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Ordering the World through Maps and Figures.

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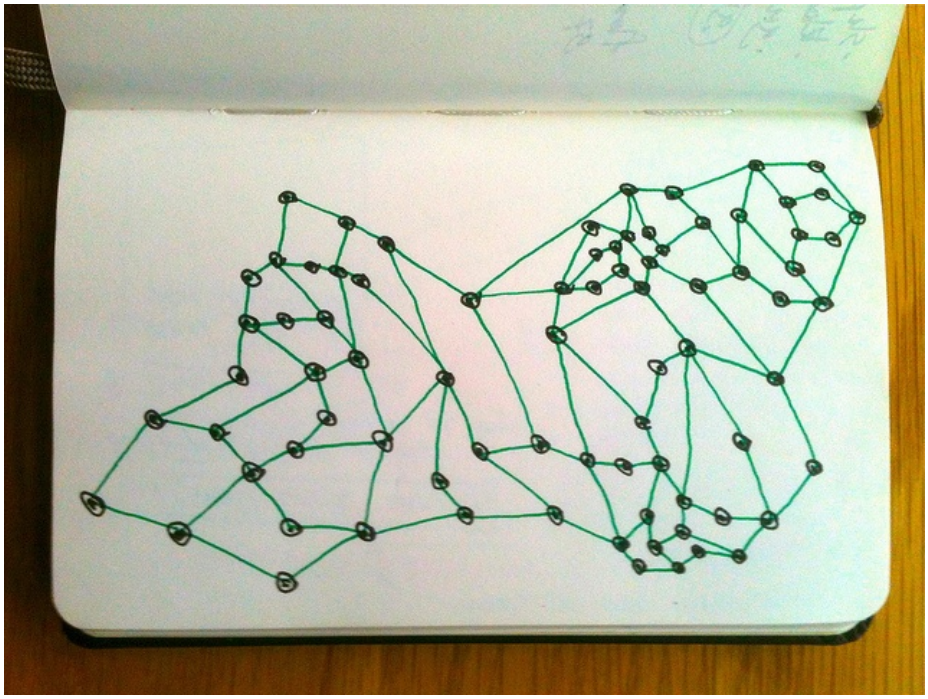

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“Time is not given to us – but spaces are. Or so it seems today, at the close of the 20th century. What remains to be seen is how spaces are given, and at what cost.” (Zumthor 1993, p. 13).

Ordering Spaces through Maps and Figures : From Measurements to Benchmarks.

Defining and imposing benchmarks is a prerogative of power[1]. The historian Witold Kula, in his now classic work on the economic systems of the Middle Ages, recounts the battles over measurements that arose between the various powers in feudal European society : cities, lords and clergy. Each claimed the right to establish and exert control over its own measurements, including

control over “violations of measures”. This right was symbolic of their autonomy from royal authority (Kula 1984, p. 27-28). Kula also points out that honest use of weights and measures (“a full and fair measure you shall have”) was an important symbol of social justice in many societies (Kula 1984, p. 16). These examples underline the idea that “measuring” – or attributing singular and different cases to common categories – is a universal social and political act. In the words of Martine Duquesne and Dominique Vellard, “measurement is of the very essence of how we think and relate to the world. If thinking means classifying, putting in order, delineating, discriminating and criticising, then it also means measuring – which means creating order from chaos, by relating objects from the real world to benchmarks that are meaningful for society” (Duquesne and Vellard 2005, p. 389). Although the phenomenon is universal, it has many anthropological, social, cultural, historical and geographical variations. It is important to bear this diversity in mind, because the metric system, which has become more or less taken for granted across the globe with industrialisation and the unification of local measurement systems, is by no means neutra l: it is in fact closely linked to the values and the social context that shaped it, and its nature is therefore necessarily *ideological* rather than *logical* (Duquesne and Vellard 2005, p. 389).

Metrology[2] is conventionally defined today as the science of measurement. It determines the principles and methods that can guarantee and maintain confidence in the results obtained from measuring. The international vocabulary of metrology defines measurement as “a process of experimentally obtaining one or more quantity values that can reasonably be attributed to a quantity” (Bureau International des Poids et Mesures 2012, p. 16). Any measurement implies comparing quantities and counting units by means of a benchmarked system (or instrument). Metrology thus aims to create, develop and maintain the benchmarks to be used as references. In this traversal, we put forward an approach to metrology that has been developed within the social sciences. More specifically, we investigate the processes involved in building what we have called the “metrology of spaces”, in other words, the production of social and technical systems geared to create, develop and maintain benchmarks or references that are used to *consider and arrange social patterns in spatial terms*. We put forward the hypothesis that whenever the construction of a social and political sphere also requires the construction of a common measuring sphere within which everything must be comparable, coding categories and procedures are established to create “classes of equivalence” (Desrosières 1993). These will then serve as a basis for ranking and categorising. The aim of this traversal is to launch a critical deconstruction of these systems. By focusing primarily on their social and political dimensions (but without neglecting their technical dimension), the idea is to try to understand how they function as ways of exerting power through knowledge.

