

Sociology & Digital Technology: The Mutation of Sociological Research

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Abstract. Due to digital technology, data production has grown exponentially, creating enormous enthusiasm within the scientific community for “big data”. This socio-technical phenomenon gives rise to dualities and conflicting attitudes in sociology: unlimited synchronic numerical data against classical data at risk of expiry, rigorous methodological process as opposed to a stagnation of the protocol. And has put in a vice the research techniques and their associated modes of resonance. In this article, from a consultation of the literature, three fundamental aspects will be subject to explore: the forced adjustment of the domain, the transformations of the methods of data collection, and the models of reasoning about the theory. In the outcome, the vast availability of digital data show how far the digital has invaded sociology by announcing the embarrassment of classical researchers facing big data, the obsolescence of traditional techniques and the change of models reasoning. Moreover, three models of interaction trace the ways of dealing with this digital derivative ranging from protection by the total refusal so that the discipline does not become digital, conservation manifested by a reserved acceptance by sociologists, finally, a trend of adoption under the pretext that digital technology transforms the functioning of societies and the ways of knowing about them..

Index Terms. Digital Technology, Big Data, Digital Ecosystems, Sociology, Digital Data, Methods, Social Reality

Introduction

Offered by platforms as disparate content [1], big data is of interest, and also a subject of debate [2]. Resulting from the evolution of storage and data processing capacities reaching a certain level of development, like the concepts of artificial intelligence, machine learning, Cloud computing, and connected objects, this widespread digital phenomenon remains unknown to the most of researchers in the social sciences [5]. Big data, the topic recently floated on the surface of scientific research, has grown exponentially [4], and aroused so much interest within the scientific community. Complex and polymorphous, following the variety of research fields, a unified definition of the term has not yet emerged. The term originated in the beginning in economics, marketing and computer management for the improvement and creation of values [7]. Characterized by the 5v: volume-velocity-variety-value and integrity, big data has succeeded in arousing a re-examination concerning the problems of the collection and processing of data. Referring to the transformation of data and the unavoidable development of information and communication tools, it makes

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possible the application of computer and mathematical approaches to sociology models simulate and analyze social facts. Endless debates have taken place in scientific research, questioning the addition of this phenomenon to produce scientific knowledge and for learning on the social specifically [8]. Since then, the literature dedicated to this sociotechnical phenomenon fluctuates according to academic positions regarding what big data entails for sociology. The profusion of mega given by computer tools pushes researchers to emphasize the updating of the laws governing the functioning of societies has become possible thanks to mathematical modelling of the social by the implementation of an inductive analysis method by putting in traditional hypothetical- deductive approaches become obsolete. The enthusiasm demanded of supporters of information and communication techniques is not always shared. Other researchers have warned against the dangers of these methods, emphasizing that an avalanche of data, ethically not yet resolved, can never rectify the protocols of knowledge. Between these two extremes antagonistic, many researchers see the controlled inclusion of computer and mathematical approaches in research on the social finds its relevance in the fact that the digital has transformed and upset daily life, and that the synchronization data massively produced by social actors on the various computer prostheses offer researchers in the social field unprecedented opportunities to model and simulate the behaviours of a N=ALL sample in an evolutionarily way. So what are the deviations and risks inherent in including big data as a source in sociological research? To answer this milestone question, three fundamental aspects constituting the discipline will be explored: the forced adjustment of the sentence, the transformations of the methods of data collection and the modes of reasoning concerning the theory.

Digitizing Sociology is Possible Today

Renewing knowledge is the ultimate goal of every researcher sociologist or non-sociologist [9]. Fascinated by the availability of voluminous and diversified data, and far from the concern of expiry, contemporary sociology researchers are beginning their departure to the digital world to take advantage of its potential and explore its powers that have been able to transform societies by learning certain aspects of prediction and distancing oneself as much as possible from the uses of analyzes of causal relationships recognized by traditional sociology, which, from the point of view of prominent data evangelists, challenge the system of disciplines scientificity. The ambition of digital sociology is nevertheless different from that of current sociology. In effect, if the latter seeks to produce knowledge on social facts from the daily life of social actors by carefully resorting to rigorous collection and analysis techniques that involve and empower the actor while distancing itself from prediction. Digital sociology returns to the anonymous mode on these two levels: firstly, it works on digital traces from digital ecosystems: consumption of services; browsing queries; opinion; choices and publications on social networks; RFID. These tracks controlled by commercial companies with limited and sometimes conditioned access; are figures that only capture some activities of connected people, while the considerable number of others not connected makes this data biased and partial. Second; the nature of these data requires the use of purely Mathematical and Computational methods of classification and analysis unknown to the most of sociologists with a prediction view. In doing so, the prerogative of collecting and analyzing this data remains a privilege of physicists and mathematicians. In this perspective of these dualities, it has become legitimate to wonder whether it is possible to identify a crisis in which the sociologist loses his jurisdiction over social knowledge by leaving the initiative to researchers from other specialities to produce understanding about social objects. The prerogative of collecting and analyzing this data remains a privilege of physicists and

