Please: what's wrong with this refutation of Bell's famous inequality?

Abstract Elementary algebra refutes Bell's famous inequality conclusively.

1. Introduction

1.1. The context is John Bell's famous 1964 essay (freely available, see ¶4-References). We use E (not P) for Bell's expectation-values, and a, b, c for Bell's unit-vectors $\vec{a}, \vec{b}, \vec{c}$.

1.2. We here refute Bell's inequality. We thus show that it is not an impediment to our provision of a more complete specification of the Einstein-Podolsky-Rosen-Bohm experiment (EPRB). Nor to our refutation of Bell's related theorem [see the line below Bell 1964:(3)] and his conclusion:

> "In a theory in which parameters are added to quantum mechanics to determine the results of individual measurements, without changing the statistical predictions, there must be a mechanism whereby the setting of one measuring device can influence the reading of another instrument, however remote. Moreover, the signal involved must propagate instantaneously, so that such a theory could not be Lorentz invariant," Bell (1964:199).

2. Analysis

2.1. From Bell 1964:(1)-(2), we have

$$-1 \leq E(a,b) \leq 1, \ -1 \leq E(a,c) \leq 1, \ -1 \leq E(b,c) \leq 1. \tag{1}$$

$$\therefore E(a,b)[1 + E(a,c)] \leq 1 + E(a,c). \tag{2}$$

$$\therefore E(a,b) - E(a,c) \leq 1 - E(a,b)E(a,c). \tag{3}$$

$$\text{Similarly: } E(a,c) - E(a,b) \leq 1 - E(a,b)E(a,c). \tag{4}$$

$$\therefore \ \pm [E(a,b) - E(a,c)] \leq 1 - E(a,b)E(a,c). \tag{5}$$

$$\therefore \ |E(a,b) - E(a,c)| + E(a,b)E(a,c) \leq 1. \blacksquare \tag{6}$$

2.2. Then, for comparison with irrefutable (6), here's Bell's famous inequality, Bell 1964:(15):

$$|E(a,b) - E(a,c)| - E(b,c) \leq \ 1 \text{ [sic]}. \tag{7}$$

2.3. So, comparing (7) with (6), Bell 1964:(15) is algebraically false: and seriously false, for

$$|E(a,b) - E(a,c)| - E(b,c) > 1. \blacksquare \tag{8}$$

2.4. That is, allowing the expectation values in (1) to range from -1 to 1 over $[0, \pi]$ via the proxies

$$E(a,b) = -\cos(a,b), \ E(a,c) = -\cos(a,c), \ E(b,c) = -\cos(b,c) \tag{9}$$

[which are consistent with quantum theory] then Bell's inequality is seriously false whenever

$$|\cos(a,c) - \cos(a,b)| + \cos(b,c) > 1. \tag{10}$$

2.5. Or, using (10) with an angular relation commonly found in Bell-studies [eg, Peres (1995:Fig.6.7)],

$$(b,c) = (a,c) - (a,b) : \text{and, say, with } (a,c) = 3(a,b), \tag{11}$$

then, in this example, Bell's inequality is false over 66% of the range $-\pi < (a,b) < \pi$; to wit,

$$-\pi < (a,b) < \tfrac{2\pi}{3}, \tfrac{\pi}{3} < (a,b) < 0, 0 < (a,b) < \tfrac{\pi}{3}, \tfrac{2\pi}{3} < (a,b) < \pi; \text{ etc.} \tag{12}$$

[1] Corresponding author: eprb@me.com Subject line: 2018J.v3.

3. Conclusions and the way ahead

3.1. Bell's inequality [algebraically false; cf (7) with (6)], is seriously false under EPRB; see (12).

3.2. Further, exhausting (1), our inequality (6) becomes

$$0 \leq |E(a,b) - E(a,c)| + E(a,b)E(a,c) \leq 1; \tag{13}$$

to be compared with Bell's inequality (7), amended under (11) and the same exhaustion,

$$-1 \leq |E(a,b) - E(a,c)| - E(b,c) \leq \tfrac{3}{2}. \tag{14}$$

3.3. Thus, in the context of EPRB and Bell 1964, (14) joins our (13) as a truism. And neither presents any impediment to our provision of a more complete specification of EPRB. Nor to our consequent refutation of Bell's related theorem.

3.4. Nor to our consequent completion—without *spooky-action-at-a-distance*—of Einstein's argument that EPR correlations can be "made intelligible only by completing the quantum mechanical account in a classical way," Bell (2004:86).

> 'For on one supposition we should absolutely hold fast: the real factual situation of the system S_2 is independent of what is done with the system S_1, which is spatially separated from the former,' after Einstein (1949:85).

3.5. For, based on that supposition, our local hidden-variable theory refutes this:

> "If nature follows quantum mechanics in these correlations [which she does], then Einstein's conception of the world is untenable," Bell (2004:86).

4. References

1. Bell, J. S. (1964). "On the Einstein Podolsky Rosen paradox." Physics 1, 195-200. http://cds.cern.ch/record/111654/files/vol1p195-200_001.pdf
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