

SCIENCE AND SOCIAL KNOWLEDGE OR WHAT WE DO NOT KNOW ABOUT WHAT WE BELIEVE WE KNOW

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ABSTRACT. What is knowledge and how can we analyse it from within social sciences as social knowledge? Our socially driven intuition tells us that knowledge is a special relation that humans have with their surrounding world. Its specificity lies primarily in the fact that it implies a direct interaction with the environment. Another important and interesting characteristic of knowledge is its tendency to replace interactions with reality with interactions between pieces of knowledge produced about that specific reality. Connected to this, regarding the issue of truth, paraphrasing both Einstein and Smith, this article argues that ‘an invisible hand’ of the realities of social phenomena makes it so, that the accepted truths of a certain society are those and only those that are functional for the survival and reproduction of that society. And for this to happen it is a must that the elite designated with the production and the legitimation of ‘the truths’ exists and produces those ‘truths’ that support the ‘general interest’ of that respective society. Most importantly is to understand that the consistency of the legitimated truths with the dominant values of the society imbedded in its social order is far more important than their consistency with the empirical observations of the reality.

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Albert Einstein and the mysteries of knowledge

i. The major difficulty in dealing with knowledge is that we do not know what it is². Our socially driven intuition tells us that knowledge is a special relation that humans have with their surrounding world. Its specificity lies primarily in the fact that it implies a direct interaction with the environment, although some forms of knowledge, such as art, religion, logic, and mathematics can function very well without it. Another important and interesting characteristic of knowledge is its tendency to replace interactions with reality with interactions between pieces of knowledge produced about that specific reality. People do not necessarily react to reality as it is, but to what they believe it is. In some cases, this substitution can prove useful. As a child, I did not have to actually try to catch a flame with my hand to figure out that such an action is undesirable. The adults around me delivered me this knowledge to protect me from a painful burn. In other cases, the substitution can be harmful. In medieval times, people swarmed into the churches during epidemics in hope of receiving deliverance based on the 'knowledge' that God had sent them disease and death as a punishment for their sins, an action that, in fact, only spread the disease even more.

In the first example, I could have probably reached the same conclusion based on my own perceptions, but sometimes knowledge received from others has priority over our own perceptions, or even opposes them. The reason I know the Earth revolves around the Sun instead of the other way around is that this knowledge was transmitted to me by others and I had to accept it as true, although I could see the Sun moving daily across the sky from east to west. And despite the fact that everybody knows from personal experience that one cannot fly on a broomstick, thousands of people were burned to death by their ancestors in the Western and Central Europe during the XV-XVI centuries, bases on the knowledge that flying on a broomstick was possible, and that those who did it were antisocial (Mackay, S.C., 2006).

Going back to the question of what knowledge is, we tend to think that it has something to do with information about our surroundings, which, if processed and interpreted correctly, will confirm, complete, or change what we already know. But in fact, we do not know what information is. We only know its effect on us. We know that it functions as a stimulus to which sometimes we react and other times we ignore, depending on how we integrate it in the set of knowledge

² In order to be able to discuss the issue of knowledge, I'm using an improvised and imperfect definition of knowledge as being a social product resulted from a common interpretation of multiple personal sensory perceptions, or generational transmitted to us that is functional for the survival and reproduction of a member of a social group or/and of the group itself (upon which the survival of the individual relies anyway).

that we already have. This applies both to individuals and to societies. But it seems that information exists even beyond us and our societies, given that all living (and non-living) matter reacts to stimuli. Information has come to be regarded as a characteristic of reality that is as important and omnipresent as time, space, energy, etc.³ (Hidalgo, Cesar. 2015). Being of such crucial importance, common sense (we do not know what 'common sense' is either!) tells us we ought to struggle to figure out what information is, in the same way we struggle to figure out the principle notions that lays at the fundamental structure of any knowledge system such as time, space, energy, matter, the universe, life, conscience, human beings, society, etc.

Wrong! If we set aside what common sense tells us, if we set aside rational thinking as it is defined by any of the logical and/or mathematical theories, if we set aside all philosophies, epistemologies, and illuminations produced by the knowledge elites of any given time and we take into consideration only the known history of knowledge, then we realize not only that we have never truly known the realities that are being described by all of the above disciplines and notions - if any, but we also realize that they have had different meanings along history and across societies. However, this aspect doesn't seem to have inconvenienced any society in their quest to describe and explain the reality, neither does it seem to do so for us today, despite the staunch rigours imposed by the scientific methodology, which anyway pertain only to the measuring of reality and not to its description or understanding.

ii. It is Einstein⁴ (Einstein, A., 1995) who offers the most clear and easy to grasp general model of knowledge, although he refers only to science: '*Science is the attempt to make the chaotic diversity of our sense-experience correspond to a logically uniform system of thought*' (Einstein, A., 1995:323). Of course science does that, but it is far from being original in this matter. Any given form of knowledge - from the most primitive burning rituals that we know of to language, writing, music, and visual arts - function in the same way. The only difference is that they use different means and apparently have different objectives.

³ '*The universe is made of energy, matter, and information*', Cesar Hidalgo wrote an entire book about information without explaining what information is, except that it is the *deus ex machina* that counteracts the second law of thermodynamics.