In this editorial, we first review new thinking on the question of metrology, underlining the increasing number of processes being used to translate the world into maps and figures. We then stress the importance of keeping a critical eye on these systems and draw attention to the earlier studies that have opened the way to these critiques. Finally, from these theoretical foundations, we draw out three avenues for exploratory studies on the different registers of metrological construction. In doing so, we are not outlining the boundaries of this traversal, in fact quite the reverse, as the idea is to encourage original contributions to the debate by offering a variety of concrete examples.

Counting and Mapping in Order to Exist :

Measurement as a “Total Social Fact”.

While metrological diversity is central to our concern, the fact that the measurement phenomenon has been intensifying for several decades now demands particular attention, as well as conceptualisation. This is because measurement has become the benchmark for everything, not only for trade but also for the individual ethos. By systematically benchmarking, comparing and ranking, metric rationalism succeeds in establishing criteria for what is normal, pathological or out of the ordinary (Houdart, Manceron and Revet 2015, p. 5).

The increasing propensity of our societies to quantify both natural and social phenomena makes it increasingly difficult to imagine that they can be understood without statistics, and without maps. Both give the illusion that it is possible to deal with what is indefinite and uncertain, to “put the world in order”. In fact, the ubiquity of measurement, and of the accompanying comparisons, is without doubt an essential characteristic of capitalism : not only because measurement enables and facilitates trade, but also – and more broadly – because, as Boltanski and Chiapello put it, the “spirit of capitalism” is founded on “conventions that allow the establishment of equivalences that overcome the particularities of people and things” (Boltanski and Chiapello 1999, p. 777) – conventions which are always about the varying magnitudes of different situations. The particularity of the current phase of capitalism is that quantifications in the different “worlds of justification” (Boltanski and Thévenot 1991) are characterised by measurements, their purpose being to monitor progress towards a new kind of management of our societies.

These phenomena are now of such magnitude that it is no exaggeration to argue, with Olivier Rey (2016), that measurement can be considered as a “total social fact”, to use the phrase coined by Marcel Mauss : in other words a set of facts that are “highly complex (…) intertwined (…), expressing all kinds of institutions simultaneously and (…) assuming particular patterns of production, consumption, services and distribution” (Mauss 1952, p. 147). Metrology pervades everything and gives meaning to the world. It imposes and reinforces a specific frame of reference for understanding the world, by establishing its own ways of translating everything into figures and maps, across the board.

Quantophrenia : When Minds are Ruled by Numbers.

Since statistics were founded in the early 19th century, they have gained immense importance, gradually extending their reach into more and more fields, to bring us into an “age of figures” (Beaud and Prévost 2000) or a “world turned into numbers”[3] (Rey 2016). Olivier Rey clearly shows that while the flow of ideas that prompted the emergence of a statistical mentality is to be found in the modern era, the “great leap forward” of statistics was triggered by the social transformations of the industrial and political revolutions of the 19th century. Following this line of thought, he considers that the 20th and 21st centuries have simply “continued and expanded a dynamic that emerged during the 19th century” (Rey 2016, p. 17).

The dynamic has expanded considerably : it initially concerned not only statistics, but also science. This has not always been the case : economics, medicine and sociology kept figures at a distance, and this continues in some currents of thought in these disciplines. Theodore Porter (1995) analysed the process of turning science into figures as the result, logically enough, of a convention in scientific discourse making numbers the cornerstone of scientific legitimacy – but also as an eminently political process. He showed, in detail, that the independence of a profession and the development of a quantification tool are mutually antagonistic : as calculation methods become

more precise, expert knowledge is often brought into question and eventually disappears. According to Porter, quantification can be a means of keeping control over a profession which is becoming too independent.

The scientific convention of using figures spilled over from science into the social and business world, and now occupies spaces of every kind : water, biodiversity and habitats are bundled into sets of indicators that attempt to show their status. The Anthropocene is surely the most telling example of the drive to turn the world into numbers. In just a few years, it has become a commonplace to say that we are now in the “Anthropocene”, a term coined by Paul Crutzen, a Nobel Prize of Chemistry winner, to refer to the age in which humans have become capable of radically and permanently transforming their ecosystem by their own actions (Crutzen and Stoermer 2004). His diagnosis is based on a series of very disparate indicators, ranging from the number of dams to global GDP and from the number of telephone communications to the number of McDonald’s restaurants that have opened across the world (Steffen et al. 2007), etc. Although supposedly rooted in technical rationality, the construction of these indicators is a theatre for power struggles in which democratic debate is sometimes totally absent (Ogien 2013).

