Probability

For years Leo had spoken of probability based only on his intuition and without attempting to explain it with the logic of mathematics and modern physics, perhaps because of his problem: he didn't understand a damn thing of that stuff. According to him it was just the *law of Murphy* embellished with mathematical formulas to make it more digestible. According to Leo, as he had written in the Talmud of Scicli, the probability was a *force of nature*, namely a *potential energy*, often unlucky.

Well, to his surprise Leo had found that that definition would seem right, or at least more likely than other possible definitions.

Here's what wrote the influential Italian physicist Carlo Rovelli in a booklet full of scientific wisdom: Seven short lessons of Physics. The book, which Leo had devoured in one day, was only 85 pages including 10 pages for the initial license and the index with a list of chapters, but contained all the modern scientific human knowledge, fortunately without mathematical formulas. Here's what it said:

The difference between the past and the future exists only when there is heat. The fundamental phenomenon that distinguishes the future from the past is the fact that the heat goes from hot things to cold things and not vice versa. Why ?

The reason was found by Ludwig Boltzmann (the inventor of Entropy) and is surprisingly simple: it is the chance, i.e. the probability. (Also known as the Law of Murphy: Anything that can possibly go wrong, does. This comment is Leo!) The heat does not go from hot things to cold things because is forced by an absolute law: it goes there only with great probability. The reason is that it is statistically more probable that an atom of an hot substance, which moves fast, should be banging against a cold atom to leave a bit of its energy, than vice versa.

It is not impossible that a warm body warms up even more by contacting a cold body: it's just terribly unlikely.

This bringing the probability in the center of physical considerations and even using it to explain the basics of the dynamics of heat was considered absurd in the beginning. Boltzmann was not taken seriously by anyone, as often happens. He ended up suicide on September 5, 1906 in Duino, near Trieste, hanging himself .... (And demonstrating very little sense of humor: comment of Leo). Too bad because his ideas were right.

Well, that's enough. Thanks to Prof. Rovelli, Leo now had in his hand what he needed for his Kabbalistic analysis of probability. "From now on I'm not going to warm up my bones in the mountains in winter or on the Svalbard in autumn, but in Cuba or in the Caribbean. Not only that, now I finally understand even the *arrow of time* that goes from past to future, via a brief moment of zero time in the present. " So had said to me Leo in front of the burning and crackling fireplace. Then he added: "Now I have the key to understanding the universe and space-time. There are few who accept what I say because they believe that my theories are just crap, but rest assured that I will not commit suicide like poor Boltzmann, at most I will drink a schnapps or two to give me courage. "So spoke Leo, and here, in brief , are his discoveries.

Probability and Statistics

I had gone to his house to interview him. And he explained to me at once that to figure out the probability, as usual he needed a practical example.

We sat by the fireplace in which burned a large piece of carobtree wood to try to visualize the future and understand what was the difference between his poor track record and his future shrouded in thick fog. He had little hope for his future !

After uncorking a bottle of Nero d'Avola he poured two glasses, one for me and one for himself, then Leo said these words: "The *cosmic bad luck* is caused by heat!"

Leo understood that the *positive probability* (we shall see later that according to Leo there was another world, that of the *negative probability* of the Devils) was the measure of success or failure of a given event in the world of "normal" beings. It was measured with the infinite series of numbers ranging from 0 (failure) in 1, (success) passing through all the other relative numbers of the type 1 / n. When was n = 1, the ratio was 1/1, and therefore the likelihood became certainty, when n instead became infinite, the ratio became zero, and the failure was total. But usually the

statistics said that all would end up wrong, because the bad luck always took the upper hand of the normal events, directing them to a partial or total failure.

To understand what constituted the unlucky probability Leo had begun to think of the thermometer, which measured the temperature, that is, the number of shocks that the mercury (or another substance) received by the particles of the atmosphere or of the liquids or bodies with which it was in contact. More energy had the particles hitting the thermometer, the higher was the temperature. It was clear that the analogy between temperature and concentration of bad luck assumed that hitting Leo was an extraordinary concentration of cosmic negativity. (In those days when he had to leave by plane from Catania to celebrate Christmas in Norway, it had happened that Etna was awakened with a strong eruption, thereby causing the closing of the airport. Why? Because the bad probability haunted him?)

The discovery that Leo had made, based on what had written Prof. Rovelli, will have extraordinary repercussions in the scientific world, but let's see how Leo had come to that conclusion.

