Bell's theorem refuted mathematically for Professor X.

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Abstract

Bringing an elementary knowledge of sums and averages to Bell (1964), we refute Bell's theorem.

1 Introduction

1.1. (i) With Bell-(#) denoting Bell 1964:(#), we label the formulas between Bell-(14)-(15): (14a)-(14c). (ii) We replace Bell's $P(\vec{a}, \vec{b})$ with $E(a, b)$; etc. (iii). Sharing Bell's indifference (p.195)—ie, $\boldsymbol{\lambda}$ may be continuous or discrete (we can work with both)—we include both possibilities in (12). (iv) Thus, based on Bell-(1): $A_i = A(a, \boldsymbol{\lambda}_i) = \pm 1$; etc. (iv) Like Bell (1964), we are bound by EPRB here.

1.2. (i) Taking math to be the best logic, it may flow for several lines before we comment. (ii) By absurd (▲) we mean math-false. (iii) Its contrary here is QM-true (■): for, given its success, QM is the gold-standard for results here. (iv) WM denotes our theory (wholistic mechanics) since 1989.

2 Analysis

$$\text{Bell-(14a)} = E(a,b) - E(a,c) \Leftrightarrow E(a,b) = \frac{1}{n}\sum_{i=1}^{n} A_i B_i ; E(a,c) = \frac{1}{m}\sum_{j=1}^{m} A_j B_j . \quad (1)$$

$$= \frac{1}{n}\sum_{i=1}^{n} A_i B_i - E(a,c) \Leftrightarrow \text{We do not require } A_i = A_j \text{, but see §3:} \quad (2)$$

$$= \frac{1}{n}\sum_{i=1}^{n} A_i B_i \; [1 - A_i B_i \cdot E(a,c)]. \Leftrightarrow A_i B_i A_i B_i = 1; \frac{1}{n}\sum_{i=1}^{n} 1 \cdot 1 = 1. \quad (3)$$

$$\therefore |E(a,b) - E(a,c)| = \left| \frac{1}{n}\sum_{i=1}^{n} A_i B_i \; [1 - A_i B_i \cdot E(a,c)] \right| \Leftrightarrow |X| = |Y| \text{ if } X = Y. \quad (4)$$

$$\leq \left| \frac{1}{n}\sum_{i=1}^{n} 1 \, [1 - A_i B_i \cdot E(a,c)] \right| \Leftrightarrow \frac{1}{n}\sum_{i=1}^{n} A_i B_i \leq \pm\frac{1}{n}\sum_{i=1}^{n} 1; |\pm Z| = |Z| . \quad (5)$$

$$\leq \left| 1 - \frac{1}{n}\sum_{i=1}^{n} A_i B_i \cdot E(a,c) \right| \Leftrightarrow \frac{1}{n}\sum_{i=1}^{n} 1 \cdot 1 = 1; \text{ etc.} \quad (6)$$

$$\leq |1 - E(a,b)E(a,c)| \text{; our QM-true result.} \blacksquare \quad (7)$$

$$\neq \text{Bell-(15)} = \text{Bell-(14b)} = 1 + E(b,c)\text{; its RHS an absurdity.} \blacktriangle \quad (8)$$

$$\text{Thus: } 0 \geq |E(a,b) - E(a,c)| - E(b,c) - 1 \equiv \text{Bell's inequality.} \blacktriangle \quad (9)$$

$$0 \geq |E(a,b) - E(a,c)| - |1 - E(a,b)E(a,c)| \equiv \text{WM-inequality.} \blacksquare \quad (10)$$

$$-a \cdot b \neq E(a,b) = -\int d\lambda \rho(\boldsymbol{\lambda}) A(a,\boldsymbol{\lambda}) A(b,\boldsymbol{\lambda}) \equiv \text{Bell's theorem.} \blacktriangle . \quad (11)$$

$$-a \cdot b = E(a,b) = \frac{1}{n}\sum_{i=1}^{n} A_i B_i = -\int d\lambda \rho(\boldsymbol{\lambda}) A(a,\boldsymbol{\lambda}) A(b,\boldsymbol{\lambda}) \equiv \text{WM-theorem.} \blacksquare \quad (12)$$

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3 Discussion

- (1): is the common start-point Bell-(14a): for Bell [us]; en route to his [our] inequality (9) [(10)].
- (2): no difficulty arises if we match results via $A_i = 1$ with $A_j = 1$; $A_i = -1$ with $A_j = -1$.
- (3): in passing (though not required here): $\frac{1}{n}\sum_{i=1}^{n}\frac{1}{m}\sum_{j=1}^{m}A_jB_j = \frac{1}{m}\sum_{j=1}^{m}A_jB_j$.
- (4): allows a simpler help-note after (5).
- (5): the help-note says it all.
- (6): by reduction.
- (7): uses the most basic definition of an expectation; a conventional arithmetic mean.
- (8): nb: by observation and using math-facts: (14b) = (15); but Bell-(14b) $\neq$ (14a)! ▲
- (9): shows (8)'s absurd upper bound to be 0. ▲ Under QM, that bound is $\frac{1}{2}$. ■
- (10): shows (9)'s QM-true upper bound is 0; ie, under QM, that bound is 0. ■
- (11): absurd, like (9). ▲ QM-true (12) refutes them both. ■
- (12): QM-true, as tested via (7)-(11); or independently. QED. ■

4 Conclusions

3.1 (i) (8) pinpoints Bell's error: Bell-(14a) $\neq$ Bell-(14b). (ii) The source of his error lies in that terse clue below (14b): using Bell-(1). (iii) The QM-truth for Bellians is this: it is absurd to use Bell-(1) beyond the bounds of EPRB—from David Bohm—the experiment that underpins his study.

3.2. In Bell's terms, our comments [·] next highlight our departure from his theorem and beliefs:

> Bell (1964:199): 'The QM expectation $-a\cdot b$ [LHS (11)▲-(12)■] cannot [sic] be represented, either accurately or arbitrarily, in the form of Bell-(2) [ie, RHS (11)▲-(12)■].' Line below Bell-(3): '(11)▲ is true [sic], so (12)■ is not [sic] possible.' Bell (1964:195): 'any theory reproducing LHS (12)■—the QM predictions—must be nonlocal [sic].' (Therefore, since the QM predictions are well-founded, locality must be abandoned [sic].) Thus, from Bell (1990:13): 'I step back from asserting that there is AAD and I say only that you cannot [sic] get away with locality. You cannot [sic] explain things by events in their neighbourhood.'

3.3. (i) Using Bell's technique—but avoiding pitfalls (via our QM-true (10)■ & (12)■)—we refute Bell's inequality (9)▲ and Bell's theorem (11)▲ mathematically and quantum mechanically. This adds to our findings elsewhere: (9)▲ & (11)▲ may be refuted without reference to quantum theory. QED.

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6 References

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