

Quantum contextuality diagrams in perspective

<http://tph.tuwien.ac.at/~svozil/publ/2018-Svozil-Cagliari2018-pres.pdf>

<https://arxiv.org/abs/1808.00813>

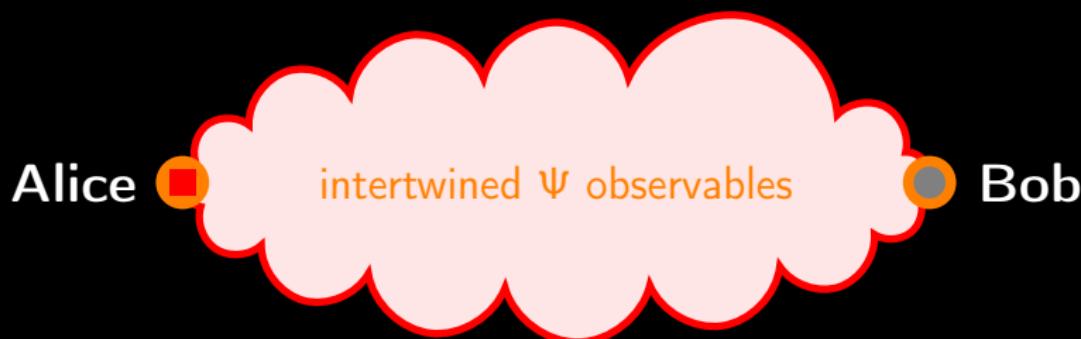
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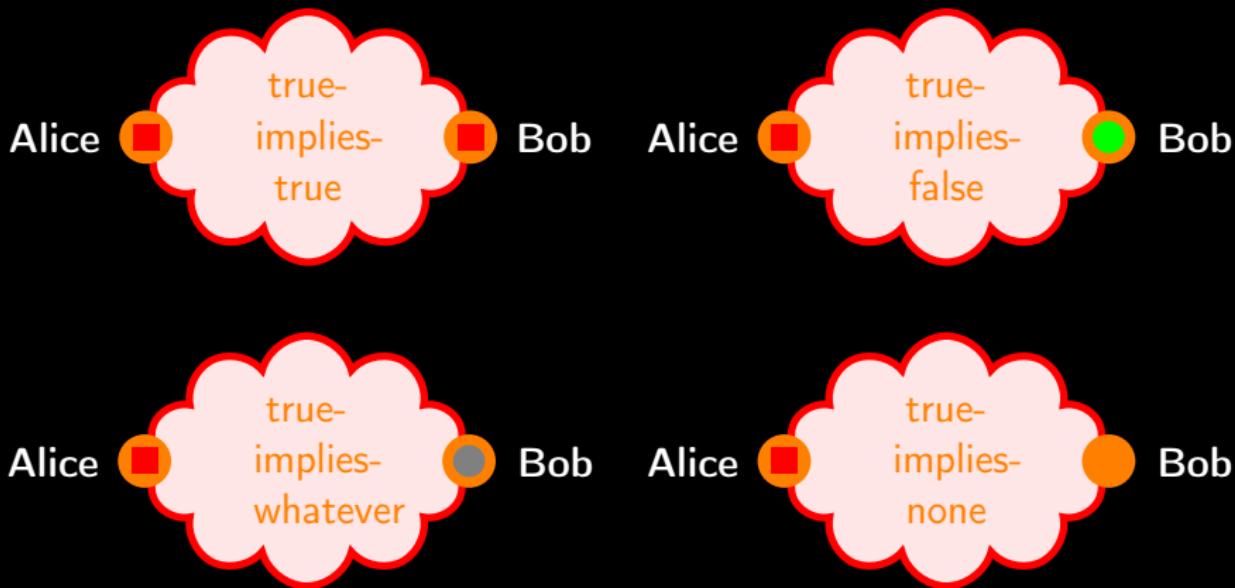
QUCAG2018, Quantum Cagliari, October 8-10, 2018

Methods & ways of exploring value (in)definiteness

- ▶ cloud structure of intertwined contexts/cliques/maximal operators/Boolean subalgebras is quantum,
- ▶ predictions about what happens within the cloud, and at its endpoints **Alice & Bob** are classical