The Mapping Frenzy, or Cartographic Bulimia.

The urge to translate the world into figures now goes hand in hand with a kind of cartographic bulimia that has turned maps into an ubiquitous tool for describing the world (Desbois 2015). While there is nothing new about the use of maps in the field of public policy, cartography has seen a huge expansion in the last ten years, which appears to be due at once to a growing need for representations of increasingly complex phenomena (Besse and Tiberghien 2017) and to the expansion of map-making well beyond the sphere of experts in that field. With the development of volunteered geographic information (Goodchild 2007), mapping has been taken beyond the preserve of government departments and specialised agencies, with mapping competences and technical capacities redeployed in both internet multinationals and free-access communities (Lin 2015). Insofar as these practices are not substituting conventional patterns of map production and distribution but rather supplementing them (or even competing with or bypassing them), the question that arises is how these representations operate and intersect, but also what the effects of such universal mapping might be.

The social sciences have a complex and even conflicting relationship with cartographic images, from iconoclastic rejection to iconophilia and even iconomania (Bord and Baduel 2004). While maps are often perceived as “the essential tool of any geographer” (Roques 1992), many studies by geography researchers – and social sciences researchers in general – have disputed the supposedly neutral scientific view that cartography is merely the fruit of steady and cumulative progress in improving idealised representations of “reality”. In his writings, Brian Harley invited the social sciences to “delve beneath the surface of maps to reveal their hidden intentions, their silences and their secrets” (Gould and Bailly 1995, p. 8). He suggested that maps should be seen not as mirrors of nature, but rather as cultural texts whose rhetoric can be analysed by drawing on the deconstructions proposed by Jacques Derrida (1976), in combination with the writings of Michel Foucault (1971) (1975) (1994) on the relationships between knowledge and power. This critical approach to cartography is organised into three main points : (1) deciphering the technical, scientific and cultural rules of mapping through history ; (2) a reading of maps as cultural texts that can be deconstructed ; (3) building a theory on, firstly, the power exerted *over* or *through* maps (their “external power”), in other words, the role of maps in power systems ; secondly, on the power of maps themselves (their “internal power”), in other words, the political effects they

produce (Harley 1990). By keeping functionalist approaches at a distance to emphasise the cognitive reach of maps, critical approaches to cartography seek to reconsider maps as subjective, socially constructed and ideological forms of power (Lascoumes 2007). What needs to be investigated is the power of enrolment of maps, rather than of cartographers, because, as proposed by Christian Jacob, they confine their users to a passive attitude that can be seen as "a form of civil obedience" (Jacob 1992, p. 354). As with statistics, maps bring into physical existence – through the use of more or less complex and opaque types of metrology – cultural and socio-political realities that are abstract by definition – they "presentify" them (Jeanneret 2011, p. 38). This effect of projection produced by maps can be such as to generate identity-based components or even values that contribute to the personification of places through prosopopoeia. In a recent study, Hélène Blais discusses the link between explorations in Algeria and its subsequent colonisation and cartographic practice. In *Mirages de la carte* (2014), she details the cartographic constructions that gave rise to "the invention of colonial Algeria" and deciphers the many tinkerings and adjustments revealed by an analysis of scholarly cartographic practice.

These "mapping mirages" are multiplying with the development of digital geography, and accentuating the scientistic rhetoric of cartographers by vastly increasing possibilities for representations that tend to impose the idea of an ordered world.

Calculating, Categorising and Ranking to Bring the World to Order.

The ubiquity of figures and maps becomes problematical when, with a constructivist rather than a realist conception of the world, figures and maps are not simply considered as descriptions of reality. If we grant that reality comes before concept, it can be deduced that a concept describes something real. But if, like the constructivists, we consider that any concept is itself an intellectual construct, and that it reflects the culture, agenda or interests of whoever is constructing it, or even the power relationships established at the time of the concept's construction, then that construction has to be questioned. The phenomenon is well known and no doubt quite banal. As Nicolas Bouleau commented (2014), putting the world into figures is not in itself a problem : what can become a problem is doing so when the mathematics are confused with reality, when the figures are used to claim that one reality predominates over another.

Since the introduction of neo-liberal policies in the 1980s, quantification has become ever more widespread, thanks in particular to policies systematising the use of indicators. Barometers, indexes and rankings compare and award grades to every kind of activity. Statistical instruments then become a technique of government, and assessments of public policies become systematised (Lascoumes and Le Gallès 2004). Under the pretext of efficiency, indicators and other benchmarks are used everywhere (Bruno and Didier 2013), not so much to understand reality but to "conduct conduct" (Foucault 1994) so that it transforms reality. The digital transition is accelerating the systematisation of metrology to bring the world to order, by making everything measurable (Cardon 2015 p. 8). And from this computed world stems a world of categories.

