

Quantum Fortunetelling

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Abstract

Recently it was proposed that quantum mechanics, if applied to macroscopic systems, would necessarily include a form of fortune telling or psychic phenomena. In this article, this claim is presented using formal quantum mechanics methods, and the results are analysed and found to be possible.

1 Introduction

In a recent online article, it has been suggested that if quantum mechanics were applied to macroscopic systems, it would necessarily follow that it would allow for psychic phenomena[1]. And while there is still debate about the applicability of traditional quantum theory to larger systems[2–5], and particularly about its applications to the human mind[6–9], this is an interesting conjecture.

The argument that they put forward is that any physical system can be described by a superposition of possible states. In the example given in Ref. [1], that includes one state describing a randomly selected playing card, and a second state describing a prediction made before the selection of the card, and possibly a third state describing the memories of the person making the prediction. If these three states could be entangled, thereby creating a single state in which all three are in the same state, or in this example all three select the same card, then it would appear that the prediction is always correct.

Since the memories of the person making the prediction are also part of this quantum state, it would follow that they believe they have made a correct

prediction every time the experiment is performed. It is our contention that this system is indistinguishable from a true psychic phenomena.

Where the model given in Ref. [1] only gives a general qualitative argument, in this article the formal equations of quantum mechanics, as reviewed in Ref. [10–12], will be used to provide a quantitative analysis of this mechanism.

It should be noted that for simplicity in notation in this article, we will use a set of cards which are numbered from 1 to 52 instead of the standard playing card suits and faces. However it should be obvious in the next section how this method could be applied to traditional playing cards, following the describing in Ref. [1]. The method is also strengthened in this article, compared with the original proposal, in that we remove the requirement that quantum mechanics must affect the human mind.

2 Method

To begin this thought experiment, suppose you have a system which is known to be governed by the laws of quantum mechanics, and which generates a number between 1 and 52 as its output. For example, one could use a set of six radioactive samples which average one decay per second. By measuring the samples for one second, one obtains a set of six numbers which are either 0 or 1 (mod 2). Arranging these six numbers as a binary number produces a random number between 0 and 63. If the result is 0 or if the result is greater than 52, it is a simple matter to measure for another 1 second interval to get a new number.

After the number is selected, we have a automated system that prints the number on a piece of paper, and seal it in an envelope without it being observed. This piece of paper is now in a superposition of all possible numbers that could have been selected,

$$|\Psi \rangle = \sum_{i=1}^{52} a_i |i \rangle \quad (1)$$

where $|a_i|^2$ is the probability that the original number was i . This will be our prediction.

After the prediction is made, and secured such that it cannot be observed or altered, a deck of cards is produced, numbered from 1 to 52. A card is selected randomly but is not observed. If this selection is governed by the laws of quantum mechanics, then the card itself will now be in a superposition,

$$|\Phi\rangle = \sum_{j=1}^{52} b_j |j\rangle \quad (2)$$

where as before, $|b_i|^2$ is the probability that the selected card was numbered i . Then the combined wavefunction of the two systems is

$$|\Phi\rangle |\Psi\rangle = \sum_{i=1}^{52} \sum_{j=1}^{52} a_i b_j |i\rangle_P |j\rangle_S \quad (3)$$

where $|i\rangle_P$ are the predicted states and $|j\rangle_S$ are the selected states.

Now suppose that there is an operator, denoted \hat{A} , that combines the two wavefunctions according to the rule,

$$|\chi\rangle = \hat{A}|\Phi\rangle |\Psi\rangle = \sum_{i=1}^{52} \sum_{j=1}^{52} c_{ij} |i\rangle_P |j\rangle_S \quad (4)$$

where

$$c_{ij} = \begin{cases} \frac{a_i \times b_j}{\sqrt{\text{Tr}(|a_i|^2 \times |b_j|^2)}} & i = j \\ 0 & i \neq j \end{cases} \quad (5)$$

After the operator has been applied to the wavefunctions, the selected card is revealed, and the combined wavefunction will now be in the state

$$|\chi\rangle = c_{kk} |k\rangle_P |k\rangle_S \quad (6)$$

where k is the number of the revealed card.

When the prediction is revealed, it follows that it will also be shown to be card k . As such, the original mechanism is proven to have correctly predicted which card would be selected. Furthermore, there is no evidence of it ever making any other incorrect predictions. The machine satisfies any definition of psychic.

3 Counterarguments

Having presented this method of predicting future events with perfect accuracy, it is worth noting some of the potential counterarguments. As the foundations of quantum mechanics are still a very active field of research[13–18] it is currently not known if these arguments will make this mechanism unphysical.

As discussed earlier, there is currently no evidence that quantum mechanics can be applied to macroscopic systems such as a deck of cards. However

while this may render this particular mechanism invalid, that does not exclude precognition on smaller scales using similar methods.

The original method proposed also assumes that the human mind is a quantum mechanical system, and that the collapse of a wavefunction can erase memories. Due to the complexity of the brain, it is unlikely that it could be modelled in such a simplistic way, and as such there is doubt as to whether this is true. However in the method presented in this article, no such assumption is required. The most tenable of the counterarguments is decoherence[19–21]. The methods which have been presented assume that the deck of cards and the predictions are isolated systems which do not interact with their surroundings. Of particular note is that the audience watching the performance could collapse the wavefunction of the prediction or the selected card by momentarily observing a different card than the one selected. As this mechanism predicts the first card that will be observed by anyone, even a slight glimpse of the bottom card on the deck would give an apparent false prediction and a negative result. However as with previous counterarguments, this may render this particular mechanism invalid but it does not exclude the possibility that a more refined method could demonstrate precognition.

4 Conclusions

In this article, we have further developed ideas originally presented in Ref. [1] and demonstrated how quantum mechanics permits psychic phenomena. While the original proposal requires the assumption that the human mind is governed by the laws of quantum mechanics, we have made no such assumptions.

While there are several possible counterarguments to the specific method that was outlined, and it is probable that this particular method could never be completed in the real world, in general this mechanism proves that it is possible to have some form of fortunetelling without violating free will. It is also possible that nature could generate psychic phenomena in this manner, although we must emphasize that this would appear to be an extremely rare occurrence, in contrast to claims in popular media.

In conclusion, we have demonstrated one form of genuine precognition using the standard laws of quantum mechanics, and provided a possible mechanism for a physical realization of this effect.

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