⁴ In the next part, I will make intensive use of the opinions of Einstein regarding knowledge in the general and scientific sense, since it is my belief that, to this day, although a century of scientific discoveries separates him from us, he is the one who captured its essence better than any of his followers. I also rely on the argument of authority because even though the theory of relativity was contested by quantum theory, Einsteinian epistemology has not yet been significantly contested by anyone.

Knowledge is nothing but the social effort to adapt the perceptions gathered through our senses to the means of actions that we use in relationship with our environment. But this is what all living matter does (we do not know what 'living matter' is!), most of it reacting in an 'instinctual' manner. We also do not know what instincts are, but we do know that they set in motion an algorithm of chemical and behavioral reactions to a perceived stimulus. We also know that the more complex organized the matter is, the more complex these sensors become and the more they complicate the algorithms of reactions. In situations that go beyond the limits of instinctual 'knowledge' some creatures⁵ become extinct, making room for a different species in the ecological niche, a species more capable of reacting efficiently to the environmental conditions that led to the extinction of their predecessors. But this biologically implemented mechanism is of course limited. Therefore, during the evolution of species a new mechanism came into being, a mechanism that we now call 'thinking' and, in the case of our species (perhaps of all hominids), we call 'rational thinking'.

Along with the continuous expansion of the organizational complexity of living matter, a new biological mechanism for processing signals developed. We will tackle this later. For now, we recall that we are dealing with a first level of knowledge - which consists of rational interpretation of sensorial perceptions and of different mechanisms of using these interpretations in order to allow and produce behavioural reactions (actions, activities) meant to ensure the survival of the respective species. Taken individually, they use only a minimum of knowledge, insufficient for the sophisticated organization of human cooperation, which is indispensable to the survival of homo sapiens. That is why there is a second level of knowledge, which Einstein describes for science as a theoretical model of the world perceived through the senses. We perceive reality as fragments in time and space, the same way we are discovering one by one the pieces of a giant puzzle. Regardless of if they are the result of the accumulation, over time, of random individual or collective daily experiences, the result of long chains of systematic observations made by ancient priests, or the result of case studies developed by contemporary scientists, there is nothing rational in the multitude of these pieces of puzzle. For this reason, this multitude of puzzle pieces have to be reduced to a model of reality that includes as many pieces of the puzzle as possible, a model which is rational by the virtue of its construction. *'Man tries to make for himself in the fashion that suits him best a simplified and intelligible picture of the world; he then tries to some extent to substitute this cosmos of his for the world of experience, and thus to overcome it'* (Einstein, A., 1995:225). In

⁵ By 'creature' I am referring to a living organism whose biography is autonomous in relation to the history of the species it belongs to.

short, knowledge – scientific for Einstein and general in our context – consists in the replacement of a chaotic and thus irrational world of isolated experiences with the unitary order of a rational model created by humans to ‘suit them best’. This means a model upon which they base and construct their actions and reactions, to govern the reality. Or at least they think they do.

This model has, again according to Einstein, two component parts and a shortcoming. The first component is a system of universal principles that, in a way similar to the axioms of Euclidian geometry, seems obvious and intelligible and between which clear relationships of determination can be established⁶. In Einstein’s view, causality is the fundamental principle of knowledge and of the evolution of knowledge: any given reality has a cause. Which is to say that knowledge consists of the theoretical identification (created by humans) of the hidden causes of the realities perceived through our senses and experiences, be them mundane or specifically constructed for the purpose of pursuing knowledge i.e., scientific experiments. The second component consists of the logical elaborations of the model, which can generate realities that have not yet been experienced, realities previously hidden from knowledge. Either because they are rare, or because they are not accessible to our senses, regardless of how much we may amplify them by the means of the most ingenious instruments.

The shortcoming Einstein was referring to, consists in that there is no rational way, no logical algorithm, no standardizable method to construct these models. The only way to obtain them is, on one hand to resort to what seems obvious – as Euclid did with his postulates - and on the other hand, and more importantly, on intuition. But we do not know what intuition is! According to the Encyclopedia Britannica⁷, credited to be the synthesis of all knowledge by the “knowers” of the world, intuition is the power to produce knowledge in a way that ignores both the givens of experience and the results of rational thinking. The way I see it, it is similar to the idea of revelation in the sense that intuition can be given just as much trust as it is given to the knowledge occurred through dreams, divination, palmistry, etc. However, Einstein – a symbol of scientific knowledge, which is considered to be the most rigorous and rational form of knowledge ever to be accepted as foundational for human action and decision-making – describes intuition as the essential mechanism for constructing a scientific model of the world, be that the natural world that we confront, or the social world in which we live. This is especially revealing in relationship with the exceptional rigour of scientific knowledge which is the dominant form of knowledge in the contemporary world.

⁶ Of the type $E=mc^2$.