With a bold flight of fancy, jumping from a tangent, Leo had wondered: what kind of temperature has the infinite empty space outside the Universe? The obvious question that came to mind was: can you measure a temperature different from zero in that void where nothing moved? About the *arrow of time* prof. Rovelli had said that the difference between the past and the future exists only when there is heat and we saw that this heat, which is measured by a temperature, is due to the movement of particles and molecules, so when there is no movement, as in the outer space of the Universe where everything is at a standstill, there is no difference between past and future, and the time is stopped? To Leo it seemed so. The arrow of time that is considered unidirectional and points from the past to the future is due to the passage of time, due to the passage of heat from cold to hot, which in turn generates a movement that generates energy and therefore more heat.

After drinking my wine I asked: "So, when there is no heat in the space-time outside of the Universe, it no longer makes sense to speak of movement and therefore of time. Then outside our kinetic Universe where everything moves, in the infinite area surrounding it, nothing moves and time stands still? "

"It seems so, but we'll never know." Confirmed Leo and said: "Time is the measure of movement, as the ancient Greeks had said, and where there is no movement

time is stopped, the time is zero, a second lasts forever. But where there's no heat, there isn't the *arrow of time*, because there is no temperature, then the probability of events is always zero. In that space bad luck doesn't concentrate because there is no arrow of time. "

This is the great discovery of Leo: *the concentration of bad luck on him was due to the arrow of time!*

The problem of the future

Now there was another problem: the problem of the future. Leo had seen that the time arrow was pointing in one direction, from past to future, and not vice versa, because of the heat, which is due to movement that goes from hot to cold, because of the *chance* that puts its cumbersome paw in it. This is a Law of Nature. Well, but I asked him: "The future exists?" The answer of Leo was *no*: "The future is only a construction created by man to distinguish the + sign that is tomorrow from the - sign that is yesterday, passing through the 0 that is today." Then Leo explained that if the future does not exist, since it has not yet occurred, nothing moves in the future and there are only the present, which is zero, and the past. The past , which is a fossilized time, a fossil chance, which has become History. And he added: "No wonder then that when we do an experiment in quantum physics, the particles seem to behave as if time were non-existent and therefore they travel at infinite speed, because to them and to their little brains future time does not exist. They don't know how to imagine. The phenomenon of *non-locality*, so much hated by the great Einstein because it contradicts his theory that nothing can travel faster than light, is explained by reducing to zero the future, because, having not yet occurred, its warmth and its chances are zero. There is no heat in what did not happen. "

"But in the intergalactic space of the universe, time is zero?" I asked.

The response of Leo was quick: "Even if there no are particles, atoms or molecules, there is certainly always a bit of energy, photons, gamma rays, so within the Universe there will always be a temperature different from zero which is now around 2.6 ° C. Recently it was discovered a *Cosmic Background Radiation* of 2.6 ° C, that despite the cooling of the Universe from the day of its birth, continues to exist since the Big Bang (about 14 billion years ago). So in the intergalactic space within the Universe time exists, and is not zero. The time there has an age of 14 billion years. "

Then Leo threw more wood in the fireplace and took on a professorial attitude continuing to explain his ideas, while I poured another glass of Nero d'Avola for both: "A positive non-zero chance can always be verified and it will be described by a number different from zero. The *statistics* are the history of the events that depend on the probability to come true (therefore they apply to almost all events) and can be used to predict if a desired event will occur or not. Statistics identify events and conditions most likely for a given event to occur. Example: If I only buy a lottery ticket, my chances of winning the prize will be small, and the statistics prove it. If I buy half of all lottery tickets, statistics show that I will have a good chance (.5, i.e. 50%) to win, but not the certainty of winning. Only if I buy all the tickets I have the certainty (probability 1, ie 100%) to win. But I'm sure that I could lose even if I bought all the tickets because there is definitely also a *negative probability*. To be clear: that of the Devil."

Laughing we took a break while we drank wine, then Leo went on to explain: "Statistics is the history of all the results of the games. The laws of physics are behaving almost always statistically, except when the Devil puts his horns into it. If the two of us eat two chickens a week, it means that each of us eats a chicken, while possibly you eat two chickens and I'll settle for a mixed salad. Then there's the fact that events outside of statistics, i.e. events that have never occurred in history, are rare. And sometimes I wonder if they happen all to me (I could lose money in real estate even in Houston, Texas). The German mathematician Gauss, described the statistical curve of the likelihood that an event will occur. Take the roll of a dice, that having 6 faces, has six numbers ranging from 1 to 6. The odds of making any number will then be 1/6, that is, one out of six throws of the dice. This is what statistics are teaching. Of course one will have to make thousands or millions of shots to confirm

the statistics, but the end result will be: 1 / 6. Before rolling the die I will know that I will have a chance of making for example 1 every sixth throw. And what odds will I have to make 7 with only one die? Clearly 0, because the numbers are ranging from 1 to 6 and 7 doesn't exist in the die.