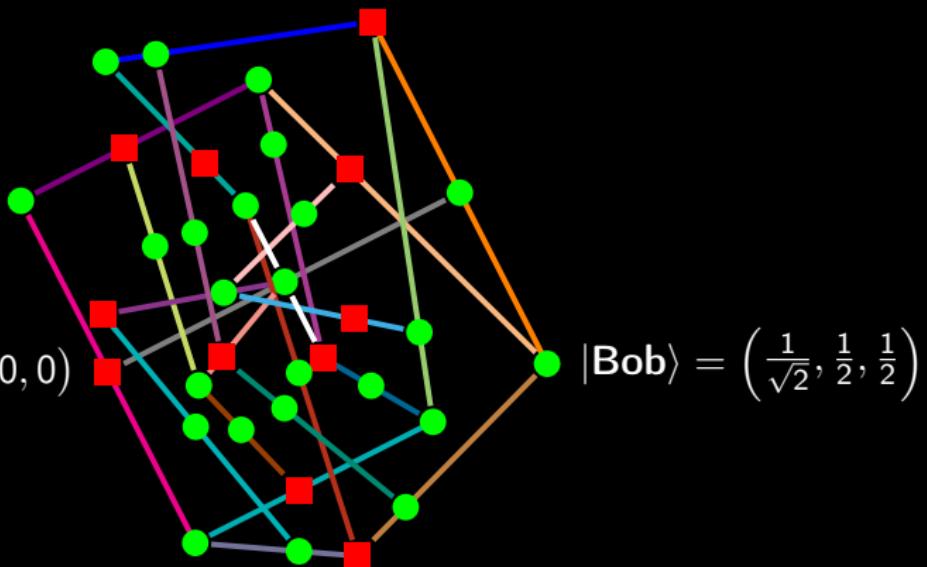
How is $|Bob\rangle$ given $|Alice\rangle$? True? False? Whatever?
None?



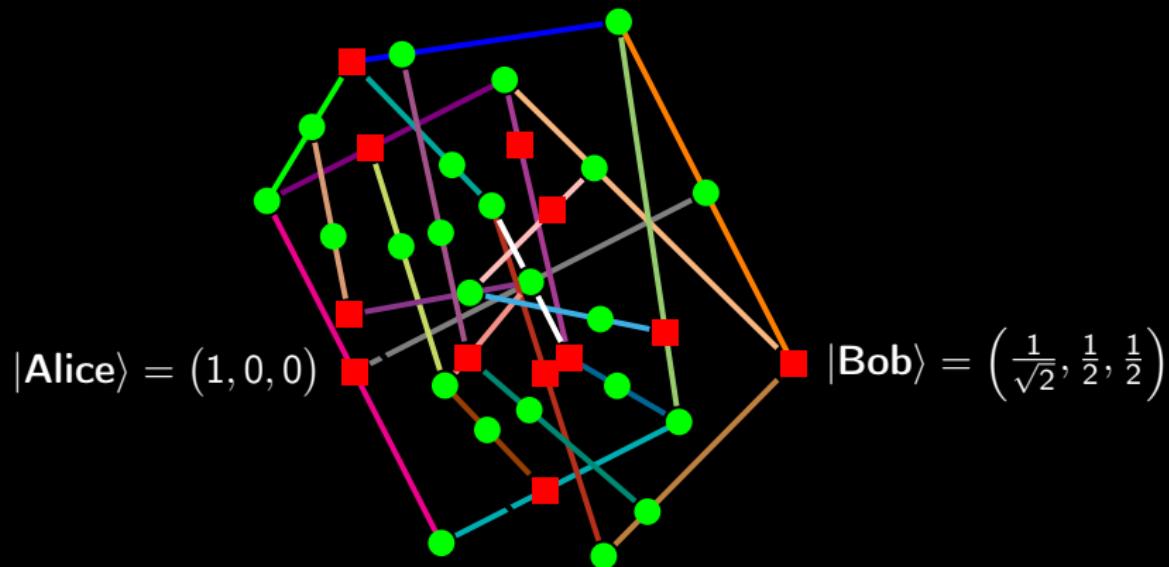
True (1) implies whatever (quantum 50:50)

$$|\text{Alice}\rangle = (1, 0, 0) \quad |\text{Bob}\rangle = \left(\frac{1}{\sqrt{2}}, \frac{1}{2}, \frac{1}{2} \right)$$
$$\frac{1}{\sqrt{2}} (0, 1, 1)$$
$$\frac{1}{\sqrt{2}} (0, 1, -1)$$

