How the world works

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Abstract

I wrote this for all people that hate a car load of formulas.

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I state you a proposition
and that proposition indicates
how the world works
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Story

Prelude

A group of elderly Magi sit in a circle and discuss what happens around them. That is not much. The youngest of them gets bored and starts considering their discussion. The chat appears regulated, because if they start from a false proposition they will be able to draw any

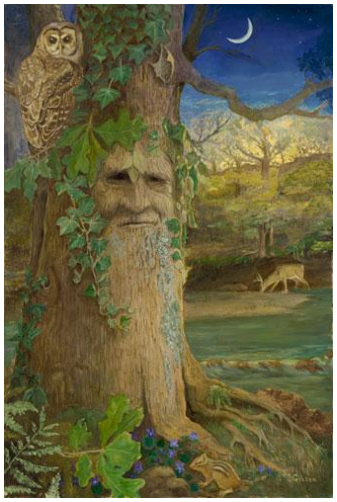
inference, whether true or not true, and then the conversation ends only in balderdash ad infinitum.

After some time, he has collected the rules. These rules prevent the conversations from getting out of control. He proposes these rules to his companion discussers. They are very pleased. From this moment on, every conversation runs fluently. The inventor writes his finding in a book and calls that book "Logic".

However, in their environment still little occurs that is worth a proper discussion. Since the talks no longer get out of control, most of the time passes in silence. The inventor feels bored again and therefore he tries to invent something else. He realizes that if he changes the rules in his book a little, then as a result, the discussions could be become much more interesting. He writes a new book that contains the changed rules. Next he changes the forest that exists in their neighbourhood in order to reflect the discussion rules.

After finishing this book and the forest, the situation has completely changed. Continuously, things appear in the forest around them that keep their conversations for ever alive. The writer calls the second book “Quantum Logic” and he renames his first book “Classical Logic”. The toolkit that he uses to create the new structure of the forest also has a name. It is called “Mathematics”.

Classical logic did come down to earth. When smart humans discuss a subject the proponent and the opponent use the rules of classical logic in order to regulate their discussion. Early in the twentieth century human scientists discovered that nature cheats with the rule of classical logic and instead obeys traditional quantum logic. They also found that a mathematical construct exists that has the same structure as this quantum logic. This construct was discovered by David Hilbert and it got his name.



M

S 

The encounter

An old, very experienced senior meets a young curious guy, which is full of questions about the things that he has observed during his trip through his world. The youngster asks the elder whether he can ask him a few of his most urging questions. The senior reacts positively by nicking shortly. However, already the first question of the studious guy startles him:

S: Mister, can you explain me how the world works?

The elder thinks a while very deeply and comes then with his answer:

M: That would be a hell of a job, but I can at least give it a try. Please, sit down on that stone, because this will take some time.

The lad sits down and looks expectantly to his narrator. The old man takes a breath and starts:

M: This can be done in the form of a tale. It could be done better in the form of a truck load of formulas, but I doubt that you would understand these formulas. Do you accept that I pack the story in a tale?

S: Well I like a tale much better than a truck load of formulas. I probably would not understand one of them. So please start with your tale.

The elder takes a breath and starts his tale.

M: The world is governed by a book of laws. It must conform to these laws. There is no punishment in not following the laws, but the world cannot do anything else then operate according to the rules that are written in the book of laws.

S: Where is that book and how is it called?

M: It is in the possession of the governor of Hilbert's bush. The book's name is "The rules of quantum logic".

S: What is in that book?

M: The book contains a small set of rules that regulate what the relations are between propositions that can be made about things that live in our world.

S: What things?

M: Well, anything that has an identity and that stores the condition it is in. Let us call such a thing an item or a particle and let us use the name state for the condition it is in. Mostly the concerned things are very small. However, some of these things can be very large. In fact these larger ones are conglomerates of smaller ones.

S: What is different with that logic? I know only one kind of logic.

M: You know the kind of logic that humans base their reasoning on. The rules are specified in a very old book that is named "Classical logic". People use the rules of logic in their discussions when they start with truth and want to stay with truth. Nature uses a kind of logic that has a much richer structure. However, in that logic only one rule is different.

S: Just one rule?

M: Indeed, that rule is weakened with respect to the older rule. But it is similar to the situation when one rule of a popular game is weakened. The whole ends up in a kind of anarchy. Instead of a simple well ruled game, it becomes a very complex process.

S: How many rules contain these logic books and what do these rules mean?

M: The books contain somewhat more than twenty rules and they specify the structure of the relations between the allowable propositions.

S: There are not much rules in these books! How can the quantum logic book rule the world?

M: You are right about this, but these rules are very powerful.

