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

 Gordon Watson.[1] **2018J.v1**

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 ¶5-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 to show that it is not an impediment to our provision of a more complete specification of the Einstein-Podolsky-Rosen-Bohm experiment (EPRB).

1.3. We go on[2] to refute Bell's related theorem [see the line below his 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

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

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

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

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

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

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

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

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

2.3. Thus, comparing (7) with (6), Bell 1964:(15) delivers false values when

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

2.4. For example, given the following expectations from QM [or classically, see fn-2],

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

then Bell's famous inequality is false almost everywhere; ie, when

$$\cos(b,c) \neq \cos(a,b)\cos(a,c). \tag{10}$$

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

$$(b,c) = (a,c) - (a,b): \tag{11}$$

then, in this example, Bell's inequality is false almost everywhere; ie, when

$$\sin(a,b)\sin(a,c) \neq 0. \tag{12}$$

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[2] With Bell's inequality refuted here, Bell's theorem is refuted at Watson 2017d:(24) and 2018L.

3. Conclusions

3.1. From (12), Bell's inequality is false almost everywhere.

3.2. We consequently reject the related Bellian conclusion cited at ¶1.3 above.

3.3. 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,

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

3.4. Thus, in the context of EPRB and Bell 1964, (14) joins our (13) as a truism. And neither presents any impediment to our proof[3] 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).

4. Acknowledgment It's a pleasure to again thank Roger Mc Murtrie for many beneficial exchanges.

5. 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

2. Bell, J. S. (2004). Speakable and Unspeakable in Quantum Mechanics. Cambridge, Cambridge University.

3. Peres, A. (1995). Quantum Theory: Concepts & Methods. Dordrecht, Kluwer Academic.

4. Watson, G. (2017d). Bell's dilemma resolved, nonlocality negated, QM demystified, etc. http://vixra.org/pdf/1707.0322v2.pdf

5. Watson, G. (2018K) forthcoming. (Please: What's wrong with this identification of Bell's 1964 error?)

6. Watson, G. (2018L) forthcoming. (Please: What's wrong with this refutation of Bell's famous theorem?)

[3] See Watson 2018L; or Watson (2017d), noting that the latter is being revised for subsequent discussions. The next step in that process is Watson (2018K).