Judea Pearl & Dana MacKenzie, The book of why. The new science of causes and effects, Basic Books, 2018, pp. 432, $ 28.80   The data, as such, are not intelligent. They do not speak to us, that is, they do not reach our cognitive apparatus with attached labels that inform them of what they mean. It would be enough to have understood the ABC of scientific epistemology to know it. Today, however, data is spoken as if they contained some kind of truth. "We live in an era - says computer scientist and philosopher Judea Pearl, winner of the Turing award in 2011 to have revolutionized the probabilistic approach to artificial intelligence - which assumes that Big Data is the solution to all problems. Data science courses are proliferating in our universities, and jobs as 'data scientists' are profitable in our societies, where the economy is 'data driven'. "In fact, he explains the tools in an interview. traditional statistics, which only look at correlations, and the Artificial Intelligence (IA) algorithms we use to query databases are like men "in the famous cave of Plato, [...] explore the shadows on the cave wall and learn to predict but they do not understand that the observed shadows are projections of three-dimensional objects that move in a three-dimensional space. "It follows, for the IA theorist based on Bayesian networks, that the" singularity "(the super-intelligence that would take control of the technologies), the arrival of legions of robots that will enslave us or an Armageddon caused by AI.The AI, today, is only able, with much, much more man's efficiency, to detect the correlation between the data. The fact that he wins chess or GO, who knows how to design drugs at a molecular level, or drive cars or pretend to be a human customer service, only shows that the range of domains where this ability to use data superficial can be applied in adaptive ways , it is larger than initially thought. "The days when - continues Pearl - the AI will know how to approach the human intelligence is close, but its abilities must be judged on three levels of cognitive abilities: see (association), do (intervention) and imagine (counterfactuals). AI today works only at the lowest level, that is, to see ".

See, do and imagine: these are the three pegs of a metaphorical scale that constitutes the narrative axis of a beautiful book that Judea Pearl wrote together with Dana Mackenzie, to explain why scientists and statisticians are only now understood when they discuss data and how to put them into relationships in order to find causal explanations of the facts. For over half a century, the authors remember, but perhaps even more so, in the academic world "the causal lexicon was practically forbidden." And this also had tragic consequences.The argument through which the narration unfolds revolves around the drawing of a "scale of causality", signed by the graphic designer and illustrator Maayan Harel, very effective to give meaning to the topics, like other illustrations, also very funny, present in the book   The lowest step, where statisticians live, deals simply with observation, and consists in the search for regularity in the world. How are the variables connected? How does it change what I know about Y, if I look at X? In other words, what does a synonymous on a given illness or a poll on electoral trends tell me? Pearl also places the current machine learning and deep learnig algorithms on which the IA is based at this first stage. The explosion of computing power and the very detailed data sets accessible have produced surprising and important results, but the mechanisms still work "in the same way that a statistic tries to adapt a line to a set of points" and "the data raw materials continue to drive adaptation processes ". The causal revolution is what has allowed the researchers to sali on the highest steps of the ladder.

Despite the heroic efforts of the geneticist Sewall Wright (1889-1988) to apply the statistical technique of path analysis, which he invented in 1918, to quantitatively describe the direct dependencies between sets of variables - today common technique - to different complex cognitive domains the intellectual supremacy exercised by the British biometrists by Karl Pearson has led to a sort of self-censorship for the use of mathematical tools to handle causal questions. Speaking of "causality" had become like talking about phlogiston after the kinetic theory of heat, so the statistics often focused only on collecting and linking data, not on how to interpret and explain them. There are statisticians, for Judea Pearl, who still "find it difficult to understand that knowledge exists outside of statistics and that data alone can not compensate for the lack of scientific knowledge".   At the second peg we pass from observing to doing, to intervening. One wonders what happened or what would happen based on the possible active modifications of a situation. What would happen to Y if I do X? How can I make Y happen? In other words: if I take an analgesic the headache will go away? what will happen with respect to different variables if I forbid cigarettes? According to Pearl, "many scientists have been traumatized by learning that none of the methods they have learned with statistics is enough to articulate, not to say, a simple question such as 'What happens if we double the price?'" The book explains how and when a model alone can answer the question   in   the   absence   of   live   experiments.

At the top of the ladder comes the "counterfactual" argument, ie imagination, retrospection and comprehension. X was caused by Y? If X had not happened how things would be today? What would have happened if I had acted differently? In other words: was aspirin giving me a headache ?; if the terrorists did not break down the twin towers, would the US wars be against Islamic countries? We are at the level of science, but also of ethics. It is about using the ability to look back and imagine what could have governed our judgments in terms of success and failure, right and wrong, etc. Once this way of arguing was considered distinctive of human intelligence, and more and more complex modeling tools have come into play in recent decades. These tools have been applied to various social and scientific problems, including the effectiveness of medical procedures, the impact of climate change and the utility of social policies.   Much of the book discusses why and how statisticians and scientists rejected causality as a scientific topic. Correlations were studied, the mantra was repeated "correlation does not imply causality" and it was thought that it was illusory to try to go beyond correlations. Experimental scientists wanted to discuss and plan the causal implications of their research, but the statisticians refused most of the attempts to consider the causes. With the invention of controlled and randomized studies (RCTs) statisticians believed they could prove that correlation implies causality. So the RCTs have become increasingly important. The use of the RCTs cleared the concept of causality, but up to a certain point. When scientists, for example, noticed that smoking could cause lung cancer, they had to wait for the RCTs to observe that smoking is associated with cancer. This eventually led the experts to imagine useful criteria for establishing causality. But even in ideal circumstances, those criteria were not convincing enough to produce a consensus among statisticians. Some very influential statesmen such as Ronald Fisher and Jacob Yerushalmi used their prestige and intelligence to evade the topic of causality and question correlations. Therefore, the positions taken by the health authorities on smoking and cancer

have been delayed for years by the discomfort of scientists in talking about causality.

Pearl emerges, through the pages of the book but also by interviews, as a very nice man, full of curiosity and joy for his work, and also much loved by students and colleagues comes to think. His enthusiasm for philosophical research must have helped him greatly to cope with the tragedy of a journalist son kidnapped and murdered by the Taliban in Pakistan. His reaction was very informative. Meanwhile, he created a foundation in the name of Daniel founded on the principles of tolerance and respect for all cultures and values that ultimately bud from a scientific culture or that cultivates objectivity and shuns conformism. "My son was killed by hatred for which I am determined to fight hatred" he said, he has not harshly criticized those who, especially liberal and progressive, accuse Israel of being a cause of terrorism and so shamefully rationalize fundamentalist terrorism.