⁷ <https://www.britannica.com/topic/intuition>

iii. Nevertheless the arbitrariness of the intuitions of those who create models of reality has very surprising underpinnings – as they are strictly personal⁸- and it inevitably leads to a plurality of alternative models of reality, which are equally accepted and efficient. Einstein is aware of this shortcoming in his description of the (scientific) knowledge process, and also of its radical contrast with the precision and rigour elicited by the mathematical-quantitative approach to the phenomenal world. He tries to solve it by appealing to the same type of *Deus ex machina* that Adam Smith had used to explain the paradoxical social efficiency produced by individual egos interfering with one another. An appeal to “an invisible hand”.

‘Nobody who has really gone deeply into the matter will deny that in practice the world of phenomena uniquely determines the theoretical system, in spite of the fact that there is no logical bridge between phenomena and their theoretical use’ (Einstein, A., 199:226).

He was deluding himself, and with him all those who thought that the scientific experiment - this exceptional and defining instrument for the natural sciences, which attempts to reproduce a tiny part of the universe in a laboratory environment; a part that is then considered representative for the entire universe - is truly capable of, at least in these domains, to make a selection among the theoretical systems proposed by different, more or less ingenious systems based on intuitions.

Because the ‘world of phenomena’ does not ‘uniquely determines the theoretical system’. There is also another determination, which Einstein knew about but choose to ignore – the society, or the social factor. Those who had tackled the issue in depth and had recognized the miraculous determinant factor evoked by Einstein were none other than a social group specifically constituted to serve as a legitimating force for its explanation. Einstein does not tell us anything about the criteria that this group had used to confirm the reality described by him, and it is easy to understand why. He does not know what

⁸ Einstein recounts that he intuited the problem of special relativity by wondering what happens to a tomato in a free-fall elevator. The physicist P.L. Kapitza recounted that, while visiting an IBM research institute in Switzerland, he found excellently equipped laboratories that were half-empty. Asking the hosts where the researchers were, it was explained to him that they organized their own working time and that the institute provided them with swimming pools, sports fields, etc. because one never knew when and where an idea would strike, which could then be tested in the laboratories. The whole ensemble of heuristic methods is itself based on the premise of advancing science by harnessing the intuition of the researchers.

these criteria are, the same way he does not know what criteria he himself had used to reach his affirmations. We thus arrive at a fork in the road that opens two diverging paths of research which are ultimately reunited through the same answers. But to arrive at this answer we need, in the first place, to remove the mystery that unjustifiably shrouds the hallucinations of shamans, the divine revelations, Adam Smith's invisible hand, or the determination of the phenomenal reality in the natural sciences, a paradigm supported with conviction by Einstein and any other type of *Deus ex machina*. Then, we have to understand why neither Einstein nor many others among those who were in full knowledge of the scientific world and its inner workings did not give the same answer as we are about to provide now.

iv. Einstein's appeal to a group whose function is to legitimate his affirmations is in conformity with social reality where an ignored or vetoed truth does not produce any effects. These groups roam throughout the history of knowledge like ants around an anthill, with the precise function of legitimating a certain rational model of reality and of delegitimizing all the others. We are not dealing with any invisible hand nor with a phenomenal reality mysteriously determining the truth. We are dealing with people who give or refuse to give credit to a man-made model of reality based on criteria which cannot be granted to have any relationship to the phenomenal reality referred to by Einstein.

In the third Century BCE, at the request of the Syracuse's tyrant, Archimedes developed a short summary of all the knowledge available about the universe at the time, in which he described the Ptolemaic model of a universe as being made up of concentric spheres centered around the Earth. A model of the world which was accepted by all Greeks "who had really gone deeply into the matter", including Archimedes himself. He briefly, and with scientific probity, mentioned a certain Aristarch of Samos who had developed a heliocentric theoretical model that no one paid attention to at the time. It would take more than eighteen centuries until Copernicus would relaunch the heliocentric model and at least another two centuries of confrontations between 'those who had really gone deeply into the matter'. Around six centuries later (325 CE), at Nicaea, in the Eastern Roman Empire, several such experts gathered to establish which of the Christian writings – among which some were already more than two centuries old - contained the true teachings of Christ. Given the fact that the Christian churches at the time were either in disagreement or in competition with one another, the result of the competition was decided in terms of the balance of power between the different groups, and not according to a reality which was in any case unknown to any of the participants. Much later, a smaller council met at the royal court of the future Charles VII of France, to establish whether

the dreams of a French teenager about the coronation of the French heir and the occupation of the city of Orleans were divine revelations or not. Given that all the present experts were supporters of Charles VII, the result of the expertise depended less on examining the divine nature of the message appeared in the dream, but more on the immediate interests of the respective experts. Of course, the number of such cases can be multiplied endlessly in any given historical period.

None of these illustrations of the socially determined nature of legitimized, and therefore accepted, knowledge refers to science. Science, which is presumed to be essentially different from all other forms of unscientific knowledge, such as myths, religions, art etc., should have a thoroughly different mechanism when selecting its theoretical system, as Einstein calls it, or its paradigm, in the words of Thomas Kuhn (Kuhn, T., 1962), or the *hard core* of its theoretical program, as Imre Lakatos names it. And, at least here, in the realm of physics - the most "scientific" of all sciences, the ideal model of ideal scientific knowledge - we ought to be able to find that reality-driven determination of the fundamental principles of knowledge. But no such thing! What we find is an endless number of councils of the same type held at Nicaea, pretentiously called 'peer review', which means 'revised by colleagues' and which arbitrarily decides 'the truth' of a product of the intuition of their peers. Peer review is a fairly complex mechanism, but in essence it does not ensure that the theoretical model is determined by phenomenal reality. All that it does ensure is that a majority of those members of the scientific community who find themselves in positions of authority decide that a certain model of reality should be adopted by most researchers in the field.

