Quantum clouds and contextuality

http://tph.tuwien.ac.at/∼svozil/publ/2018-Svozil-Vaxjo2018-pres.pdf

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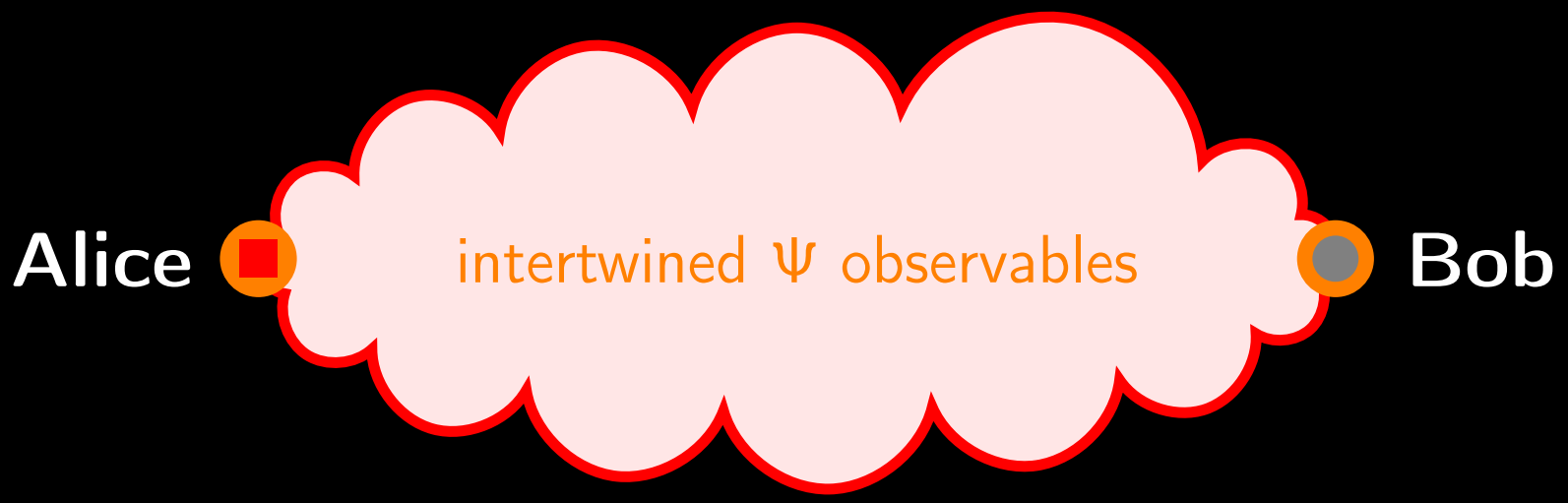
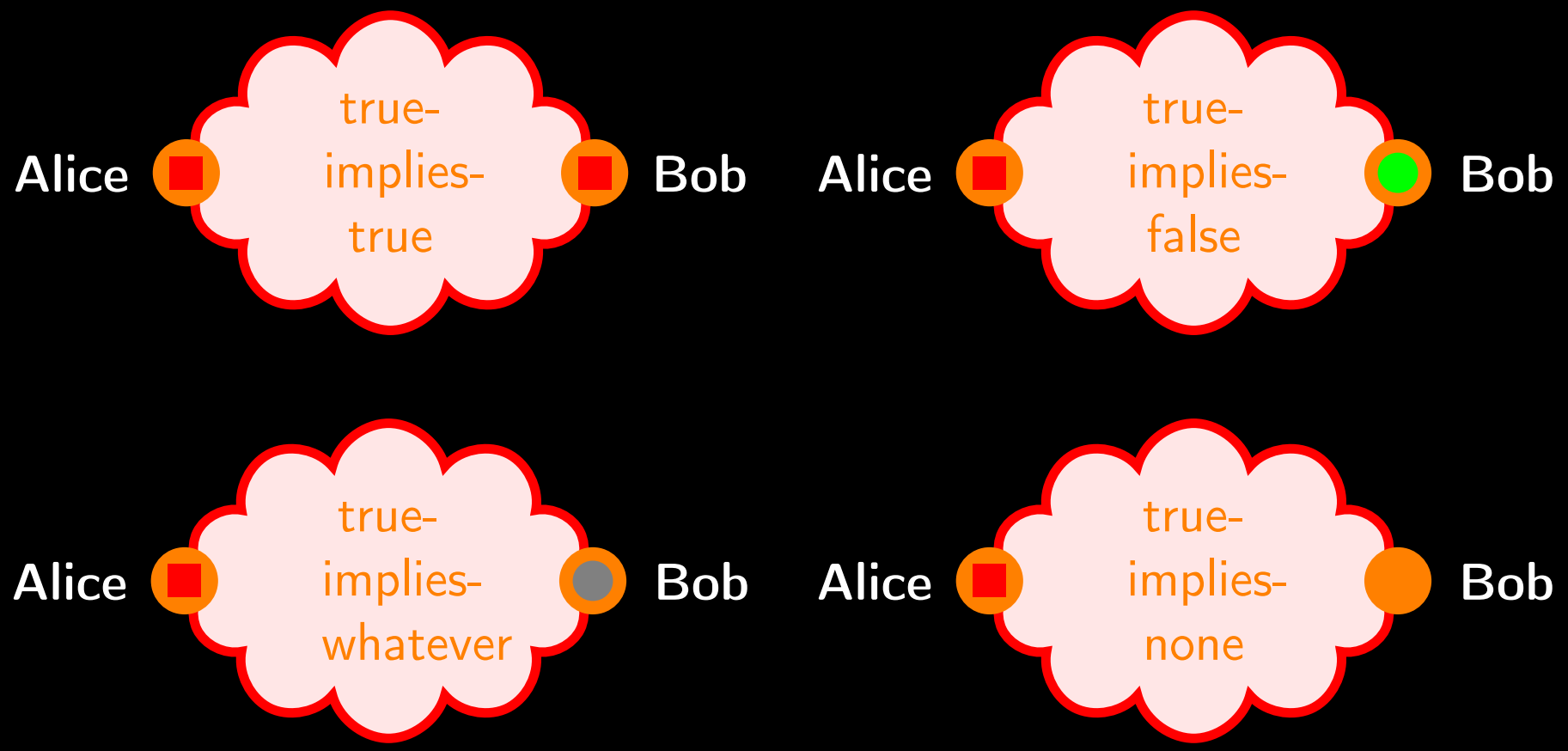
Methods & ways of exploring value (in)definiteness