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This bold statement elicited a vigorous response from Abbott: "The fools from physics and computer science who imagined they could answer all the questions posed by the social sciences and humanities with their random exponential graph models and their terabytes of text corpora will end up in the same dump as the sociometrists and social physicists of the 1930s, the sociobiologists of the 1960s (...) they have no genuine interest in important questions of the humanities or the social sciences, they are a cause of annoyance[6].If physicists and computer scientists call for the transformation of the discipline, they do so not only in terms of data collection tools, but also invite sociologists to rethink the normative foundations of the domain. Nuancing the debate is beyond my analytical skills, but that does not prevent me, as a novice researcher in the amid of this enormous and prolific scientific exchange between these thinkers, in providing clarifications on the possibility of foreseeing that a field has begun to form. After the outpouring of diverse and voluminous data from digital ecosystems from the 2000s, all disciplines have become coveted targets, especially those interested in predicting trends and human behaviours. Sociology, as a profession producing social knowledge by adjusting the method of data collection with the mode of reasoning, is facing with voluminous and more heterogeneous materials in unfamiliar numerical forms related to fields of activity. Unspecified social. While quite a few sociologists began to familiarize themselves with this new world of research years ago [17], the majority of them: especially those who have not learned computer science and applied mathematics lexicon; tweet out the swarm and are not in tune with the requirements of these computing devices. As a result, many researchers from different backgrounds: physicists, computer scientists, mathematicians filling the void and claiming the renewal of the discipline by producing knowledge in an inductive mode [6].The jostling of these researchers from other fields outside of sociology has put traditional sociologists in a vice. So, the sociologist who brings together basic training in sociology, computer science and computational sciences will henceforth be the model of the contemporary sociologist suitable for the following directions of sociological research. The sociologist's multidisciplinary training allows him not only to explore new avenues of research, but also to enjoy increased visibility by publishing in well-known journals in the field [10].Faced with this embarrassment; most sociological researchers have remained critical by contesting the idea of building sociological knowledge from digital traces or by measuring the feelings of Internet users[11], and that the analysis of social dynamics is beyond the capabilities of a learning machine [10]. The emergence of methods related to the profusion of big data originating from the crossing of various disciplines far from sociology[12], makes it easier for researchers in applied mathematics, computer science and physics to deal with objects that form original themes of sociology. The ambitions of these researchers have widened to the production of social knowledge by taking advantage of the new difficult position in which the discipline finds itself following the emergence of this investigative news offered by these digital devices. So, sociologists are almost forced to

rethink their know-how and their interpersonal skills to convert by making rational and reasonable choices. Because, within a few years, the intellectual practices that direct and animate the process of research will disappear because, this diversification of the data, undoubtedly, will transform not only the methods [13]. In this context, for fear of the expiration and disappearance of the ancestral intellectual model, sociology is led to make radical changes on the systematic level as well as on the theoretical level by repositioning these digital techniques in its approaches [14].

Towards a Mixed- Method

The question of the method seems to be the main escape route for the discipline to be updated. Indeed, the heterogeneity of digital data, (images, texts, messages, figures) exceeds the profitability of conventionally recognized tools (interview, survey, observation) to provide access to corners of digitized social life[15].The social actors produce and leave signals by using of computer tools which permanently feed the databases[16].These traces represent the virtual side of actual social activity. These digital activities emitted by connected human beings constitute a significant challenge for sociologists poorly trained in artificial intelligence to take advantage of them. So how can they produce knowledge about these social activities by drawing inspiration from models that do not match the history of the discipline?

The restoration of laboratories whose mission is to study social objects within GAFAM companies (Google, Apple, Facebook, Amazon) by taking advantage of data from digital platforms, heralds a cutting-edge launch of new ways of acting on social issues. By analyzing these numerical data, unprecedented avenues of research are opening up and, the jurisdiction of sociology is being called into question. The almost total marginalization of sociologists within these labs suggests that a scientific revolution is underway and that sociology is no longer the prerogative of sociologists [17]. So how can researchers with no sociological concerns develop sociological knowledge by renewing the methods of sociological inquiry? Is it possible for anyone to become a sociologist? For Pierre Bourdieu, the profession of the sociologist is not based solely on the concern for validation to the detriment of the Universalist conception of social facts. [18].The entry of learning machines into sociological research attracts less attention, because the most of sociologists ignored the logic of their functioning. On the other hand, the secondary effort of mathematicians and computer scientists is targeted, based solely on programming and machine feed[19]. So, Sociologists are not the only ones, who investigate. However, they remain the only ones who produce better sociology. Is this a riddle? Sociologists remain inactive in the face of big data and, claiming jurisdiction over social knowledge against data scientists from other specialities with no sociological concerns equipped with current methods of inquiry claim to produce better sociology than sociologists themselves [20].