The existence of a well-defined, rigid, and all-encompassing structure of authority in any scientific community is a well-known reality. What is less known is the process through which it is established. The ideology that legitimates the hierarchy of authority positions in science is based on the myth according to which the authority of the knowers derives from the quantity and quality of the knowledge that they possess. The reality though is more prosaic. What we preciously call "scientific community" is in fact a social elite like any other, as thoroughly structured, and bureaucratic like any other, and legitimized in the same way as any other. Which is to say, by means of the same social mechanisms of power distribution that exists in a particular society. That is why, when an eminent professor from the University of Texas counted 24 pairs of chromosomes and published the result, this number immediately gained an authority proportional to the status of the respective professor, amplified by the authority attributed to the University of Texas on the knowledge field. As a result, the number of 24 chromosomes was taken up and repeated so often that it became

a truth as solid as the one that affirms that the Earth is round. All those who afterwards had the occasion or the curiosity to redo the counting would have to lean over backwards to reach the 'correct' results. And even if they couldn't manage to count the 24 pairs, they would prefer to believe that their methods had been inadequate. It would take 33 years of scientific and social evolution until another American would count only 23 pairs and it would become accepted that the first professor had simply been wrong.

Social knowledge

i. Einstein's description of knowledge in general and of scientific knowledge in particular is a structure made up of four components, two of which are realities observable via the senses - human experiences and the abstract models of realities - and the other two are 'mysterious'. The first one of the last pair is the 'intuition' of the theoretician who is constructing a theoretical model by struggling to achieve what rational thought cannot achieve, which is to bind the theoretical model to human experiences. Intuition is an extremely personal and imprecise mechanism of knowledge production, and what these features eventually lead to is the simultaneous apparition of a plurality of divergent or contradictory models of reality described by the senses (Einstein, A., 1995). But empirical reality, at least the reality as described by the physics contemporary to Einstein and his followers, proves that in the end a single model is accepted as the 'true one' by most members of the knowledge elite. However, explaining such a common choice is a difficult problem since one has to find a cause for this common choice, and a mechanism that provides the necessary links that insures such a unity of agreement. There are only two categories of possible candidates for this cause: either the common choice is determined by the results of the study of reality itself, due to its obvious evidence, or it is determined by the social realities to which both the creator of the model and his peers belong. Einstein *had* to choose the first category, in order to be consistent with the methodological principle of the objectivity of science, that proclaims that scientific knowledge is independent of any social determination or influence, which make its models universally true.

But such a choice transformed the problem of the mechanism linking the cause (the reality) to its effect into an insoluble one, since Einstein himself was rightfully sure that there was no rational thinking that links empirical observations to the model itself. So that, Einstein launches the hypotheses of a 'mysterious determination', similar to the one launched by Adam Smith a century and a half earlier regarding the 'invisible hand' that acts in order to reunite the egotistical

actions of individuals on the market in service of the public interest. Namely, the interest that Adam Smith and the social group he belonged agreed upon being “the general interest”. Of course, Einstein knew the underpinnings of the peer review system, as well as the general structure of authority that exists in any and especially in the scientific knowledge production – he was part of it all! He was well aware of his personal legitimating power in his field and consequently in politics and in society as a whole. What he was not aware of was that belonging to this complex network of relationships could determine him to build and his peers to agree to the choice of the dominant model to describe physical reality. He did not realize that he is combining *the apples of the experimental truths with the pears of the legitimate truths* and that by doing so he violated his own methodological principles. Because the legitimation that is given to a theoretical model of the reality by an institutionalized group of people doesn't make it valid, it only gives it credit by default. This credit implicitly discredits all the alternative models either by eliminating them (sometimes with the input of their creators as well) or by ignoring them and thus making them inconsequential upon reality. It is precisely the same mechanism that is used in any mythology, in any religion, any political discourse, and any artistic current, etc.

Paraphrasing both Einstein and Smith I would suggest that ‘an invisible hand’ of the realities of social phenomena makes it so, that the accepted truths of a certain society are those and only those that are functional for the survival and reproduction of that society. And for this to happen it is a must that the elite designated with the production and the legitimation of ‘the truths’ exists and produces those ‘truths’ that support the ‘general interest’ of that respective society, i.e., legitimize its existing⁹ social order. Most importantly is to understand that the consistency of the legitimated truths with the dominant values of the society imbedded in its social order is far more important than their consistency with the empirical observations of the reality. That's why there is no algorithm that could link empirical reality to a rational model of natural reality, since rationality means selecting and adapting non-social realities to a social instituted objective, while natural realities have no objectives. So that there is nothing mysterious with the intuition. It is just the non-logical mechanism that allows the researcher to rationalize the existing empirical experiences according to the necessities and the objectives of the societies he is a member of.