Putting the world into figures also puts it into categories and introduces the "divisive practices" (Foucault 1994) associated with categorisation. To make social and spatial diversity intelligible, institutions categorise the populations and areas they are responsible for, and this demands investigations into the way power relationships are affected by the categorisation and manipulation of the boundaries where "otherness" begins and ends. In prisons studies, for example, researchers have analysed the processes and effects of categorisation (by ethnicity, religion or gender). They show that the categorisation process acts as an instrument to achieve the goals of the institution, as

“the expression and the vector of its power” (Michalon and Bruslé 2016, p. 13). As norms that have been imposed, categories are then considered as a disciplining procedure in the same way as surveillance. Categorisation is eminently spatial, in both its effects and provenance, and builds on the profusion of different ways of measuring spaces to pervade every section of society. The metrology of spaces is thus becoming one of the “gridding principles” (Foucault 1975, p. 167) used for the material and spatial organisation of political power. Thus, because the outcome of putting the world into figures and maps is categorisation, they shape and set the scene for political action by bringing its economic, social, cultural and other spheres into a particular order.

Not only is the production of maps and figures historically and socially situated : it also influences social change by conveying particular ways of ranking analyses of the world. This performativeness, underlined by Denis Retaillé when he refers to “maps-as-proof” (Retaillé 1996, p. 88), brings Michel Lussault to consider maps as “unassailable weapons for making things look true” (Lussault 2003, p. 51). It is thus linked with the power to create self-referencing icons in which statistical or cartographic hierarchies establish the reality which they then reflect (Desrosières 2000) (Casti 2005). This traversal is therefore looking to launch a critical investigation into the ways in which measuring spaces brings the world to order.

Beyond the Mystique of Maps and Figures : A Critical Approach to Ways of Bringing the World to Order.

To address this dual reality (the pervasiveness and performativeness of spatial metrology), we need to delve beneath both the *magic of numbers* and the *truth effect* of maps. We look first of all into the social production of reference benchmarks, through analyses of the discourses and practices that surround their production ; secondly, we analyse the different patterns of appropriation and control over spaces and the power relationships involved in the production of measurement systems ; thirdly, we investigate the effects of these multiple systems of measuring spaces on the spaces themselves at the different scales at which they are applied, the social realities they produce, and especially their spatial dimensions. Our starting assumption is that the new measuring systems are at once produced by spaces and producers of spaces. To do so, we will attempt to deconstruct what is taken for granted in these *arithmetical and cartographic realities* that are tending to become the norm in every sector of society, by deciphering the spatial issues at stake in the processes at work in their production (and therefore their genealogy), their circulation and how they are imposed, but also the forms of local or global resistance they can give rise to.

Genealogy and Production.

Measurement, as we have said, is a process of characterisation and ranking to construct norms, which has rapidly become widespread in the last few decades. While the process has spread into ever more varied fields, each way of putting the world into maps of figures is unique : although the procedures may be comparable – perhaps because they derive from the same spirit –, they are always contingent upon the history of each object to be measured. Understanding this contingency means understanding how the measurements are constructed, in other words, looking beyond theoretical discussions (but without excluding them) to reveal the patterns, details and subtle “mechanics”, both social and technical, involved in building up these measurement systems. The aim is to understand, precisely and in concrete terms, how they come to exist and subsequently become established as “black boxes” (Latour 1989, p. 12), in other words as dominant realities, norms or references that are virtually unquestioned, partly because not everybody can necessarily

understand them, and partly because they are easily “naturalised” : “Commensuration is often so taken for granted that we forget the work it requires and the assumptions that surround its use. It seems natural that things have prices, that temporality is standardized, and that social phenomena can be measured” (Espeland and Stevens 1998, p. 315). The aim is therefore to make what is opaque both visible and intelligible by opening up these “black boxes” to shed light on “the nature of the social encapsulated in the machine” (Mattern 2018).

This necessarily brings us to the diversity of those who produce systems for measuring spaces. What are their roles, and what are their interests, explicit or not ? How, and with what systems, do they produce ways of measuring ? How do they quantify social phenomena ? How do they manage and control spaces by these means ? By what means do they put the world into figures and maps ? Finally, what are their motivations and intentions, subconscious or not ? And what representations and constructs of the imagination underlie these conscious or subconscious intentions ?