- 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

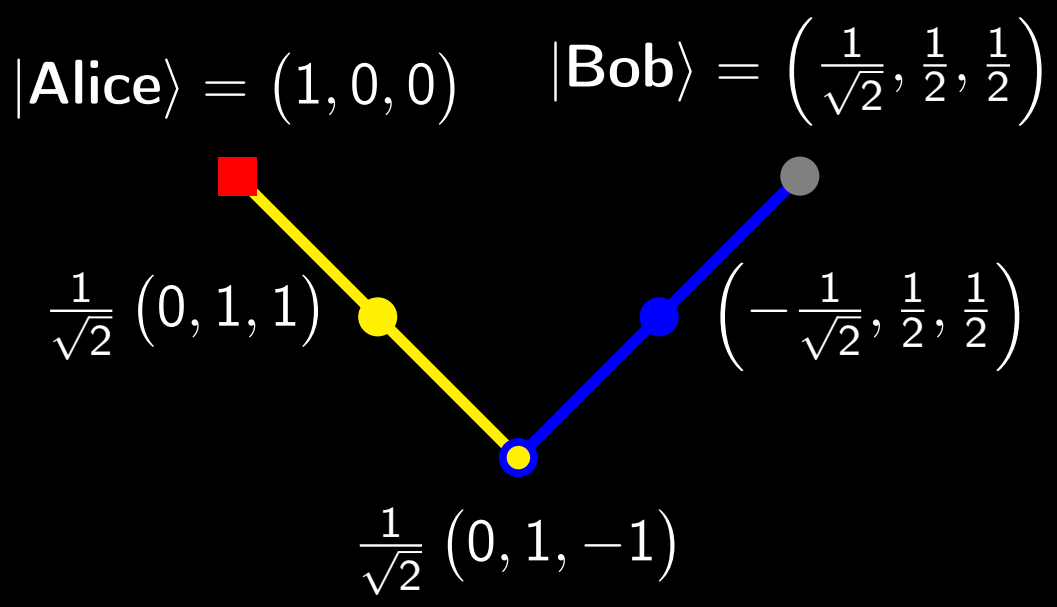


How is $|\mathbf{Bob}\rangle$ given $|\mathbf{Alice}\rangle$? True? False? Whatever? None?