S: Please explain that.

M: Well, the structure of the propositions is reflected in the structure of Hilbert's bush. Hilbert's bush is a huge and dense forest and is connected to our world. Via these connections Hilbert's bush controls how the world works.

S: Thus, if I visit Hilbert's bush, then I can see how the world works?

M: No, if you visit Hilbert's bush, then you can see how the world is controlled.

S: How, can I visit Hilbert's bush?

M: Well, you can join me on a virtual trip to Hilbert's bush. I will be your guide.

S: Fine. How does Hilbert's bush look?

The man describes a very strange environment. The chap follows the old man in his mind and shows astonished. However, in advance his guide warned that he would present a tale. So, he must belief what the man tells.

M: It is like a huge forest of poles. All poles have the same length and the feet of all poles are hooked at the same point in the centre of the bush. In this way the poles form an enormous sphere.

S: Where do these poles stand for?

M: The poles are the axes of a multidimensional cube that has an enormous dimension. First think of a three dimensional cube. Take a corner of it and take the three axes at that corner. You can identify the position of all points in the cube by three positions on rulers that are taken along the three axes.

Now, as in an umbrella, fold these axes together, such that they form a small bundle. Next add a large amount of axes to that bundle. Give every axis a unique label. We like to use these labels as a global positioning system (GPS). Thus each label gets a unique GPS code. Add a ruler to each of these axes. You can still define the position of each point in the multidimensional cube by stating the corresponding positions on the rulers. Next increase the number of dimensions until it reaches infinity.

The axes now form a dense ball and they all are numbered with a unique GPS label. Finally unfold in your imagination the "umbrella" again until all axes are again perpendicular to each other. You can start counting the dimensions of the cube, but you will never finish counting.

Of course such a thing is possible in your imagination, but not in our three dimensional world.

S: Thus the poles are a plain set of axes.

M: Yes, but the space between the perpendicular axes can also be filled with other poles. In this way several sets of mutually perpendicular axis poles can be found.

S:What is the function of these axis poles?

M: Different sets of mutually perpendicular axis poles have different colours. Some axis poles are green poles. Together they form a base in which the position of all other poles can be expressed. Another set of axis poles are red. Also they form a base.

Some of the poles are silver white. They are not necessarily axis poles. The silver white poles appear in bundles.

S: What is the function of the green and red poles?

M: At their top these poles contain a data store in the form of a label. The data stores of the green poles contain position data. They are a kind of position indications that you find along our roads. Instead of a single number the stores contain all three coordinates. It works like a kind of primitive 3D GPS system.

M: The data stores of the red poles contain speed data, or better said momentum data.

S: That is a strange kind of forest!

M: Indeed, but it is not the only thing that is strange about Hilbert's bush. Let me tell more about the silver white poles. The silver white poles are only loosely coupled with a GPS value or a momentum value. In fact the coupling is stochastic and can be described by a probability distribution.

S: What is a probability distribution?

M: It is a kind of cloud that has a high density value where the probability of presence is high and a low density value where that probability is low.

S: Why do the white poles exist?

M: The bundles of white poles represent and at the same time control the items in our world.

S: How is that arranged?

M: The items in our world are reflections of bundles of white poles in Hilbert bush. What happens to the bundles will happen to the items.

S: What is the role of the red and green data poles?

M: In this way a silver white pole can with a certain accuracy determine the current position and the current momentum that describe the moves of its pupil in the real world.

S: But, why are there two types of data poles?

M: The governor arranged it that way. In this way the white pole cannot determine both types of data at the same time. It is another detail of how the governor models our world. The stores of the red and green poles contain the values of the properties of the type observation to which the pole belongs. Mathematicians call these values eigenvalues and the corresponding poles eigenvectors. With this trick the governor leaves us uncertain about our exact condition.

S: What are mathematicians?

M: Mathematicians are scientists that amongst other things study the mechanisms, which determine the structure and behaviour of Hilbert's forest. The creator of the forest used mathematics to give it its functionality.

S: With some trouble I can understand what you paint for me.

The student tries to imagine the strange situation. Apparently two worlds exist. One in which he lives and one from where his live is controlled. He visualizes the forest in his brain.

S: Can white poles read data?

M: No, in fact a shepherd that takes care of the silver white bundle does that. The forest is very dense. So, the shepherd can walk on top of these poles and guard his herd of sheep. From now on, I will call the silver white poles the shepherd's sheep.

S: How does the shepherd read the data?

M: The shepherd must turn to the data pole in order to read its data. If he is close to a green pole, then he is rather far from a red pole. In fact he may be at nearly the same distance from quite a series of red poles. He will usually read the nearest data pole. The same holds when the shepherd looks at the green poles. Thus, the governor plays a strange trick with our world.

