



COLLOQUIUM

Quantum picturalism (and some interpretable AI, and some music)

Prof Bob Coecke (Quantinuum, Oxford, UK)

DATE: Friday, 14 March 2025 | 16h00–17h00 SAST

VENUES: • Neelsie Cinema, Stellenbosch University
• Online

--- A recording of the talk will be published on the NITheCS YouTube channel afterwards ---

ABSTRACT

Over some 20 years we have developed a diagrammatic quantum formalism, sometimes referred to as quantum picturalism [1, 2]. We showed that this formalism enabled secondary school students to perform exceptionally well on an Oxford University post-graduate quantum exam [3]. It was, in fact, John von Neumann himself who denounced 'his own' quantum formalism that relies on Hilbert space. Alternatives had been proposed, including by von Neumann himself, but none play a role in quantum theory today. Quantum picturalism on the other hand, is not widespread in the quantum industry. The same formalism has been used as the basis for interpretable AI, and even music.

[1] Bob Coecke and Aleks Kissinger (2017) Picturing Quantum Processes. Cambridge University Press

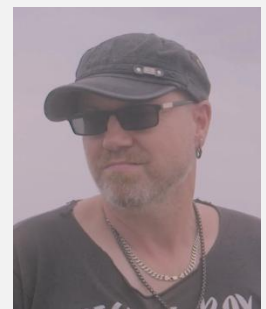
[2] Bob Coecke and Stefano Gogioso (2022) Quantum in Pictures. Quantinuum

[3] <https://www.theguardian.com/science/2023/dec/16/physicist-bob-coecke-its-easier-to-convince-kids-than-adults-about-quantum-mechanics>

BIOGRAPHY

Bob Coecke is the Chief Scientist at Quantinuum, a Distinguished Visiting Research Chair at the Perimeter Institute for Theoretical Physics, and an Emeritus Fellow at Wolfson College, Oxford, UK. Previously, he was a Professor of Quantum Foundations, Logics, and Structures at Oxford University, where he spent 20 years. During this period, he co-founded and led a multi-disciplinary Quantum Group that grew to 50 members and supervised nearly 70 PhD students.

Prof Coecke pioneered Categorical Quantum Mechanics (now included in the AMS MSC2020 classification), ZX-calculus, DisCoCat natural language meaning, mathematical foundations for resource theories, Quantum Natural Language Processing, and DisCoCirc natural language meaning. He co-authored *Picturing Quantum Processes* and *Quantum in Pictures* and was the first academic to hold a title that explicitly included "Quantum Foundations." He is also a recipient of the IEEE LiCS Test-of-Time Award.



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