Neither is what Einstein believed to be the influence of the world of phenomena on the choice of the true model of reality a mystery any more. Mainly, because there is none or, the best case, its influence is quite limited. In science,

⁹ In some cases these truths may legitimate the emergence of an alternative social order which needs, of course needs the emergence of a new social knowledge.

as well as in any other pre-scientific form of knowledge, there will be empirical observations or known realities that are not consistent with its accepted model, but can not be ignored. So that any form of knowledge will develop pseudo-explanations or any other form that permit to accept them as real but unable to falsify the existing dominant model. *'There are more things in heaven and earth, Horatio, / Than are dreamt of in your philosophy'*¹⁰ is as good an illustration as *'God works in a mysterious way'* in pre-scientific science, as it is the existence of paradoxes in any existing scientific theory.

The extent to which a legitimate truth is consistent with the reality may well be slightly relevant, as it is in any ancient explanation that now we consider to be just a myth or a false true. Social knowledge doesn't about this. What really matters for it is that a certain assertion about reality provides the legitimate knowledge for an equally legitimate reaction of the society if and when it has to react. It might be a prayer or an antibiotic, a new technology or a new economic or social policy, such as an increase of the price of credit or the emancipation of slaves. The effectiveness of such a technical or social engineering is also less irrelevant as much as its failure may be explain within the same legitimate theory, paradigm or according with the postulates of the social knowledge. Any alternative description of the natural or social reality In other words, since in order for any type of truth to be accepted in a society as being as such, it has to be legitimized by appealing to a "general truth", the conclusion is that science, like any other forms of knowledge, legitimizes its models of reality according to a general knowledge, generally accepted by the society for its instrumental functionality in the process of reproducing itself. In what follows I will identify this knowledge as 'social knowledge'¹¹.

ii. *Social knowledge* is that knowledge credited as being 'true' in a given society at a given point in its history It constitutes the foundation and the legitimation for all existing and accepted realities of a society: the values, the objectives, the instruments, and the practices of the different subsystems that form the respective society and the majority of its members. That is, all that exists in a society or in a human community - from language to food recipes, from social relations to dress codes and from power networks to art, entertainment or sexual relations. The social knowledge opposes any attempt aimed at diminishing its domination, regardless of whether such an attempt is internal or external, but remains in the same time tolerant, flexible, and dynamic. A triad of characteristics that we basically find in any type of the life form organization that we call society.

¹⁰ Shakespeare, W., *Hamlet*, act I, scene 5, any edition.

¹¹ The introduction of the concept of "social knowledge" raises many questions about the nature and structure of society that I will not deal with in this article.

Traveling in the USA, the count of Tocqueville criticize the censorship effect that the American democracy - which he considered a tyranny of the majority - had upon thinking:

*... tant que la majorité est douteuse, on parle; mais dès qu'elle s'est irrévocablement prononcée, chacun se tait, et amis comme ennemis semblent alors s'attacher de concert à son char. ... Je ne connais pas de pays où il règne, en général, moins d'indépendance d'esprit et de véritable liberté de discussion qu'en Amérique.*¹² (Tocqueville, A. de, 1835:84)

A few decades later, Mark Twain was expressing the same idea through his famous quip, saying that God gave Americans two exceptional gifts: "freedom of speech and the wisdom of not using it".

Both Tocqueville and Mark Twain were referring to a specific type of political discourse and behaviour, where the social control is often doubled by the control of the state's administrative and repressive institutions. In the case of knowledge elites, especially of those whose activity is far removed from the mundane issues of policies and ideologies, the determinants of social knowledge are more subtle, but nevertheless efficient.

We already know that in societies in which the dominant form of knowledge was non-scientific - the most at hand example being the religious societies - the social determination of knowledge in regard to the natural and social realities was predominant. From Socrates, who was forced to drink poison for his philosophical ideas, to Giordano Bruno who was burned at the stake for his cosmic pluralist vision of an infinite, uncentered universe, to Galileo Galilei who was imprisoned and forced to renounce his heliocentric model of the universe, to the scientific works of Jewish scholars that were burned by antisemites or to the banning of sociology and genetics by Stalin, the dominant ideology had the same dogmatic character that religious dogma used to have in societies where the dominant form of knowledge was that in the shape of the revelation, which the dogmatic authorities attested to be of divine origin.

However, we are firmly convinced, like Einstein, that an 'arbiter of truth' exists at least in the natural sciences, and that this arbiter is the reality itself. And, since societies believe this to be true, so do most scientists. Their conviction runs so deep to the extent that the entire structure of scientific research - from

¹² '...as long as the majority has doubts, debate occurs; but once the majority has irrevocably decided, everyone is silent, and friends or foes rally to its chariot... I know of no other country in which independence of spirit and genuine freedom of debate reign more poorly than in America.'