The genealogical method is a useful way of addressing the latter considerations. Knowledge is inseparable from the power that established it. As the one justifies the other, the process whereby knowledge, measurement and ultimately power become naturalised complicates the development of a critical perspective. Michel Foucault, who first coupled the analysis of knowledge and power, put forward the archaeological approach to understand “how objects are constituted, how subjects arise and how conceptions take shape” (Foucault 1971, p. 163). By detaching the approach from classic historical analysis in that it not only considers facts from which lineages can be followed up directly but also brings out resemblances, archaeological analysis can be used to investigate how the “systems”, meaning the instruments used for measuring and for applying measurements, were created, and the contexts in which this occurred. Systems and contexts are intertwined, each reinforcing the other as time passes. A system always responds to a change in context : every historical period has had its own way of handling its relationships with quantification and comparison. Each period also undergoes conflicts and strong tensions, to which a measurement is supposed to respond. These conflicts then give a particular shape to quantifications and explain what they mean.

Circulation, Imposition and Resistance.

Describing the grammar of divisions – how it arose and was built up – is not enough : we also need to understand how it is disseminated. Working on its circulation also means attempting to give historical depth to metrological processes, to show how its tools are reused, as well as the changes and continuities (in methodologies especially) that can bring out different interpretations at different times. Once measurement systems are produced, the need is to analyse the ways in which they circulate through society. From this point of view, the creators of a measurement system are also its users – individuals and groups, whether organised or not – and the populations directly or indirectly affected by it are beneficiaries, victims or merely passive objects of the expanding processes of quantification and mapping.

These players are involved in a whole spectrum of social and political relationships. As underlined by Espeland and Stevens, the act of measuring or making something measurable is expressed in multiple forms of power : it can help to make or vindicate decisions ; it can be manipulated by elites just as it can limit their power ; it can create subservient subjectivities or trigger resistance (Espeland and Stevens 1998, p. 332). The use of measurements can therefore also produce social and spatial disorder, or controversy and social conflict at the very least, particularly as multiplying measurements (or maps) can create new ideological battlegrounds and arenas for negotiation,

antagonism and diverging political stances between players (Bonnecase 2012). This is the spectrum we need to examine, from the imposition of measurements to the way they are deflected as they circulate and disseminate, and simply by being used.

One question that arises is how figures and maps are liable to become frameworks that constrain people's behaviour. In the seething interplay of interactions on the ground, it is interesting to observe how hegemony builds up as some measurements are brought centre stage while others become invisible. Can these ways of creating reference standards be interpreted as vectors of "government", in the sense of rationalising and regulating relationships between populations, resources and the State (Foucault 1994) ? On the other hand, adopting a viewpoint more similar to that of Michel de Certeau (1980), how are these figures and maps deflected from their goals, or "poached", not only in daily life (how does anyone bend the rules and move the goalposts ?), but ultimately to serve more organised resistance movements, whether local or global ? Do those who resist the figures and maps imposed upon them have enough room for manoeuvre to develop effective resistance strategies ? Or are they trapped by the rules and variables imposed on them, so that resistance can only be tactical ?

Advocates of "statactivism" (Bruno, Didier and Prévieux 2014) or "radical cartography" (Bunge 1971) – respectively aiming to turn statistics and maps into means of criticism and political counterweights – argue that the production of alternative indicators, or "counter-maps", reveals elements of reality that do not appear in the dominant representations of spaces and territories. Looking beyond the ideological and activist stances where these ideas originate, is this indeed the case ? Can maps and figures help to impose more "progressive" solutions and support revolutionary causes ? To what extent do some of these movements bring the figures and maps themselves more radically into question ? How far do they question the very principle of quantification and mapping, or at least the "map" concept ?

And a final question would be whether resistance to metrology, up to a point, is in fact one more myth conveyed by the social sciences as they persist in seeking signs of micro-resistance in every walk of human life. Do not most people endorse quantifications of the world, of *their* world, and do they not submit to measurements rather than act upon them ?

Three Lines of Study.

The field of study opened up in this traversal relates to a workshop co-moderated, in Bordeaux and Pau, through the Passages[4] joint research unit (UMR), by the three authors of this paper. The workshop was the fruit of efforts to draw together the critical studies undertaken by the laboratory : on the one hand, studies that bring in the theories, objects and approaches of critical cartography and mapping in indigenous contexts, directly in line with the work of mapping historian Brian Harley ; on the other hand, output from political ecology, which combines environmental history, the sociology of science and technology and the study of social movements and political geography (Blanc Demeulenaere and Wolf 2017). Over and above their differences, these schools of thought have many common sources of inspiration, including Foucault's approaches to power and knowledge, the history of metrology, the history and anthropology of science and technology and the socio-history of public statistics of Alain Desrosières. The idea of exploring the spatial dimension of metrology emerged from comparative studies of these works and their intellectual lineages. Here, we put forward three lines of research – among other possible avenues – to illustrate the scope of our reflections, all three being the fruit of our respective areas of scientific

specialisation.