> *For the insiders: This is the source for the existence of Heisenberg's uncertainty principle. It is the cause of the quantum behaviour of small particles.*

S: I must say, that is a strange situation!

M: Yes, let me proceed. It will become even much stranger. So, I will switch to a more pictorial description.

S: Please, go on.

M: The shepherd drives his sheep through Hilbert's bush. He does that guided by the smells that he receives from other silver white bundles. The smells are mixtures of perfumes that are attractive and perfumes that are repellent. The shepherd reacts on these smells.

In fact these clouds of smell stand for the probability distributions that are mentioned earlier.

S: What is causing these smells?

M: These smells are caused by the properties of the sheep. They hang as a blurring mist around each white pole, thus around each individual sheep. The sheep may also move inside

the scope of the herd. That movement may also be caused by the influence of the emitted smells.

S: How does the shepherd keep his sheep together?

M: Well, that happens in a particular way. The bush is so dense, that it is impossible to let the poles move. Instead at each of his steps the shepherd redefines the poles that belong to his herd. These poles turn silver white. The poles that get outside of the herd obtain their original neutral colour. The smells create a tendency to minimize action of the cheap. Further there exists another mechanism, which is called inertia.

S: What is inertia?

M: The smells invoke a sticky resistance of the system of all herds against change. Inertia represents the combined influence of all other herds. The most distant herds together form the largest part of the set of herds. So, they have the largest effect. The influence of each individual herd decreases with distance. However, the number of herds increases faster with distance. The difference between the distant herds averages away. As a consequence the distant herds form a uniform background influence.

S: What is the effect of inertia on a herd?

M: Locally the inertia produces an enormous smell pressure. A smooth uniform movement does not disturb this potential. When the herd accelerates it stirs the perfumes and in this way the inertia produces an extra smell that goes together with this accelerated movement and it tries to retard the acceleration.

S: I understand now how position is treated. What about time?

M: The shepherd owns a simple clock. That clock counts his steps. His steps are all the same size. When he drives his sheep around, he follows a track in Hilbert's bush. All shepherds take their steps in synchrony. In facts at each of their steps the complete forest is redefined. In this process the smells act as a guide. They store the current condition of the forest and they represent the preconditions for the new version of the forest. You can say that the smells represent potential versions of the forest. This includes potential versions of sheep. These potential sheep are not actual but virtual sheep.

S: So, compared to space, time is handled quite differently.

M: You understand it quickly and perfectly! You understand it better than the physicists of the last few centuries. Most of them were wrong with this subject. They think that time and space belong in one inseparable observable characteristic.

S: How many of these sheep exist?

M: As many as there are particles in our world. So, there exist an enormous number of sheep and herds, but they are still countable. They can all be identified. All shepherds take their own track through Hilbert's bush.

S: That must make Hilbert's bush very large!

M: It is. Let me proceed.

It must be obvious now that the herds influence each other's movements via their smells.

The lad reflects and pictures the forest in his mind as an enormous sphere. On top of that sphere a large number of shepherds push their own herd of silver white lights forward on curving tracks that are determined by the smells that other herds produce. At each of the shepherd's steps Hilbert's forest is reconfigured. The old man must have a strange image of the world. Nonetheless, he must have his reasons.

S: So, the shepherds play a crucial role!

M: Yes, they manipulate their own herd. However, the smells of their sheep influence for other shepherds the observation of the position and momentum of other herds.

S: How do the smells influence that observation?

M: They give the data that are transmitted in the smell an extra turn. It means that other shepherds do not get a proper impression of the position and momentum data that are sent by other herds.

S: Is there a good reason for this confusing behaviour?

M: No, there is no reason. It is just a built in habit of all sheep. On the other hand, the governor established that habit when he designed mathematics. He designed mathematics such, that Hilbert's bush and its inhabitants behave according to the rules in his book.

S: What is the consequence of this strange behaviour?

M: The consequence is that the particles in the world get the wrong impression of the position and momentum of other items. For them it appears that there exists a maximum speed. And these items think that they live in a curved space.

> *For the insiders: This is the source of the existence of relativity as it was discovered, but not explained by Einstein.*

S: Do they think that?

M: For them, it is the truth!

S: So, I live in a curved space and for me there exists a maximum speed.

M: That is right. You properly understand how the world is controlled. As long as you do not interpret that maximum speed as the limit set by your local police officer.

S: What happens inside a herd?

M: The sheep inside a well-shaped herd perform rhythmic movements. You could say that they are dancing. Physicists call it harmonic movements. These dances occur under the control of the shepherd. He considers them as his own possession.

S: What do you mean with a well-shaped herd?