the construction of the scientific experiment to the construction of the theoretical models which are foundational to the experimental realities that they are probing - is built upon it. But in the same time, we also know that this theory (of the prevailing of reality upon the imagination of theoreticians in various fields of research) has its shortfalls. And furthermore, we are all aware, as was Einstein, that a scientific community, national or even international, in the end is just a social group like any other, subjected to the influences and the pressures of the society. Which is perfectly normal, given that, as we previously established, science exists so as to be useful to society – either through its direct results or through the engineering processes that it provides grounds for. If it wasn't, instead of science we would be dealing with a 'glass bead game'¹³, perfectly useless and therefore condemned to extinction, an action that any society would take if it would reach the conclusion that it is wasting its resources on the high maintenance of an elite whose products are useless even for themselves.

iii. Immanuel Wallerstein made the just observation that scientific disciplines are cultures (Wallerstein, I, 2004). Such cultures contain a certain quantity of legitimated knowledge, they contain criteria for identifying the science behind a research, norms and rites for inducting new members and ideas (theories), what Thomas Kuhn called 'paradigm', and Imre Lakatos's 'research program', and all of the other socio-scientific baggage specific to the respective field of knowledge. And, in Einstein's words, all those who have dealt with the issue of scientific knowledge recognize, under one name or another, the existence of a global culture of science. A culture which the society considers legitimate and able to induce authority. But they stopped at that, believing that anything more said would contribute to the delegitimization of science as a dominant form of knowledge in society. In reality, similar to any subculture of a society, the scientific one is subsumed to the culture represented by social knowledge and this subordination presupposes the inclusion, in the scientific culture, of a set of values, foundational myths, convictions - be them religious or secular - and ideological beliefs, etc. which describe a general picture of the world we live in.

For Einstein, two such myths prohibited him from reaching an understanding of social knowledge as a decisive component of the mysterious mechanism that operates the selection of one unique model of reality among the totality of such models constructed by the theoreticians of the field. The first is the myth of the objectivity of the scientific knowledge of nature. The second is the myth of individualism in scientific research (of the realities of nature). None of these attest to any other reality, apart from the reality of the historical existence of

¹³ The phrase belongs to the German writer Herman Hesse and is described at length in his dystopian novel of the same title.

these two convictions. And none of them are specific to scientific knowledge, although they are often taken as intellectual foundations of its existence and organization.

The myth of objective knowledge, or the myth of truth affirms the capacity of the dominant form of knowledge in a society at a given moment to describe a reality and its relationships with the realities it interferes with, exactly as they are. We know from history that societies have periodically changed their dominant forms of knowledge, and they have therefore used different models in order to describe the same realities. What we also know from history is that it is not for the sake of truth that societies change their dominant form of knowledge, but because they themselves change and as a result they have to change their dominant form of social knowledge. And along with every change, the new dominant form of knowledge convincingly argues the falsity of the previously valid model of reality, and in an equally convincing way argues for the superiority of its own model.

This is how the eminent physician Steven Weinberg proceeded in his book popularizing the Big Bang theory as a theoretical model for the origin of the known universe. He opposed the sophisticated theory of contemporary physics to a Norse myth explaining the same origin. The Norse myth claimed that the universe had been created by a giant with extraordinary powers who was feeding on the milk of a cow that ate salt (Weinberg, S., 1985). Given that societies have at all times constructed myths about the origin of the universe and given that other myths of this type were more familiar to him and to these readers, it is obvious that Weinberg searched for the most incredible, most improbable and ridiculous myth about the origin of the universe that he could find, in order to set the Big Bang in opposition to it¹⁴. It is obvious that the Norse explanation about the giant and the cow is totally unacceptable as a model of the apparition of the universe for contemporary society, but in fact there are two characteristics of this opposed explanations of the origin of the universe that are mostly relevant for our research. The fact that the two explanations have, in the end, the same structure and the same essential shortcoming. And the fact that Norse society, like all other societies in history, managed well enough with their own model of a universe created by a giant fed by a cow¹⁵, just like the contemporary societies manage with a model of the universe created through a Big Bang.

¹⁴ As it is equally obvious that he avoided using the Christian myth of the origin of the universe for social, commercial and political reasons.

¹⁵ The Norse myth is not as original as Weinberg thinks. In Greek mythology, Zeus was fed on the milk of a goat.

iv. When it comes to the structure of the origin myths, they usually¹⁶ start off from a reality which pre-exists and is exterior to the universe – a logical shortcoming, given that any universe should contain its origin - and from a cause that is put into motion by unknown reasons, followed by a semi-automatic development of a process that leads to the apparition of the world as we know it; that is, as it is known by the social knowledges of the societies that created and adopted the respective myth as a theory for the origin of the universe. In the Norse myth, the reality pre-existing the universe is formed by the cow-giant couple and, of course, the block of salt, while the motivation behind the giant's creation of the universe is unknown to us. In the same way that God's motivation for 'creating Heaven and Earth', as by the oldest version of the Christian myth (Genesis, 1.1), is unknown. In the explanatory model of contemporary physics, 'in the beginning' there was 'a singularity' - an unknown and unknowable entity that was devoid of dimensions (space and time) and was infinitely¹⁷ hot. For unknowable reasons, it exploded (Big Bang) and gave birth to the current universe according to the 'laws of nature', meaning the regularities that we observed in our study of the universe - around 13 billion years later, and that seem to have necessarily been contained in that singularity, and therefore to have pre-existed the known universe.

