# Bell's Theorem in the light of prescriptions

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## Abstract

A prescription is a logical way of obtaining outcomes. Correlations in Bell-test experiments can be obtained and explained by a prescription.

In mathematics prescriptions can occur. Prescriptions are no variables, no formulas and no operators. Yet following the prescription will lead, with certainty, to a wanted outcome. A prescription is a prescription because constituents have to be found from which the wanted quantity can be calculated. The constituents have to meet a certain requirement.

For example: as far as we know no formula exists that yield only prime numbers when calculated for any natural number. There is always a natural number to find for which a formula doesn't yield a prime number. This is not very strange: by definition prime numbers withdraw from every rule of calculus. However, a prescription exists that always yield a new prime number, or a combination of new prime numbers, for any natural number. The prescription is as follows:

1) Choose a random natural number N;
2) Find all prime numbers < N;
3) Multiply all those prime numbers;
4) Add 1 to the outcome of the multiplication;
5) This, with certainty, is a new prime number, or combination of prime numbers > N.

The wanted quantity is a prime number > N. The constituents are all the prime numbers < N. The requirement that they have to meet is that they are prime and that they are complete. To find the new prime number, or combination of new prime numbers, one must have deduced that the product of all successive prime numbers up to a certain number added with 1 cannot be divided by any of the prime numbers of that succession. This fact is based on the notion that adjacent natural numbers differ by a unit of 1.

Also in physics prescriptions can occur. In Bell-test experiments correlations emerge that cannot be explained by a local hidden variable theory. This is Bell's Theorem. He proved this mathematically by introducing a factor λ representing the hidden variable. This factor λ is supposed to can be anything, be it a factor, a formula or an operator. Bell's Theorem suggests that the correlations cannot be explained by a theory based on local-reality. That suggestion is not rightly. It is true that, assuming Bell's inequalities, the QM correlations can not be obtained using the factor λ. That is not so strange because a ratio of probabilities (Bell's) adding to 1, cannot be changed into another ratio of probabilities (QM's) adding to 1 by multiplying by whatever factor or operator. However, this doesn't mean that the correlations cannot be explained according to local-reality. If λ is a prescription then the wanted ratio of probabilities can be obtained (and explained).

A prescription exists for the spin direction of pairs of entangled particles that, with certainty, yields the wanted correlations. This prescription exactly tells which particle pairs show combinations of equal outcomes and which pairs show combinations of opposite outcomes although the particles of each pair have opposite spin directions. From their numbers, as part of the total number of measured pairs, the probability (estimation) for a combination of equal outcomes and for a combination of opposite outcomes is obtained and from these probabilities the correlation can be calculated. The prescription is:

1) Make a sphere and choose a line through the centre of the sphere;
2) Generate a large number of random diameters in the sphere;
3) Calculate (using a coordinate system) the angle between the chosen line and each diameter;
4) If an angle is smaller than φ, then assign a combination of equal outcomes to the diameter and if an angle is bigger than φ, then assign a combination of opposite outcomes to it;
5) Count the numbers of equal and opposite combinations and calculate the correlation.

With certainty the wanted (QM) correlation is found. In this prescription the sphere represents the vector space containing the spin directions of all measured particles. The chosen line represents the line of motion of the measured particles. The random diameters represent the random opposite spin directions of the particle pairs. The angle φ represents the angle between the settings of the detectors that measure the particle pairs.

The wanted quantity is the correlation given by QM and shown by experiments. The necessary constituents are the particle pairs showing combinations of equal outcomes and the particle pairs showing combinations of opposite outcomes. The requirement for the outcomes of the particle pairs is that their combined outcomes depend on φ. Pairs giving combinations of equal outcomes have a spin direction that makes an angle with the line of motion that is smaller than φ and pairs giving combinations of opposite outcomes have a spin direction that makes an angle with the line of motion that is bigger than φ. How the outcome combinations depend on φ is deduced from the Principle of Perspective. The Principle of Perspective is the realization of the fact that one observer can observe one object from only one direction. Since in the experiments entangled pairs are being measured from two directions (and an entangled pair can be considered to be one object), this fact has to be taken into account by applying the Principle of Perspective.

For explanation see Ref. 1). That site also encloses a computer program based on the previous description, showing the correct results.

In this way it has been demonstrated which pairs give combinations of equal outcomes and which pairs give combinations of opposite outcomes, showing the mechanism behind Bell-test experiments and showing that a theory based on local-reality can explain the correlations that occur in these experiments.

Reference:

1) G. van der Ham; The Bell Game Challenge Examined:
[https://bell-game-challenge.vercel.app/](https://bell-game-challenge.vercel.app/)