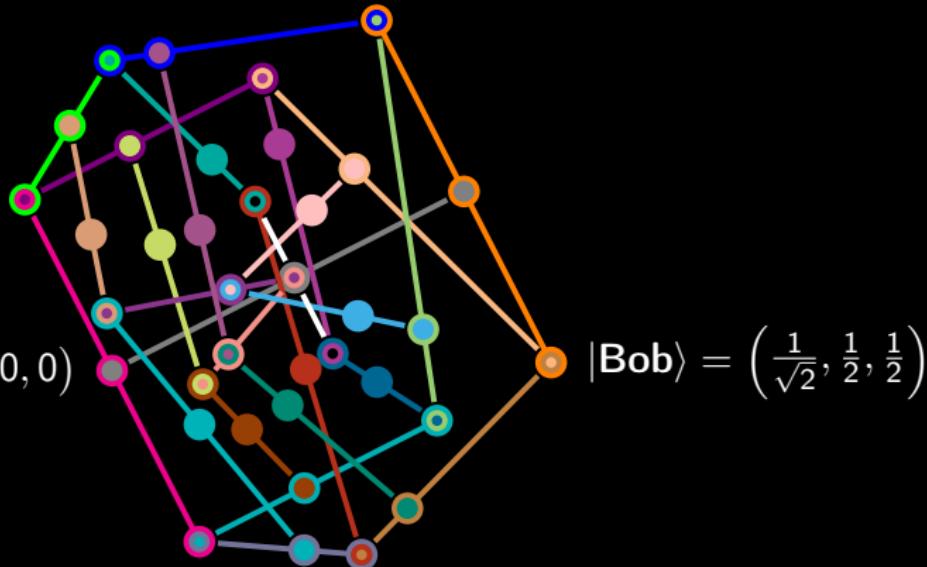
True (1) implies false (0)



True (1) implies true (1)



True (1) implies value indefinite (Abbott, Calude, KS 2015)



Strategies to obtain value indefiniteness/partiality

The scheme of the construction & proof of partiality of value assignments is as follows:

- (i) Find a logic (collection of intertwined contexts of observables) exhibiting a true-implies-false property on the two atoms **a** and **b**.
- (ii) Find another logic exhibiting a true-implies-true property on the same two atoms **a** and **b**.
- (iii) Then join (paste) these logics into a larger logic, which, given **a**, neither allows **b** to be true nor false. Consequently **b** must be value indefinite.

Extensions of value indefiniteness/partiality

Partiality/value indefiniteness can be extended to **any** vector \mathbf{b} non-collinear and non-orthogonal to \mathbf{a} : Alastair A. Abbott and Cristian S. Calude and KS, "A variant of the Kochen-Specker theorem localising value indefiniteness", Journal of Mathematical Physics, **56**(10), 102201(1-17), 2015; <https://doi.org/10.1063/1.4931658>



For a (in some respects weaker) statement relative to global truth assignments, see Itamar Pitowsky's "Infinite and finite Gleason's theorems and the logic of indeterminacy", Journal of Mathematical Physics **39**(1), 218-228, 1998; <https://doi.org/10.1063/1.532334>

History of contextual sets & relational properties realizable by two-point quantum clouds

if a is true classical value assignments	anecdotal, historic quantum realisation	reference to utility or relational properties
imply b is independent (arbitrary)	firefly logic L_{12} eg, Cohen, 1989[pp. 21, 22]	
imply b false (TIFS)	Specker bug logic KS, 1965 [Fig. 1, p. 182]	Stairs, 1983 [p. 588–589], Cabello et al, 1995 . . . 2018
imply b true (TITS)	extended Specker bug logic	KS, 1967 [Γ_1 , p. 68], Clifton, 1993 [Sects. II, III, Fig. 1], Belinfante, 73 [Fig. C.I. p. 67], Pitowsky, 1982 [p. 394], Hardy, 1992, 1993, 1997, Cabello et al, 1995 . . . 2018
iff b true (nonseparability)	combo of intertwined Specker bugs	KS, 1967 [Γ_3 , p. 70]
imply value indefiniteness of b	depending on types of value assignments	Pitowsky, 1998, Abbott et al, 2012 . . . 2015

Epistemology/ontology of clouds of intertwined contexts/cliques/maximal observables/Boolean subalgebras



Some discussions/warnings related to realism versus idealism

- ▶ Sigmund Freud, “*gleichschwebende Aufmerksamkeit* (Engl. *evenly-suspended attention*)” Ratschläge für den Arzt bei der psychoanalytischen Behandlung, 1912, 1999
- ▶ Walter Terence Stace, *The Refutation of Realism*, *Mind* 53, 349-353 (1934), <https://doi.org/10.1093/mind/XLIII.170.145>
- ▶ Edwin Thompson Jaynes, *Mind Projection Fallacy: supposing that creations of our own imagination are real properties of Nature, or that our own ignorance signifies some indecision on the part of Nature*. The angry “omelet papers”, 1988, 89

Thank you for your attention!