Before being dismantled by any faithful enthusiast of the truths produced by science for my impermissible reduction of the sophisticated physics-mathematical theory of the Big Bang so that it resembles the ridiculous origin myth adopted by the Norse long ago in the unscientific past, I want to make an appeal to the double authority of the Vatican and of the well-known English physicist, Stephen Hawking. In one of his books he talks about how he participated in a conference about cosmology held at the Vatican, followed by a meeting with the pope during which it was explained to them that the Catholic Church accepts the Big Bang theory, but that physicists '*should not inquire into the Big Bang itself because that was the moment of creation and therefore the work of God.*' (Hawking, S., 2003:63) A few pages later he admits that, if the anthropic principle is accepted, as some physicists do, then '*It would be very difficult to explain why the universe should have begun in just this way, except as the act of a God who intended to create beings like us*' (Hawking, S., 2003:74). Thus, the Vatican and Hawking are

¹⁶ I generalize, without any statistical grounding, the few myths of the origin of the universe that I am familiar with, and there are not many. I believe the generalization in no way affects the present argument, for in fact it is enough to observe that the Norse myth and the Big Bang theory have the same explanatory structure.

¹⁷ 'Infinitely' is not a measure of anything. It is a euphemistic formula used by mathematicians and scientists alike, in order to acknowledge that we are clueless about something.

doing exactly the same thing - recognizing the structural resemblance between the scientific explanation and the mythological one. And this resemblance must have a source, which may be the result of a biological or social determination of humans - we can only conceive explanations in this manner. But at the end of the day, this determination is one and the same thing since the primordial human (*homo erectus*) was conceived and formed exclusively within and under the protection of society and thus his biological evolution was geared towards adapting to the requirements of social life instead of adapting to those of the natural environment, as did the other animals.

If this is how things are with this explanatory structure¹⁸, then in no way are we dealing with a determination by the phenomenal world - by the empirical reality - of the selection of the model of reality deemed as being "true". The selection among the plurality of models of reality that consecrate knowledge of any type belongs more likely to what we have called social knowledge, than to any determination elicited by the phenomenal world. It is out of the question for the phenomenal world to have influenced the myth of the giant and the cow in any way, because there is no empirical evidence that any of the two had ever existed anywhere outside the imagination of the creators of the myth. And the fact that myths or theories of this or any other kind share the same structure should rather convince us that beyond the plurality of social knowledges particular to each society, they all have a common set of elements that define social knowledge in general, a sort of generic social knowledge that has two essential and permanent components - daily experience as a mechanism for collecting information from reality, and rational thinking - as an instrument for ordering, processing and inferring models of reality. None of these two components fulfil the rigorous conditions presupposed by the ideal model of science and, more importantly, none of them are situated outside of the determination of social knowledge.

Daily experience is on the one hand selective, and on the other it is fully subordinated to the model of reality, regardless of how that model is constructed. Which is to say, daily experience/observation only rarely occurs randomly or under the pressure of reality. However, within systematic forms of knowledge, daily experience is subordinated to the rational theoretical model of reality. If the theoretical model posits that the future can be read in the bowels of birds, then Roman priests will sacrifice birds and read into their entrails before every important battle, instead of paying more attention to environmental conditions, weather, landscape, technological and logistical capacities, etc. On the other hand, unsystematic daily experience was dominated by the necessity to ensure

¹⁸ As well as with the much more debated case of grammatical structures, for example.

the successful use of quotidian engineering. Is there a need to run a thin, long piece of metal through two pieces of wood in order to fix them together? Daily experience led to the conclusion that it was more efficient to have one sharp end run through the wood, and have the other end, which is being hit with a heavy object, wide. Most often, the two components were joined together, completing one another.

The medics of Antiquity knew from the general model built by religion that the healing of a wounded person depended on the will of the gods, therefore sacrifices took place, prayers and incantations were uttered and amulets were worn. But daily observation told them that dressing the wound with an alcoholic or vinegar-based solution would reduce the risk of infection. Thus they enacted a mix of empirical results derived from the successful use of mundane engineering in combination with the religious model of reality subordinated to social knowledge. Its particularization for the medicine of the time was realized through the invention of gods specialized in the protection of both wounded and doctors. In the Middle Ages, these were replaced with equally qualified saints, and in the contemporary world with famous personalities in the medical world or with treatments based on models of reality situated outside of the scientific model.

v. What results from here is that the pressure of the phenomenal world upon knowledge in general and upon scientific knowledge in particular, which Einstein was referring to, is predominantly enacted not upon the models of reality, but upon experience/observation. And this enactment does not take place directly, as the result of an observation that contradicts the knowledge held true until then, as in the case of the discovery of black swans by Europeans who had been convinced that all swans were white. It is enacted in an indirect manner, only after the engineering process established in the dominant knowledge fails and only when, after a sufficient number of failed attempts, society - always society - accepting the conclusion that the source of the error is found in the sectorial knowledge of that field, will impose the creation of a new research program or the construction of a new paradigm. That is to say, of a new model of reality, on the condition that this new model does not in any way interfere with the credibility of the general model of the world created and carried out by social knowledge. This is what the cardinal Bellarmine was asking of the heliocentric Foscarini (Favaro, A. (ed), 1968) (and, implicitly, of Galileo Galilei) in 1615 and this is what pope John Paul the Second asked of Hawking & co. in 1981. This is what Einstein was asking of his colleagues with his famous quip, "*God does not play dice*", at a time when the quantic model of physical reality was becoming a real competitor to the paradigm of general relativity.