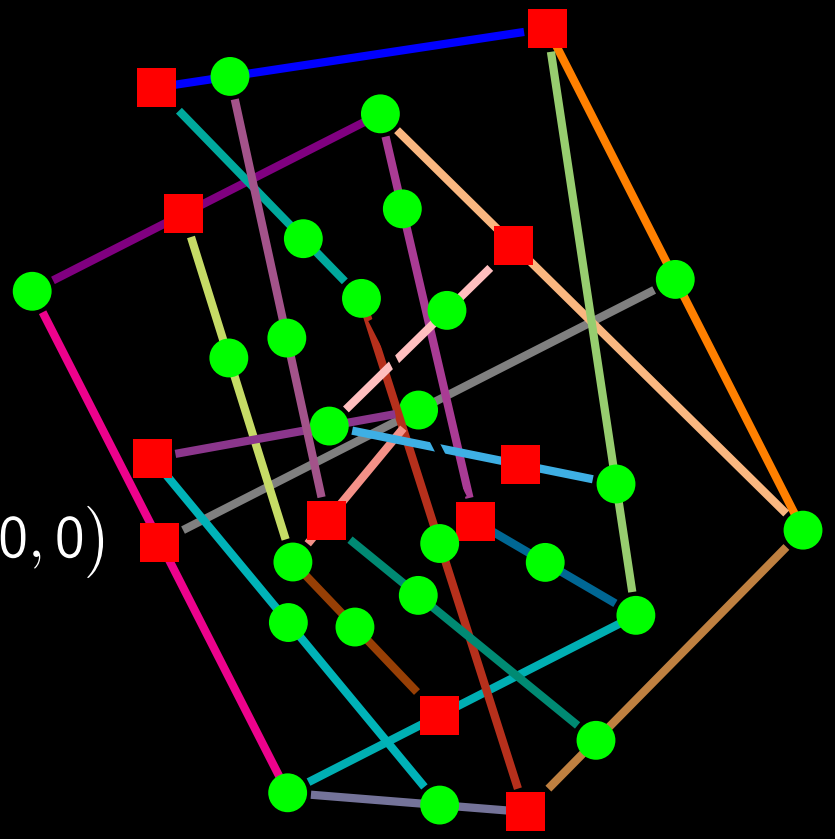
Adán Cabello, José R. Portillo, Alberto Solís, KS, Minimal true-implies-false and true-implies-true sets of propositions..., arXiv:1805.00796

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



True (1) implies false (0)

