

The Unspooky Violation of Bell's Inequalities:

Georgina Woodward 2nd Dec. 2022

Abstract

Examination of the violation of Bell's inequalities by analogy (improved). The how, why and what Bell's inequalities require and therefore must sometimes be violated in a universe where things happen rather than just exist. Identifying that what happens via a process is not the same as what is predicted just using prior existent traits. Conclusion and recommendations given for locality, realism and spacetime.

Bell's inequalities:

John Stewart Bell, said "Quote "If [a hidden-variable theory] is local it will not agree with quantum mechanics, and if it agrees with quantum mechanics it will not be local." Wikipedia Bell's theorem. "Local" is referring to the principle of locality, that cause and effect is due to immediate surroundings. "Hidden variables", properties that are unknown but if present are affecting the outcome of experiments.

Its not an overlooked existent trait, character or property that's responsible for the statistical outcome. What's missing is the taking into account of the process happening. That brings probability into the 'picture' because of the possible variation of the specific relation of interacting parts. That leads to a misunderstanding. *The thought that the statistical outcome is proving quantum mechanics must be the cause.* Rather than showing that the universe isn't just existence but also involves sequential happenings. Happenings that may have, because of the complexity of the existing things and their relation, involved *at the time of interaction*, probability of different possible outcomes. Consider the complex asymmetric chemical structure of a polarizer and the variables involved in interaction with the physics and chemistry of the structure as a photon meets it. The meeting does not always have only one possible way of happening.

One demonstration of violation of Bell's inequalities involves shooting entangled pairs of photons at polarizers and seeing what happens for different combinations of angles. Giving pairs of results that are each whether the photon passed through the polarizer or not.

An analogy will be given.

Are you or are you not a 'gets through doorway A' person?

At the end of a straight pathway there is a doorway. It is fixed into a circular wall panel that can be rotated. This presents different amounts of ease/difficulty going through. Vertical is easiest followed by near vertical. Horizontal is impossible. As it is a slot too high off the ground height to get into. Your athleticism limited. Close to horizontal is most difficult but may be manageable, only just.

You do not know in advance what orientation A will be in. Lets say you are blindfolded and only discover doorway As orientation on reaching it. The doorway is vertical, you walk through with ease.

A friend with the same build and athleticism has walked along the straight path in the opposite direction. The pair of you began your journeys back to back. Your blindfolded friend comes to a doorway and goes through. Luckily for the friend this doorway too is vertical. This test is repeated and every time you both walk through with ease without any communication between you.

Next the doorway is rotated 90 degrees. Now on reaching the doorway neither of you can get through. Not being supremely athletic.

Then just one of the doors is returned to vertical. One will now walk through with ease and one be stopped by the door obstacle. Still without any communication.

The situation has gone from always correlated i.e. both pass, to always correlated neither pass, to always uncorrelated, one does pass and one does not.

The ease or difficulty of the doorway entrance is always because of the orientation encountered. There does not need to be communication telling each friend what the other has found.

The challenge continues with different combinations of angles. One door vertical and one door at 45 degrees allows one friend to pass with ease and the other faced with an obstacle between easy and difficult that can be successfully passed 50% of the time. (neither of you are very bendy.) 50% of the time there will be failure to get through the 45 degree doorway. There is no certain correlation or lack of correlation, Again no communication is needed to get this result. Each person is just taking on the situation they individually face.

However when both doors are at 45 degrees there will be the case that both pass through or both fail without agreement via communication about what result will happen. This is due to both being in the same condition from the outset. For analogy both persons are feeling particularly energetic and Sprite-ly having drank a large cup of coffee 15 minutes before the test. Both will pass the 45 degree test with flying colours. Or alternatively both are feeling weak and tired, deprived of sleep and coffee. This time both will fail the 45 degree test. (It would be easy to have an anti-correlation from the outset instead. Just by giving one of the human partners coffee and depriving the other. Which one gets coffee does not matter. It is just a way of showing the creation of a pair of opposite conditions.)

More combinations of angles are tested. Small difference of angle gives high likelihood both will pass, if one does giving correlation. Close to but not exactly 90 degree separation there is high likelihood one will pass and the other won't but not perfect 'anti'-correlation.

If we were talking about photons or waves associated with photon carriers they can have 'orientation' too. That statement needs qualifying; They really are in a condition whether fixed or changing that is potentially measurable. Measuring involves applying a context that will yield a particular outcome. So measured this way the orientation is x. Measures with a different orientation of measuring apparatus the orientation result is different. This is a kind of relativity. The measurement outcome depends on how you look. That does not mean the condition measured does not exist until measured. *It means how that condition is described, the measurement result does not exist before measurement.* It could be said this way: the existing particle has a relation to everything else that exists

being a part of the pattern of all existing, that might be called it's absolute, unmeasured orientation.

That does not need to be static. A measurement related to that orientation is looking at it in one particular, limited way. A measurement produced is a particular characterization, when measured that way. Such as the result of an orientation of polarizer. Same applies to electrons and Stern Gerlach apparatus orientations.

The absolute orientation of the pair is matched at creation. They can be created as having opposite characteristics (anti-correlated pair) or the same (correlated/ singlet state). There is a symmetry that is retained even over great separation. That being a consequence of the individuals retaining their own identities.