Metro-Logical Patterns Outside and Beyond the State.

The first line of research investigates the universal and specific aspects of the metrology of spaces, anchoring them in historical time and taking an anthropological perspective. While the construction of a common space to be measured is a universal function, each historical, social and geographical context nevertheless produces its own "metro-logic" – by analogy with Georges Balandier's "anthropo-logical" concept (1974). One of the earliest known measurement systems, and perhaps the most widespread, is anthropometry**.** This involves using the parts of one's own body as the main units of measurement (foot, arm, hand, finger, arms akimbo, footsteps, etc.) (Kula 1984, p. 33) (Kula 1984, p. 35). This system is still used today, for example by the Mocoví in Argentina, who use hybrid counting systems that combine a numbering and anthropometric system with the metric system adopted with the westernisation of their society (Martín López and Giménez Benítez 2005). Witold Kula shows that in Europe, variations in the measurements that preceded the metric system can be accounted for by the fact that rather than being conventions, measurements had a *social significance* that could vary in space and time. Their precision was therefore contextual rather than absolute, unlike the measurement units in use today, which are immutable because they are derived from astronomical phenomena that are unrelated to humans (in which case, the size of a unit is of little consequence : what matters is that it is invariable) (Kula 1984, p. 9-10).

The question of historical and geographical diversity leads to the question of the systems for measuring space that were in use in societies organised into states other than the modern variety. How did these societies develop and maintain their reference standards over vast geographical areas ? Archaeology and written sources have delivered information on the road system of the Tawantinsuyu (Inca empire), which stemmed from the Inca policy of unifying measurements in the territories they conquered while endowing them with a sacred dimension. It seems that their waymarks (boundary markers) referred to complex mechanisms for measuring distances, regulating travel and marking out territories, while also corresponding to forms of social organisation and resource distribution linked to the *mita* system of compulsory labour in the Inca empire (Sanhueza Toha 2004). Societies that anthropology and evolutionary thinking long referred to as "stateless", for want of knowledge on the complexity and singularity of their political organisation and the inability to consider them outside the categories of European modernity, provide many examples of cartography. In some nomadic societies of North and South America, geographical knowledge was transmitted through songs, narratives, dreams or rituals. Rather than finished products, these maps relate to ritualised social practices and processes. When a map was needed to continue a journey, it could be sketched on the ground, in the snow or in the ashes of a campfire (Hirt 2009) (Hart 2012). These "pictures of experience" created by human interactions with places were as functional and transmissible as any map from Rand McNally or National Geographic (Warhus 1997, p. 3).

Understanding the human diversity of the metrological rationale is certainly a goal in itself, and a great deal of research is still needed to improve our knowledge on the subject. But shifting the cultural focus is also a condition *sine qua non* to fully understand and contextualise our own social practices, without which a critical approach to the logic of measurements, quantifications and mapping of spaces would have little credibility. Therefore, once again, there is a need to question the "great divide" between Western science and other systems of knowledge. According to the philosopher of science David Turnbull, this means accepting the idea that all knowledge systems,

of whatever culture or period, are local assemblages derived from a range of practices, instruments, theories and people ; that some systems assemble knowledge through art, ceremony or ritual, while Western science does so through disciplinary societies, the construction of instruments, the standardisation of techniques and the writing of articles ; that, finally, the main difference between Western science and other systems of knowledge lies in power : the source of scientific power lies not in the nature of scientific knowledge but in its greater capacity for moving and applying the knowledge produced beyond the location of its production (Turnbull 2000, p. 38).

Finally, “ancient” or “other” measurement, numbering and mapping practices can also help us to understand the heterogeneity of our contemporary world, and especially the practices that are renewed or reinvented in the nooks and crannies of resistance to hegemony – either that of the State and its rationale of government, or that imposed by the ubiquity and omnipotence of metric logic. This is the case with some of the counter-mapping practiced by many indigenous organisations and communities around the world, as they seek – among other goals – to decolonize mapping ; a movement similar to the decolonization of knowledge and methodology launched by the Maori scholar Linda Tuhiwai Smith (2002).

Environmental Metrology.

The second field of investigation proposed by this traversal addresses the rising importance of environmental issues in recent decades, and particularly the rapidly growing trend of translating environmental degradation into figures. As a result, expert knowledge is often left aside in favour of standardised measurements (Alphandéry et al. 2012). Sometimes, attempts to find a common method for calculating different kinds of environmental degradation will use just a single unit of measurement : this may be, for example, an indicator of ecosystem services provided by physical environments, or even – when the aim is to estimate the cost of various kinds of degradation or the cost of doing nothing – a monetary unit. However understandable, this approach to environmental issues can be problematical : because of the diversity of environments and patterns of appropriation, spaces clearly show the advantages and limitations of metrology. Though necessary to reduce differences and objectivise certain characteristics of an environment, metrology leaves many patterns of appropriation, use and representations of spaces quite unaccounted for (Roche et al. 2015). To many, participatory science could become a way for the public to take part in metrology, by collecting data or building up alternative data. Although platforms for contributors, participatory data collecting and so on are central to this idea, the systems are often opaque and need to be deciphered.

