooperation and co-development of theories and methodological approaches between the different social sciences. In this, it is different from the many competition-centred approaches of theory-choice that view the co-existence of different theories and methods explaining a same phenomenon as the grounds for the falsification (e.g., Popper), elimination (e.g., Paul Churchland, etc.), and/or simply abandonment (e.g., Kuhn) of the "weaker" ones. An integrative pluralism is also distinct from an epistemic anarchism that aims to normatively impose a plurality of scientific approaches in order to stimulate scientific progress (e.g., Feyerabend (1975), Chang (2002)). Nor, in fact, does it entail that different approaches are inevitably incommensurable, as staunch relativists would have it. Instead, we acknowledge the existence of different explanatory frameworks and argue that interdisciplinary dialogue can obtain when the identification of the causal factors underlying a phenomenon serves as a common epistemic goal. Finally, our defence of pluralism does not rest on a rejection of the metaphysical assumption of monism – i.e., that the world is itself one, united thing --, nor does it entail that we need to grant reality to various types of entities (e.g., Dupré's (1993) 'promiscuous realism'). Rather,

we argue for an *epistemic* pluralism, the benefit of which is cashed in terms of a complementarity between approaches leading to a more comprehensive understanding of some phenomenon.

Our view of pluralism is in line with Peter Galison's view on scientific disunity and pluralism in the physical sciences. In his *Image and Logic*, Galison (1997) argues for a pluralistic view of physics, showing how theoreticians, experimentalists, and instrument-makers often have very different problems, methods, and languages when working on some common project. However, this plurality becomes productive as the different traditions develop what Galison terms 'trading zones', i.e., a minimal language that allows the different traditions to exchange and jointly solve problems. The languages so developed are not universal and englobing, the different approaches are not unified, but the benefits of interdisciplinarity are achieved by establishing a common epistemic space of interaction between the traditions. Similarly, we argue that the integration of multiple approaches should rely on three epistemic values, that of consistence, consilience, and complementarity. Instead of striving for a unified theory that would englobe the different methods and theories of the social sciences, aiming towards these epistemic values has the benefit to offer a more comprehensive understanding of the contributions of the different causal factors producing a phenomenon under study.

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