Conclusions

i. The influence of reality (the phenomenal world, in Einsteinian terminology) upon the theoretical model of reality is therefore weak. The first necessary condition for such an influence to happen is that a continuously increasing number of actions based on the existing legitimate knowledge are failing, and the failures could not be ascribed anymore to engineering mishandlings. That could raise questions about the accuracy of the legitimate theory or paradigm. However, theoretical models usually have a much higher explanatory capacity of post-factum realities, that is the failed actions, than predicting the future, which means accuracy. The second necessary condition is that the raising social costs of these failures is that the soaring of the social costs of the failures becomes socially unacceptable. This very rarely happens, since societies are able to absorb immense social costs in order to preserve a social knowledge that is the embodiment of its specific values and organization. However, knowledge in any form, and especially scientific knowledge, can easily diversify and even modify theorems and theories in order to include as relevant new realities as much as such changes do not falsify the existing legitimate social knowledge. But altering a legitimate truth will always face some social resistance from the beneficiaries of the social effects of that legitimate truth.

Resistant when facing inconvenient realities or alternative interpretations, legitimate theoretical models are however more easily influenced by social, political, ideological, religious, or even aesthetical factors and agents. This final criterion (aesthetics) seems to have a bearing even upon physics – the science taken as a model for scientific activity in all fields. Even Einstein expressed the requirement that the fundamental laws of nature be framed as simply as possible, as is his famous formula ($E=mc^2$), which by now belongs to social knowledge. Simplicity can be considered more of an aesthetic¹⁹, rather than a scientific criterion and at least one research has shown that the followers of Einstein in creating models of the natural universe are more inclined to judge each other's models in terms of standards of the beauty (Hossenfelder, S., 2018) of the mathematics demonstrations they used to arrive at their results, instead of judging them according to their correspondence to reality. Mathematics is considered to be institutionalized rational thought in its most perfected form. But it also has a series of shortcomings that derive from the nature of mathematics itself, which belongs to the realm of imaginary. Unlike all the forms of knowledge that have preceded them, the natural sciences and, in most part, the social

¹⁹ Simplicity is an aesthetic criterion only in certain cultures and societies, where it is obviously part of what I call social knowledge.

sciences are trying to translate observable reality into the imaginary world of mathematics where it is mathematically processed until there is a sense of a new finding, for which scientists struggles to identify a correspondent in reality.

We saw earlier that the mechanism through which such a link is established is the agreement of the scientific community, which functions as a complex social group. Then Stephen Hawking announces that, for now, the scientific community is divided between two models of reality²⁰, between which he cannot make a choice and to which the phenomenal world is stubbornly impassive. Then comes Sabine Hossenfelder who announces us that the models are not being accepted just for the sake of their correspondence to observable reality, but also because of beauty, and that these risks affecting their correspondence to reality. And the chain of critiques addressed to the methodology of the models of reality constructed by physicians continues, as Jim Baggott lets us know that theoretical physics has already parted from the reality that it was supposed to have modelled (Baggott, J., 2013) while a study conducted upon published pieces of medical research²¹ argues that 70% of them are false, that is they are unscientific (Ioannidis, J.P.A., 2005). Meaning that the results of these studies were neither impartial, nor an accurate description of the reality. However, they were accepted as legitimate scientific truths and founded legitimate medical practices in the domain. There are no reasons to believe that other areas of scientific study perform better, or worse, natural sciences included, even if the percentages are varying from one domain of study to another.

ii. However, there are reasons to believe that social and political sciences perform somewhat worse. That's because of the ideologies. An ideology is a particular social knowledge derived from the dominant social knowledge of a certain society at a certain historical time that legitimates the social interests of one or more social groups belonging to that society. An ideology is consistent with the basic principles and theorems of the social knowledge but its main function is to legitimate the values and objectives of a special social group (and any other that is interested in one or all of these objectives). Usually, such social groups create political elites meant to represent their interests and to promote their objectives as objectives of the society as a whole, which allows them to use the totality of the social production as resources for accomplishing its own interests, via social engineering i.e., political, social, economic, and cultural policies

²⁰ The one grounded in Einstein's general theory of relativity, and the one grounded in the quantum paradigm.

²¹ That is to say, on research accepted as scientific by the community in the respective field.

of the government. In specific conditions, contrary to the social status of the natural sciences whose truths and theories found the technical engineering. At least that is what the political elites themselves believe as it was declared by the American politician Karl Rove to a selected group of social scientists:

We're an empire now, and when we act, we create our own reality. And while you're studying that reality—judiciously, as you will—we'll act again, creating other new realities, which you can study too, and that's how things will sort out. We're history's actors...and you, all of you, will be left to just study what we do. (apud. Hunter DeRensis, 2019).

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