The debate on quantifying the natural world based on the idea of ecosystem services, recently addressed by the social sciences, is a good example of these points. The ecosystem services idea, which stemmed from a point of intersection between ecology – or rather, certain currents in biology, especially the “ecosystem approach” (Daily 1997) – and economics – specifically, the economics of ecology (Costanza et al. 1997) –, served as the basis for the Millennium Ecosystem Assessment (2005) and its diagnosis of a profound crisis in biodiversity. It has since been applied to a whole array of concepts, measurements and means of action that have morphed into a fully-fledged system where knowledge equates with power (Arnauld de Sartre et al. 2014). The goal is to reduce the diversity of environments and wildlife into the simplest possible set of indicators, and to do so for the explicit purpose of including impacts on natural environments into cost calculations – for example for planning projects.

The “market visibility” of the natural world (Robertson 2006) is fully consistent with a phase in the

quantification of the world fuelled by the extension of capitalism in the contemporary period. But is this a process of commodification of the natural world, as many have feared ? Analysis of the process that has led to this new way of making nature visible suggests otherwise : those who made use of the ecosystem services idea were conservation biologists, in a bid to strengthen the justification for environmental protection (Gómez-Baggethun et al. 2010). Were those who put forward the idea unaware of the commodification that occurred (Gómez-Baggethun and Ruiz-Pérez 2011) ? This is currently a hot topic, that requires, in particular, an analysis of the processes that brought the idea in question into being and circulation, and through which it is being imposed.

Individualised Metrology.

The third field of investigation in this traversal concerns the new ways of counting that have emerged with the growing numbers of sensors and the use of geolocalisation in an ever-increasing range of everyday objects. These developments have produced an exponential increase in individual “footprints” that include a spatial dimension (Beaude 2015). Metrological instruments thus seem to have become operators of the factual, which gives any individual an unprecedented ability to visualise the nature of the space of another. The recording and capture of data and metadata produced by individuals turn them into potential documents : “people have become documents like any other, with identities that no longer “belong” to them, and over whose visibility they have little control (as their profiles are now indexed by search engines) and whose commercial purposes they underestimate” (Ertzscheid 2009, p. 244). To escape the logic of reducing individuals to mere data files serving commercial or political ends, critical analysis is essential to unravel the mechanics of these metrological processes. At stake are our individual and collective powers of choice over the means of classification and organisation that are used to govern our existences (Rouvroy and Berns 2013).

These individualised systems of measurement therefore deserve our attention, in the same way as the “quantified self” idea that provides tools, principles and methods enabling anyone to measure their personal data in the form of digital traces (captured by a variety of instruments, from connected watches to weighing scales, phones, bikes and so on), to analyse them (by sending out daily logs) and to share them (via social networks for example). The aggregation of these personal data points to a break with previous methodology : their sheer quantity hints at a previously unknown degree of exhaustiveness. It also breaks with theory : as the point of entry is the individual, it becomes possible to “disaggregate the social”, avoiding categories, such as social class, that are sometimes seen as reductionist and thus reflecting the increasing interest of the social sciences in the individual. For example, individualised systems of metrology now hold out the promise of grasping everyday mobility to take the immanent “pulse” of a city, without reference to any set of given standards, norms or categories (Rouvroy and Berns 2013). Computing power and the sheer quantity of data seem to hold out the possibility of delving into what is most specific in individuals, what is furthest from the norm.

These individualised systems of metrology also make it possible to produce pointers based on algorithmic predictions. Since 2013, for example, Google Maps has been using a contextualisation algorithm that aims to personalise maps by incorporating traces left by users on the internet (Google search histories, geographical locations, contents of emails, messages on social networks, etc.). This could signal the demise of the shared cartographic view of a common area, making way for individualised expressions of interest in spaces (Joliveau 2013). With the “single map” idea, it is no longer individuals who map their lives and their world : instead, an algorithm develops a cartographic expression that is supposed to correspond to the individual. The status of maps is thus

subverted : instead of a rational, stable and shareable representation of a common reality (Lardinois 2013) that can serve as an interface for dialogue, maps become the fruit of an algorithm which, even if it is not highly sophisticated, is nevertheless completely opaque and therefore, ultimately, impossible to share (Noucher 2014).

