**Refutation of the principle of superposition of states**



From: Hari Dass, N.D. (2013). "The superposition principle in quantum mechanics - did the rock enter the foundation surreptitiously?". arxiv.org/pdf/1311.4275.pdf

$$|\psi\rangle = \alpha|1\rangle + \beta|2\rangle \qquad (1.1)$$
$$|\text{good}\rangle = 1/\sqrt{2}\,\{\,|\text{red}\rangle + |\text{yellow}\rangle\,\} \qquad (2.1)$$
$$|\text{bad}\rangle = 1/\sqrt{2}\,\{\,|\text{red}\rangle - |\text{yellow}\rangle\,\} \qquad (3.1)$$
$$|\text{red}\rangle = 1/\sqrt{2}\,\{\,|\text{good}\rangle + |\text{bad}\rangle\,\} \qquad (4.1)$$
$$|\text{yellow}\rangle = 1/\sqrt{2}\,\{\,|\text{good}\rangle - |\text{bad}\rangle\,\} \qquad (5.1)$$

Eq. 1.1 as "the principle of superposition of states" [asserts] that the *complex linear superpositions* also represent *quantum states* of the system".

We assume the Meth8/VŁ4 apparatus and method where the designated *proof* value is T. Other values are F contradiction, N truthity (non-contingence), and C falsity (contingence). The 16-valued proof table is row-major and presented horizontally.

LET p q r s: good, smell, red rose, yellow rose; ~p bad, as Not good;
~ Not; + Or; - Not Or; = Equivalent to; > Imply; < Not Imply, less than, ∈;
% possibility, for one or some; # necessity, for all.

The irrational constant (1/(2^0.5)) is ignored throughout this demonstration.

We treat Eqs.1.1-5.1 as expressions on the complex plane ℂ. Meth8/VŁ4 maps them by substituting the Equivalent connective for ℝreal numbers with the Imply connective for imaginary numbers.

"(red Nor yellow) Implies (Not( red Or yellow))" (0.2.1)
(r-s)>~(r+s) ; TTTT TTTT TTTT TTTT (0.2.2)

p>(r+s) ; TFTF TTTT TTTT TTTT (2.2.2)
~p>(r-s) ; TTTT FTFT FTFT FTFT (3.2.2)
r>(p+~p) ; TTTT TTTT TTTT TTTT (4.2.2)
s>(p-~p) ; TTTT TTTT FFFF FFFF (5.2.2)

We rewrite Eqs. 2.2.2 and 3.2.2 as Eq.0.2.2.

By substitution from the text we write:

"the states [good, not good] have *definite values* of some other *attribute* which we could call *smell*" (6.1)
(p+~p)<q ; TTFF TTFF TTFF TTFF (6.2)

"Suppose we start with [good] and make a *colour* measurement.
The outcome will be red or yellow with equal probability." (7.1)

Because probability (possibility) is now invoked, we rely on our previous proof that the modal operators as equivalent to the respective quantifiers for this application.

%p>#(r+s) ; NFNF NNNN NNNN NNNN (7.2)

We remark that Eq. 7.2 expresses that a possible state of good implies the necessity of the color as red or yellow. Eq. 7.2 does not state the necessity of a probability. (Author Hari Dass later changes that possible state of good into a necessary state of good at Eq. 12.1.)

"If it is red, the state after the measurement is [red],
and likewise for the outcome yellow." (8.1)
(r>r)&(s>s) ; TTTT TTTT TTTT TTTT (8.2)

Let us say that the outcome is *red*." (9.1)

Because Eq. 9.1 is a conclusion, we write it as the consequent of both Eqs. 7.1 and 8.l.

((%p>#(r+s))&((r>r)&(s>s)))>r ; CTCT TTTT CCCC TTTT (9.2)

"Now imagine a *smell* measurement on the system." (10.1)
q ; FFTT FFTT FFTT FFTT (10.2)

"Because the state after the last measurement i.e [red] is an *equal* superposition of the good and bad smell states, the outcome will be one of these randomly and with equal probability." (11.1)

Eq. 11.1 has two parts, the antecedent resulting in the combination of Eqs. 9.2 and 10.2 and the consequent as the equal probability (%p=%~p).

(((%p>#(r+s))&((r>r)&(s>s)))>r)>(q>#(%p=%~p)) ;
TTNF TTFF TTNN TTFF (11.2)

"Therefore, even though we started with a state whose *smell* was *certain* i.e good, an intervening colour measurement has completely destroyed this certainty!" (12.1)

A state which *smell* was *certain* as good is (q>#p), and when connected with an intervening measurement for red, produces the antecedent below. The consequent is the *possibility* of good from Eq. 7.2 above.

((q>#p)&((((%p>#(r+s))&((r>r)&(s>s)))>r)>(q>#(%p=%~p))))>~#p ;
TCTT TCTT TCTC TCTT (12.2)

In Eq 12.2 we change the "%p" from Eq. 7.2 into "#p", but the table result is the same as in Eq. 12.2.

"Instead, the smell information has become totally *unpredictable*! This is the inherent *indeterminacy* of quantum theory." (13.1)

We remark on 13.1 that the smell information as a required variable was unpredictable from Eq. 7.2.

What was predictable above was the possible determination of red or yellow, and good or not good.

> "This is also a demonstration that the pair of observables *colour, smell* are mutually *incompatible*." (14.1)

Statement 14.1 does not follow from 13.1 or from our results because compatibility is not considered.

> "Existence of incompatible observables is the essential content of the *Heisenberg Uncertainty Relations*." (15.1)

Elsewhere we show the Heisenberg uncertainty principle is *not* tautologous.

The combined literal Eqs. as rendered above show the principle of superposition of states in Eq. 1.1 is *not* confirmed, and hence is refuted.