The Bell-CHSH inequality refuted as Bogus Bellian logic (BBL)

Abstract: The Bell-CHSH inequality is often touted as S=E(a,b)+E(a',b)+E(a,b')-E(a',b'), ~(2<|S|)=(|S|≦2), and E=(N_{++}+N_{--}−N_{+-}−N_{-+})/(N_{++}+N_{--}+N_{+-}+N_{-+}). We confirm this is not tautologous and refute the Bell-CHSH inequality as Bogus Bellian logic (BBL).

We assume the method and apparatus of Meth8/VŁ4 with Tautology as the designated *proof* value, **F** as contradiction, N as truthity (non-contingency), and C as falsity (contingency). Results are a 16-valued truth table in row-major and horizontal, or repeating fragments of 128-tables for more variables.

LET p, s, w, x, y, z : E, S, a, a', b, b'; ~ Not; & And; + Or;
> Imply, greater than; < Not Imply, less than; = Equivalent; @ Not Equivalent;
% possibility, for one or some; # necessity, for all or every;
(%p<#p) ordinal two; (p@p) ordinal zero.

For examples of Bell test experiments, the famous formulas often trotted out are:

S=E(a,b)+E(a',b)+E(a,b')-E(a',b') (1.1)
(((p&(w&y))+(p&(x&y)))+((p&(w&z))-(p&(x&z))))=(p=p) ;
TFTF TFTF TFTF TFTF, TTTT TTTT TTTT TTTT (1.2)

with ~(2<|S|) = (|S|≦2). (2.1)

We define the absolute value operator for |S| to mean 0 ≤ S for (2.1.1)
~(s<(p@p)) ; TTTT TTTT FFFF FFFF (2.1.2)

~((%p<#p)<~(s<(p@p)))=(p=p) ; TTTT TTTT NNNN NNNN (2.2)

We substitute Eqs. 1.1 into 2.1. (3.1)
~((%p<#p)<~((((p&(w&y))+(p&(x&y)))+((p&(w&z))-(p&(x&z))))<(p@p)))=(p=p) ;
NNNN NNNN NNNN NNNN, NTNT NTNT NTNT NTNT (3.2)

Remark: Injecting quantifiers onto variables does not help.

Eqs. 1.2, 2.2, and 3.2 are *not* tautologous and *not* equal, establishing bogus Bellian logic (BBL).

LET p, q, r, u, v : E, N_{++}, N_{--}, N_{+-}, N_{-+}.

We further define the experimental estimate E.

E=(N_{++}+N_{--}−N_{+-}−N_{-+})/(N_{++}+N_{--}+N_{+-}+N_{-+}) (4.1)
p=(((q+r)-(u-v))\((q+r)+(u+v))) ;
FTFT FTFT FTFT FTFT, TFFT FTFT TFFT FTFT (4.2)

Remark: Including Eq. 4.1 to map explicitly free variables does not help.

We rewrite Eq. 3.1 to include the explicit definition of Eq. 4.1.

If Eq. 4.1, then Eq. 3.1. (5.1)

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(p=(((q+r)-(u-v))\((q+r)+(u+v))))>
~((%p<#p)<~((((p&(w&y))+(p&(x&y)))+((p&(w&z))-(p&(x&z))))<(p@p))) ;
                    NTTN TNTN NTTN TNTN, TTTT TTTT TTTT TTTT,
                    NTTT NTTT NTTT TTTT, TNTN TNTN TNTN TNTN,
                    NTNT TNTN NTNT TNTN
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(5.2)

Eqs. 4.2 and 5.2 are also *not* tautologous, further establishing bogus Bellian logic (BBL), and refuting the Bell-CHSH inequality.

Remark: The assumption of fair sampling as a loophole here is irrelevant because it is not bivalent, but based on a probabilistic vector space.