The doorway experiment will be conducted again but this time in outer-space. You can approach the doorway from different orientations because now the pathway can be rotated around the circular wall in which the door is located and you have heavy magnetic boots sticking you to the pathway so that you don't fall but are able to walk along it. You tackle the door obstacle as you find it from your own orientation of approach. Your friend does the same. You do not communicate. The results show the same statistical pattern as the previous earthbound tests.

Bell's inequalities are about states of being. The question are you a person who will go through door A doesn't really make sense, when we think about what has just been described. Blindfolded and told nothing you can not claim to be someone who will go through or someone who will not. It depends upon how the scenario unfolds. This may be slightly inconvenient for spacetime in which everything is said to exist; Past, present and future. If the outcome already exists, what it was to enable that outcome already exists too. That is not the case if the material future is unwritten (i.e. doesn't exist), the outcome is becoming and fits what happens, when it happens and not before.

Will you go through A? I don't know. A's orientation compared to my own until I get to A is unknown. That will decide if I go through or not. Will communication from a friend help with getting through the door. No. Getting through is up to me and the obstacle as it is presented.

Re. spooky action at a distance. There is a presumption that information has to be given to the partner particle to ensure it always behaves as it should. Such as going through x orientation of a polarizer, if the first tested particle has gone through that orientation i.e. making the partner into a definitely goes through x particle. A change of what it is from an uncertain behaviour type of particle. The description of the particles is being changed to match the updated knowledge but this isn't a fundamental change in the type of particle involved or its behaviour.

Why it is an unnecessary presumption: One of the particles will not independently change what it does and so become uncorrelated with its partner unless acted upon by something but not the partner prior to the test. The particle is individually behaving according to the relationship established at the time, and place of its own meeting the polarizer, and given its energy and angular momentum obtained at production of the pair. Conservation applying to each individually maintains their symmetrical relationship and therefore symmetry of behaviour.

Bell's inequalities being met demand that passing or not passing are prior existent traits. An example of such traits is often something like has or has not; hat, gloves and glasses. Goes through door A, goes through door B, goes through door C are not prior existent traits. They have to come into being. They are happenings that depend on the circumstances and relations applying at that time and place not fixed existence that is always the same. A comparison is with a basketball can be made. For a standard sized ball, colour, decoration and whether autographed are prior existent traits. Does or does not go through the basketball hoop when thrown on a particular occasion is not a trait of the ball that exists prior to the throw being taken. (unless you want to argue that it does exist as a part of spacetime ahead of the present being experienced. I think that is wrong) Does or does not go through the basketball hoop is the result of the particular relations of ball hoop and player and process happening at the time. Having gone once through the hoop it can not be said to be in a goes through hoop state. The passing through only applies to that one particular try.

We are really talking about photon particles or photon carriers meeting the complex asymmetrical chemical structure of a polarizer. The relation between them that is established decides if it passes or not. Does this really *demand* a quantum mechanical explanation? Or can we have a world where not everything is decided and knowable before it happens. Without the need for faster than light communication or lack of local realism.

To demonstrate that this is how the real material world is. This does not just apply to esoteric photons and polarizers or abstract doorway thought experiments, Don't count your chickens before they're hatched. You might reason that number of eggs equals number of chickens expected. However firstly not all eggs are necessarily fertilized. Also chick embryos can die in their shells for example because of overheating. These are 2 definite won't hatch groups. Healthy chicks given a healthy egg environment should hatch. Though some external misfortune such as a visiting predator may intervene. So they are still not 100% certain. Further more, and more interesting is that live chicks can die in their shells at hatching. For example because the eggs have become too dry and as a result the egg membrane has become too tough to break out from. These live chicks have the potential to break out and live and potential to die trying. Making them maybe chickens. So there are won't hatch eggs, group No, and will likely, given no unforeseen external circumstances, will hatch eggs, group Yes. That could be used for a basic estimate. Not taking into account that there are maybe chickens. In reality hatching is a *process* and like birth is not certain. Health of chick and health of egg environment come together to decide if hatching is successful or not, at the hatching time. To elaborate; Think of a chick hatching involving; the biology of chick, its structure function and health within normal range. Which can involve biochemistry, metabolism and presence of pathogens (type and prevalence), as well as the structure, function and health of the egg, temperature, moisture level, oxygen level.

Conclusion and recommendations

The statistical results obtained in tests of Bell's inequalities are not demonstrating "Spooky action at a distance." It is because the experiments involve happenings that can result in different outcomes according to the particular circumstances encountered at the time and place of the test. They are the ordinary maybes aka. 'it depends'. Unlike certain states, like a right handed red glove. More akin to throw of a basketball.

If something has to be relinquished it shouldn't be locality. As communication is playing no role in outcomes obtained.) and it shouldn't be material reality, actualized existence. Measurement produces observation products, whereby something can be known. It can't actualize (make actual) the existent thing measured. For this reason realism should be retained, meaning things are real prior to measurement. But additionally *things happen, there are processes* affecting outcomes. Preventing the complete categorization of objects into will and won't groups.

Spacetime has a role to play in physics *, but as the background for where physics happens is wrong. Spacetime just *is*, it's not happening. Happening is problematic for the model. Spacetime should be reserved for observation products. Whereas material happening has a metaphysical background of sequential change occurring altering the pattern of existence at Uni-temporal Now. (All that exists currently at the same and only time). * Existence is unitary whereas different observers can disagree about the location of observation products seen. Each making their own product using the sensory input obtained at their location.