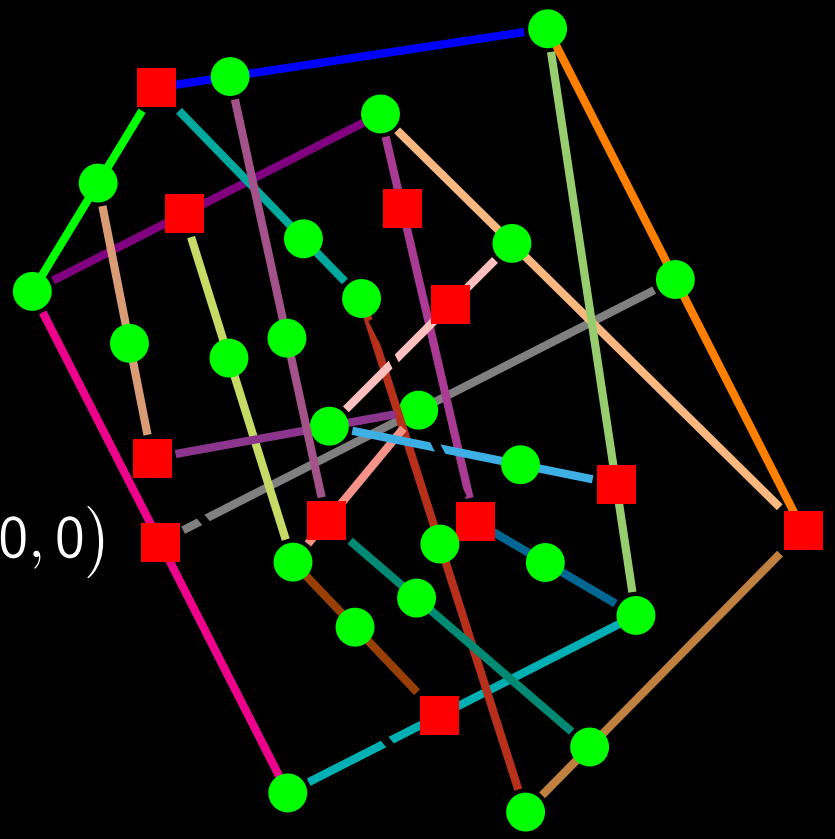
$|\textbf{Alice}\rangle = (1, 0, 0)$



$|\textbf{Bob}\rangle = \left(\frac{1}{\sqrt{2}}, \frac{1}{2}, \frac{1}{2}\right)$

True (1) implies true (1)

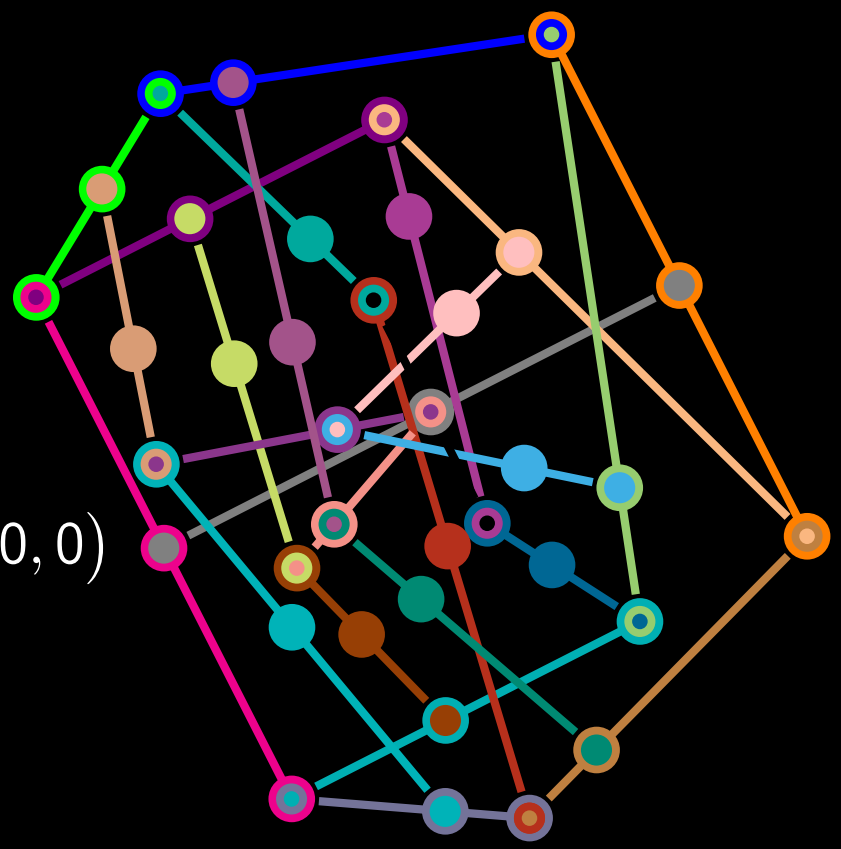
$|\textbf{Alice}\rangle = (1, 0, 0)$



$|\textbf{Bob}\rangle = \left(\frac{1}{\sqrt{2}}, \frac{1}{2}, \frac{1}{2}\right)$

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

$|\mathbf{Alice}\rangle = (1, 0, 0)$



$|\mathbf{Bob}\rangle = \left(\frac{1}{\sqrt{2}}, \frac{1}{2}, \frac{1}{2}\right)$

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 **b** non-collinear and non-orthogonal to **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 (somewhat 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

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!