The diversity of methods within sociology has placed it well to take advantage of this continuous methodical evolution. Indeed, whether it concerns the foundations of quantitative methods or qualitative methods, it is essential for the field to rhyme with these novelties, to revitalize a fertile social imagination capable of grasping the complexities of digital data in a way that could claim jurisdiction over the study of the social[21].What follows from these considerations, in all cases, is the need to hybridize the methods to what even qualitative methods allow to reinforce the results resulting from an analysis of numerical data via learning machines. Because it is not the massiveness of the numerical data that will call into question the validity of the traditional methods, but especially the

emergence of these machines like supports of analysis. What is evident is that the hybridization of methods allows sociologists to intervene in the world of big data to ensure that they can explore the potential of new worlds of big data. Because this hybridization creates repertoires of research that are not accessible using traditional methods. The significant challenges for the field are the multiplication of data and that relating to the sample. The explosive increase in type and number of data generated by the various sensors, the digitization of everyday life and search engines offer a better possibility of describing the social world in a way hitherto impossible for sociologists [22]. However, can one carry out a purely sociological research in the absence of the slightest knowledge on an extended sample? Doesn't the absence of any reference mean the lack of representativeness? Knowing how to read the web is insufficient for a sociologist wishing to take advantage of big data, because the profusion of massive data, goes hand in hand with the acquisition of new skills: computer calculation skills, geocoding to map, operation databases etc. then a good contemporary sociologist has managed to update himself permanently in order to integrate easily into the club of new researchers.

The Sociological Reasoning: Transforming to Conform

Does the sociologist adjust its analysis to fit new data? [23]. How to validate knowledge produced by analyzing massive data constructed outside of all recognized sociological methods? In current sociology, exploring, analyzing and interpreting data made in the light of a theoretical and practical framework called a paradigm. The latter supports the researcher with keys that allow him to undertake a method that responds to the specificities of the data and adapts to the epistemic requirements of the field [24]. So how does sociology prove it? How does sociology prove what it has been asserting through its various methods for years when it makes it possible to understand the functioning of a given society in a given time? To produce scientific knowledge, the sociologist settles beforehand in a theoretically recognized model, the latter providing him with logic distinguishing sociological reasoning from a mathematical demonstration. Indeed, digital data, from an epistemological point of view, technically constructed, are only traces, removed from real life, abandoned by social actors who are unaware of the slightest characteristic. This simple particularity has a significant impact on the theoretical positioning of the researcher. So the lack of a normative framework makes epistemic continuity between the data and the coveted knowledge impossible. The approaches mobilized are always insufficient and often criticized because Calculations and graphs do not explain social facts and do not give access to culture, however, legitimize decision-making. To know what we wish to know, the journey of constructing new knowledge about a new object requires a new epistemology leading to fertile and knowledge-producing thoughts about the contemporary reality [25]. In this context, the analysis of digital traces that we determine under the name big data in sociology is only in its infancy, and the mobilization of the philosophy of science is essential to take the possible modifications seriously affecting the discipline. The elaboration of a theoretical and conceptual edifice facilitating the paradigmatic positioning for the study of this type of data contrasts with the obsessive preoccupations devastating sociologists who are not accustomed to this kind of analysis and who find themselves forced to do it later if they want to remain researchers of the social. It is a virgin research field for sociology with few roadmaps to guide ambitious sociologists to enter this new field full of ready-to-use data. Contrary to the usual data, this vast socio-technical phenomenon is rich in various data and calls for a multidimensional approach: technical, social, ethical and political, requiring an encyclopedic mind able to