M: A well-formed herd represents in our world a well-formed object, such as an atom or a molecule.

S: Why is everything set up in such a strange way?

M: The governor of Hilbert's bush is very intelligent, but also very lazy. He does not want to create many rules, so that he does not have to write much in his law book. That is why he invented Hilbert's bush. He builds the consequences of all his rules into the structure and the dynamics of Hilbert's bush. That structure is in principle very simple. The same holds for the dynamics. In this way he does not have to take care on how the world evolves. However, this leaves an enormous freedom for what happens in the world that is controlled by Hilbert's bush. That on itself results in an enormous complexity of the world we live in. That renders the governor very, very smart and very, very lazy.

S: How did Hilbert's bush get its name?

M: Hilbert was the first human that discovered the governor's bush. So people give it his name.

S: Can everybody visit Hilbert's bush?

M: In principle yes. Everybody that possesses sufficient imagination can visit Hilbert's bush. There exist two guides. A mister Schrödinger tells the story as we did. He tells the story as if the bundle of silver white poles moves through the bush of green and red poles. The other guide, mister Heisenberg tells the story as if the bundle of white poles is stationary and the bush of green and red poles moves around. For the world it does not matter what moves. It only senses the relative motion.

S: How did intelligent creatures like us enter that world?

M: The governor installed a tendency to reduce complexity by means of modularization into his forest. When more compatible modules become available it becomes easier to construct more capable modules and more capable items from these modules. Given enough time, more and more capable items are created, which finally result in intelligent creatures. Scientists call this process evolution. It is a chaotic process, but it possesses a powerful tendency.

S: Uch. Can I tell this to my friends?

M: Yes, you can. And if you have learned to read formulas and work with them you can come back and I will tell you the same story in a cart load of formulas.

S: Thanks. I will come back when I am grown up. Can I still ask a final question?

M: You are a sauce-box, but you are smart. Go ahead.

S: What are you going to do after this?

M: I will visit a very old and very wise scientist, called Mendel. He claims that he has a cohesive explanation for all smells that shepherds react to.

S: Why is that important?

M: If his claim is right, then he has found the Holy Grail of physics.

S: Gosh!

After this the boy departs. Later he will become a good physicist.

Interpretation

The book of laws contains a number of axioms that define the structure of traditional quantum logic as an orthomodular lattice.

Hilbert's bush stands for an infinite dimensional separable Hilbert space that is defined over the number field of the quaternions. The set of the closed subspaces of the Hilbert space has the same lattice structure as traditional quantum logic.

The green poles represent an orthonormal base consisting of eigenvectors of the normal operator Q. This operator represents an observable quantity, which indicates the location of the item in space.

The red poles represent an orthonormal base consisting of eigenvectors of the normal operator P. This operator is the canonical conjugate of Q and represents an observable quantity, which indicates the momentum of the item.

The bundle of silver white poles and the herd of sheep represent a closed subspace of the Hilbert space that on its turn represents a particular quantum logical statement. This statement concerns a particle or a wave packet in our surroundings. Q describes the thing as a particle. P describes the thing as a wave packet.

The shepherd represents a complicated operator U_t that pushes the subspace, which is represented by his herd, around in the Hilbert space. The operator U_t may be seen as a trail of infinitesimal unitary operators. It is a function of the trail progression parameter t. The progression parameter differs from our common notion of time, which is the coordinate time.

Traditional quantum logic defines only the stationary structure of what happens in Hilbert's bush. The dynamics are introduced by the shepherds that react on the smells.

The smells correspond to physical fields. The fields transport information about the conserved quantities that characterize the movements of the item and its elements. Each type of preserved quantity has its own field type. The operators U_t react on these fields. Inertia shows how these operators reflect the actions of the fields. Any acceleration of the item goes together with a reconfiguration of the fields.

The operator U_t transforms the observation operators Q and P into respectively

$$Q_t = U_t^{-1} \cdot Q \cdot U_t$$

and

$$P_t = U_t^{-1} \cdot P \cdot U_t$$

This distorts the correct observation and ensures that the observer experiences a speed maximum and a curved space.

The eigenvalues of Q and P and the trail progression parameter t characterize the space-time in our live space. As already indicated t is not the same as our common coordinate time.

De eigenfunctions of U_t control the (harmonic) internal movements of the particles.

The sheep represent the elements/properties of the elementary particles that make up the local herd.

The effect of modularization is treated in http://www.crypts-of-physics.eu/ThereExistsATendencyInNatureToReduceComplexity.pdf.

A tale is a tale.


HvL


The Philosopher Tempted.
PLATO
DANTE
ZENO
the
Alchemists
MEDITATIONS