If we play with two dice things change. The probability of making 1, or 13, with two dice will be 0, that of making 2, or 12 will be 1/6 X 1/6, or 1/36, that is, the compounded probability of each die. The probability will increase up to a maximum for 7, because you can make seven with 1 + 6, 2 + 5, 3 + 4, 4 + 3, 2 + 5, 6 + 1. Then a shot out of six will give me as a result 7 and the chances will be 1/6. "

To confirm what he said Leo showed me the Gaussian curve, shown below. The curve has the shape of a bell and describes for example the statistical probability of making 7, at the point M as the maximum probability.

The curve also shows that 2 and 12 are rare events that have very small probability (1/36) and are represented by the standard deviations of -3 and + 3. While most of the results (95%) is between - 2 and + 2 standard deviations from the mean M.

The curve of Gauss
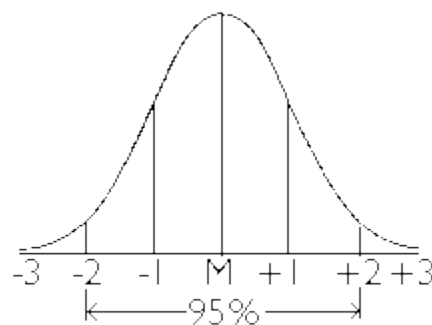
The space-time

Leo went on to explain his theories: "The space-time can be thought as a box of infinite dimension in which possible events occur. With two dice it is impossible to make 1 or 13, and therefore these events have a possibilty 0 to occur in space-time playing with two dice. In space-time the most likely events occur more often. And unlikely events? Occur after a large number of trials, it takes a long time but then at

the end they occur. And those impossible? They never occur. Having said that, when someone speaks of miracles, remember that. Spacetime contains our Universe and possibly many other Universes. But now it's time to talk about *negative probability*, that of the Devil. "

Full of curiosity, I poured a third glass of Nero d'Avola, emptying the bottle, while Leo with an iron poked the fire in the fireplace. Leo took a sip of wine and began to speak: "If there was a world of non-existence, parallel to that of the Being, what probability could we assign it? The Being has a probability that varies between 0 and 1, the infinite series of positive events that start from a non-event until you get events of complete success, from the failure to occur to the certainty of occurrence. What kind of range would we assign to the probabilities of the non-Being? A negative probability that starts at 0 and ends at -1. What would happen in this environment? In physics a world such as this exists, it's that of *antimatter*, but it is a fatuous world that exists only for a few split-seconds and then is immediately annihilated by the world of normal Matter. From the philosophical point of view the opposite of certainty is uncertainty, the opposite of success is failure. If this environment exists it must be what the religious people call Hell. "I was stunned and I continued to listen with interest. "Go on!" I said.

"Well it is clear that in such a world of the antimatter, which is a proven physical reality, the arrow of time should go on the contrary, from the future to the past, that is from the non-existent that is the future, to the fossil that is the past, through a fatuous present that lasts only an infinitesimal moment. It would start from a probability 0, that of the future, to a negative one, that of the past, of history that has ceased to exist and to which we can give the value - 1. This explains the unexpected and negative events in the world. This is the evil field of negative probability that is intertwined with positive probability."

It was true, I knew that the great physicist Richard Feynman in his diagrams showed that antimatter was moving from the future to the past.
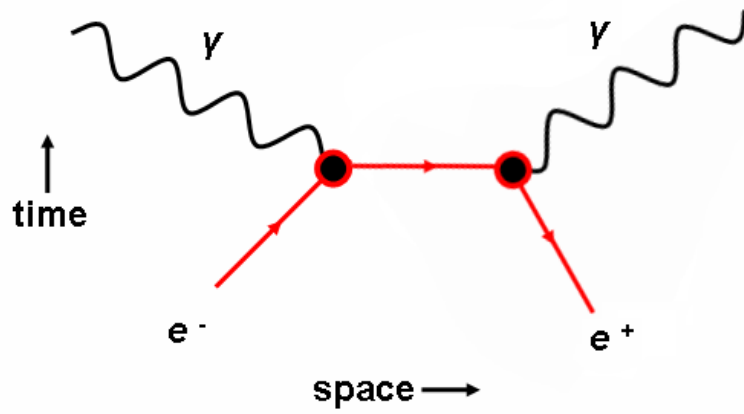
Diagram of Feynman : a positron e + moves contrary to the arrow of time.

Leo's logic was impeccable and I couldn't find another answer than a long applause, accompanied by a toast.
His logic was flawless and was documented by the experiments.
The Devil existed!