take advantage of it in its complexity. To do so, sociological reasoning, so that it can exploit this new terrain and fill the gap resulting from the insufficiency of classical tools, must equip itself with an epistemological vision delimiting the value and meaning of these traces far from the fallacious mystification generated by the scarcity of studies on this kind of data. So, sociologists are invited to consult data in their field of research to carry out an accumulation marking out the practices of future research. The diversity of digital data requires an assortment of approaches and methods that sometimes exceed the capacity of classically recognized techniques in sociology, therefore the comprehensibility of these data by sociologists less trained in the field of computational science techniques requires a reconfiguration of systems of basic training so that, they include modules related to recent technological innovations to restore methods and standards governing the practices of interpretation and validation to avoid calling into question the scientific nature of the discipline. It is a new framework for sociological thought. The theoretical stakes no longer decide the relevance of the results, only the successive approximations that are at the heart of the debates. [26]. Can algorithms analyze social data by giving them meaning better than the sociologist? In other words, does artificial intelligence replace human Intelligence in the production of social knowledge? Indeed, algorithmic reasoning is mainly based on what and how much, unlike the sociologist who adds the how and the why. According to the French researcher in information and communication sciences at the University of Aix-Marseille Fidelia Ibekwe, “if the paradigm of big data were to prevail, we would enter a science without purpose, without causality and without knowing subject... founded on correlations [27].

Results

Third-Generation Sociology at a Crossroads

Opening the way to the sociology of traceability unrelated to a reference whole characterized by socio-demographic qualities, big data pushes the sociologist to work on probable actors. Indeed, the fundamental concepts of sociology such as community, society, sociability are diverging by giving way to terms attached to digital culture: (accounts, Internet users, verbatim, connectivity, clusters, icons.). Collecting data from these elements on the various digital artefacts hardly constitutes a valid vigorous basis for the application of the ideal types and models of society that govern the sociology of the first and second generation. So sociologists find them at a crossroads: resisting. For fear of the total digitization of the discipline, sociologists continue to reveal the disadvantages of digital traces. According to them it is impossible to exploit them to extract generalizable rules and norms on the pretext that there is a significant part of the unconnected, as well as data, are produced for purposes other than research, so they cannot generally provide purely scientific answers for the problems of sociology and their variables are not always valid for the study of a social fact. Other sociologists partially accept the addition of big data, emphasizing that they shed light on different dimensions of the social. As a result, the velocity of this data (real-time) removes the concern for preemption that threatens the data collected in the field, as well as data constitute new entities that no longer refer to people or groups: they are neutral. For the contemporary sociologists, practicing sociology from their specialities (mathematicians, physicists, computer scientists), big data heralds the end of the jurisdiction of sociologists over sociology. According to them, it is impossible to deny the crucial role of platforms that replace research fields, and which constitute inexhaustible

resources of raw materials for the sociologist.

Theory and Object

Big data, seems generate intense and profound changes in social research. It is fueling a discourse of promise of creating unprecedented research possibility through a better use of data in the information age. However, faced with the lack of hindsight and shared and academic definitions of this recent phenomenon, the exploitation of data in the service of sociological research poses methodical difficulties for sociologists who are poorly trained in the field of applied mathematics, computer science and physics. Then, they are called upon to undertake profound modifications to cope with the influx of increasingly large volumes of data, and to position oneself in relation to a set of general questions: Does big data constitute a revolution for the sociology? Will they transform our ways of studying and knowing social facts? The problem facing sociologists today is that of access to data hosted by companies, which are increasingly reluctant to share it with public research actors. These new data are most often the prerogative of mathematicians and physicists for whom they constitute crucial competitive resources. The consequences of this situation can only be shocking for research in sociology, which does not have any status allowing it to claim some form of access to this data. In this area, the difference compared to traditional data from official statistics is so clear.

Data Access

The constraints on access to this data tend to increase from one way to another. Some company strongly restricts the right to share collected data (Twitter). Others offer to sell data, (Google map), in addition, the protection of personal data is sometimes put forward to justify all the limits placed on access to data [28]. The solution envisaged is related to the creation of a legal framework for copyright: this would involve authorizing an exception to copyright and database producers to allow the sharing of this information. In addition to collection and processing, the problem of access and management of resources is an important issue raised by the proliferation of digital data. Two obstacles seem the most difficult for researchers in the human sciences: intellectual property rights and the protection of privacy. Even if more information is found, not all of it is available either for legal or ethical reasons. The solution to access this data and others, which are not posted online but may be useful, is then the way of negotiating access to these databases. In other words: the drafting of a contract, the commitment of a refund, the communication on behalf of the company... it is considered useful to set up a long, time-consuming procedure guaranteeing the proper use of the data within a framework that protects copyright and preserves privacy.