Thus, while conventional statistics produce selectiveness and conventional mapping produces common references, *individualised metrologies* focus only on unique profiles and personalised background maps. What does this shift imply ? Besides, although these digital traces are unparalleled sources of data on spatial behaviour (mobility, consumption, learning, etc.), they are intrinsically biased by the imposed focus on the individual as the level of granularity common to all spatialised social phenomena (Quesnot 2016). What, then, are the socio-political issues that arise from these ever-multiplying individualised measurement systems that are effectively helping to undermine reference standards and equivalence classes ?

On the Necessity of Multiplying Embodied Approaches.

This traversal thus sets out to explore, through articles from a variety of research fields, the assumption that maps and figures are instruments for ordering the world and therefore, ultimately, at once an expression and a vector of power. However, despite this well-proven observation, various effects of distancing, challenging and deflection can also come into play. The need is then to explore the ways in which mapping and statistics can be undermined. Although maps and figures are everywhere, there are still areas of reality that cannot be mapped or put into figures. These limitations seem to exist not so much in terms of objective limits (which metrological systems cannot handle) as in terms of moral, symbolic and identity-related limits (Espeland and Stevens 1998). We believe the need to address these questions is all the greater as recent promises regarding “big data” strongly convey a resurgence of positivism, or of what some call “digital neo-positivism” (Mosco 2013). While critiques of statistics (Desrosières, Didier, Thévenot), mapping (Harley, Crampton, Wood) and technology in general (Simondon, Ellul, Illich) have existed for a long time, they are struggling with more contemporary questions, aside from those apocalyptic predictions which, however newsworthy, are basically caricatures[5]. In the last few years, many studies claiming a critical approach have, in attempting to tackle the intricacies of today’s socio-technical systems, succumbed to the temptations of speculation by adopting disembodied theoretical stances that miss the complexity of the processes whereby spatial metrologies are built up, circulated and imposed. This is why we believe that “rearming” criticism (Noucher 2017) has become imperative in order to delve beyond radical critiques that reject statistical and mapping processes without stopping to analyse them. Through the articles in this traversal, we therefore propose to multiply the kind of exploratory analysis that can delve deeply into data, algorithms and real situations to bring out what maps and figures – and those who produce them – have to say, by addressing the techniques used and attempting to open up the black boxes from which they have emerged. We also believe it necessary to adopt a historical perspective, bearing in mind that the hegemony of maps and figures is contingent on history and that while other worlds have existed in the past, still others – desirable or not – are possible in the future, to loosely quote Serge Latouche (2002). To keep this broad view, we also call for contributions that may, on the one hand, reveal the diversity of human “metro-logics” by providing us with material to understand their anthropological and historical take on how figures and maps are used to order the world, and thus give us a better grasp of the specific and unprecedented nature of the contemporary processes at

work ; and, on the other hand, that question, from a post-colonial or decolonial perspective, the ethnocentric orientations of ways of thinking that clearly reflect Western frames of thought.

Engaging in such a debate through a traversal has three advantages, given the subject under discussion. Firstly, as an open-access publication, we offer not only visibility but also possibilities for dialogue, as we are open to all comments, corrections, clarifications and arguments. Over time, readers' contributions will help us to gradually build up material for discussion, working closely with the cross-disciplinary workshop run by the Passages joint research unit, in Bordeaux and Pau but also much farther afield. Topical developments in science, politics and the arts will thus help to guide our reflections. Finally, the flexibility of our website allows for a variety of formats : feature articles may be supplemented as needed with comments, images, codes, interactive geo-displays or reviews so that, within the next four or five years, we will have produced a compilation that can be used for purposes of every kind – except to make up a reference standard !

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Note

[1] With thanks to Bénédicte Michalon, Vincent Bonnecase and Béatrice Collignon for their careful revising of the French text, and their constructive comments.

[2] From the Greek *metron*, meaning “measure”, and *logos* meaning ” science”.

[3] *un monde [qui] s’est fait nombre*. Comme le lecteur l’aura compris, les citations en français ont elles aussi été traduites en anglais.

[4] The Passages laboratory is a joint research unit (UMR 5319) set up in January 2016 under the authority of the CNRS, the University of Bordeaux-Montaigne, the University of Bordeaux, the University of Pau and Pays de l’Adour and the Higher National School of Architecture and Landscape in Bordeaux. The workshop on “Critical Metrology of Spaces”, a cross-cutting scientific initiative from the laboratory, is organised into four to six sessions per year. More informations can be found here.

[5] Recent works by Éric Sadin, *La vie algorithmique : Critique de la raison numérique* (L’Échappée, 2015) and *La silicolonisation du monde : L’irrésistible expansion du libéralisme numérique* (L’Échappée, 2016) are good examples.

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