Adopt to Adapt

Without doubt, this is one of the most important issues; sociologists are poorly equipped and trained to take advantage of these digital devices, leaving the prerogative of the organization and production of knowledge on many phenomena: Social, historical and cultural to computer scientists and physicists, and their research in classic objects of sociology (crime, organizations, work, sociability, art, innovation, etc.) are based on big data, and their results are often valued in sociology journals as well as in scientific journals. Using developed techniques that are not associated with sociology, computer scientists and

physicists deal with common objects with the discipline. The marginal presence of sociologists in GAFAM labs gives the impression that research in sociology tends to demand practical solutions by drawing inspiration from a business model that does not correspond to the discipline. These transformations are not only of interest to ICT sociologists, but also challenge the whole of sociology. So, the sociologist must adapt to the digital evolutions in progress to be able to survive in this context full of competition between the different types of knowledge on the social. Like physicists and mathematicians, sociologists of digital artifacts approach the primary objects of the discipline. So, habits and beliefs for them are only flows of ideas which are translated into behaviors, all variable like flows of energy which give rise to changes in movement (referring to the abandoned notion of physics social). In appreciating prediction, the contribution of new sociologists in terms of analysis is distinct from analyzes of interpretable causal mechanisms enjoyed by traditional social scientists. In this experimental perspective, digital artefacts have enabled the emergence of elite of sociology researchers using the Web as a data resource, which makes it possible to create online sociological experiments. Like the digitized disciplines, sociology is on the conquest of a positional advantage concerning this work of digitization. ICT sociologists have developed automatic processing methods and data encoding practices by multiplying interpretative frameworks.

Discussion

Big data has aroused great interest in the social sciences. Many researchers are drawn to the promise of the phenomenon. These promises are of three types: methodological, empirical and theoretical. Access to huge sets of empirical data was enthusiastically welcomed by researchers in the social sciences: unprecedented and extensive information making it possible to study subjects never apprehended and to know with greater precision entire aspects of Human behavior: data for mobility studies, data for demographers to study individual movements. These biases provide rich and reliable information on the journeys of a population [29]. These data can be updated, which limits the classic risk of expiration that other survey methods experience. To study conjugality, sociologists have also taken an interest in the data on the subject. They had access to interaction data between users by studying not only the unions made, but also the couple in the making [30]. The automation of recordings and the acceleration of processing make the study of an entire population very fast than a limited sample. The change is significant, since it is the question of representativeness that ceases to arise, so the statisticians say “N = All”. The wealth of these data, rapid and numerous lead to an exhaustive investigation [31]. The study is both meticulous and exhaustive, qualities that are rarely combined but made possible by the multitude of usable data. Finally, theoretically, according to some recent studies, which have studied huge corpora of published texts, the accessibility of new data makes it possible to advance knowledge [26]. Without doubt, this is one of the most important issues; sociologists are poorly equipped and poorly trained to take advantage of these digital devices, leaving the prerogative of the organization and production of knowledge on many social, historical and cultural phenomena to computer scientists and physicists. The ambition went beyond mere empirical discovery or theoretical elaboration. For several sociologists, big data would change the way we look at society in general, their consequences will modify our perception. [...] Big data will change the humanities, transform the social sciences”. [9]. The reason for this change is in the mass of data [33]. Sociologists hope to find hitherto unknown regularities and also hope to bring out the

laws of the functioning of the social world. Invisible to sociologists, these fundamental laws and tendencies which govern societies. However, they would be accessible to researchers capable of making the data speak and uncovering the hidden laws of the social world.

Conclusion

Advances in technology have placed inexhaustible potential at the service of scientific research. The evolution of data collection systems calls for multidisciplinary and multidimensional logics and the advent of digital communication support the whole and provide power in the processing of data which, if it has enormous potential, also raises new legal, ethical and societal questions. An exploration of the state of the art in different productions that have addressed the subject has led us to note that:

- 1) Big data covers a set of statistical methods that have been known for a long time but have been brought up to date by the existence of this massive data and the technical capacities now available to process them. [34]
- 2) Can promote new avenues of research within the social sciences, but it can also threaten the existence of traditional tools and increase the digital divide between researchers. [7]
- 3) Studies on the social, in real life, most often make it possible to analyze the additions and the added values in methodological and empirical matters. However, existing debates on these values of these studies show that the evolution of the statistical system does not automatically mean the evolution of the standards of the discipline.
- 4) Researchers are called upon to position themselves in relation to big data by taking into account its weaknesses and its promises, which gave us three types of reaction: total protection against a methodological and empirical revolution coming from outside which aims to question the heritage of the founding fathers and pioneers of the discipline. A second less protectionist and much conservative reaction calling on researchers to integrate digital technology as a social object. Finally, an attitude that enthusiastically considers big data as a major renewal that will bring sociology up to date so that the discipline can survive in a context where competition between different types of knowledge has put the different disciplines in a vice[7].

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