

JOHN VAN DE WETERING

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EDUCATION

PhD September 2016 - Present
Radboud University Computer Science Department *Nijmegen, the Netherlands*

- 4 year PhD programme as part of *Quantum Computation, Logic and Security* ERC Advanced grant.
- Promoter: Bart Jacobs.
- Supervisor: Aleks Kissinger.
- Thesis title: *Quantum Theory from Principles, Quantum Software from Diagrams*.

Undergraduate 2011-2016
Radboud University *Nijmegen, The Netherlands*

- Bachelor in Mathematics *Cum laude* 2011-2014
- Bachelor in Physics *Cum laude* 2011-2014
- Master in Mathematical Physics *Bene meritum* 2014-2016
 - Master Thesis at Oxford University Feb-Jul 2016 supervised by Bob Coecke.
Resulted in two papers (10 and 13 under heading Publications).
- Honours programme 2014-2015
 - Report presented at *WEI Education and Humanities Academic Conference* in Vienna and Ireland
International Conference on Education in Dublin.

WORK EXPERIENCE

Technical Advisor September - December 2019
Cambridge Quantum Computing *Cambridge, United Kingdom*

- Hired for my expertise in quantum circuit optimisation.
- I found and implemented new methods for optimising quantum circuits.

SUMMARY

- 14 published papers, 5 additional preprints.
- 56 citations in 2019 and 140 citations total (according to Google Scholar).
- Creator of widely-used open-source software PyZX.
- Co-supervised 4 Master students. Lecturer on two Master level quantum computing courses.

TEACHING EXPERIENCE

Radboud University 2011 - Present
Various teaching *Nijmegen, the Netherlands*

- Co-lecturer of 2018 & 2019 Master's course *Quantum Processes and Computation*. I designed teachers' materials and the lectures.
- Co-supervised Master students Stach Kuijpers, Sal Wolffs, Louis Lemonnier and Arianne Meijer, leading to paper 2, and preprints 3 and 4 (see heading Publications and Preprints below).

- Teacher's assistant for courses covering Linear algebra, Probability theory, Analysis, Differential equations and Complex functions during undergrad and PhD.

OUTREACH AND ACADEMIC SERVICE

- Member of the Gender Equality Working Group of the European Quantum Flagship project.
- Reviewed for the journals *Quantum*, *LMCS* and *Proceedings of the Royal Society A*.
- Reviewed for the conferences *LICS*, *QPL* and *AsiaCrypt*.
- Presented my research to a wide non-academic audience at FOSDEM software meetings.
- Heavily involved in the construction of the ZX-calculus website and Wikipedia page.

GRANTS

Unitary Fund 2018
Awarded for development of PyZX <http://unitary.fund>

- Recipients: John van de Wetering and Aleks Kissinger
- The Unitary Fund is a \$2000,- grant to support open-source quantum software.

SOFTWARE

PyZX April 2018 - Present
Co-creator and lead developer github.com/Quantomatic/pyzx

- Open-source Python library for quantum circuit optimisation with the ZX-calculus.
- Its T-count minimisation routine is the current state-of-the-art.
- It is used by academics in Oxford, Nancy and Grenoble.
- Industry interest by Cambridge Quantum Computing, IBM, DWave and QuTech.

INVITED TALKS AND LECTURES

- Invited lecturer for L'Agape Summer School 2020. *Quantum Theory from First Principles*.
- Talk at open-source software conference FOSDEM 2020.
Quantum circuit optimisation, verification, and simulation with PyZX.
- Talk at open-source software conference FOSDEM 2019.
PyZX: Graph-theoretic optimization of quantum circuits.

CONFERENCE TALKS

Note: All talks resulted from having a peer-reviewed abstract accepted.

- Quantum Physics and Logic 2020.
Dichotomy between deterministic and probabilistic models in countably additive effectus theory.
- Quantum Computing Theory in Practice 2020. *Quantum Circuit Optimisation with the ZX-calculus*.
- Workshop on String Diagrams in Computation, Logic and Physics.
Simulation of quantum circuits by ZX-diagram contraction.
- Applied Category Theory 2019. *An effect-theoretic reconstruction of quantum theory*.
- Quantum Physics and Logic 2019. *PyZX: Large Scale Automated Diagrammatic Reasoning*.
- European Quantum Technology Conference 2019.
T-count optimization of quantum circuits using graph-theoretical rewriting of ZX-diagrams.
- Symposium on Compositional Structures (December 2018).
PyZX: Quantum circuit optimization using the ZX-calculus.

- Foundations 2018. *Reconstruction of Quantum Theory from Universal Filters.*
- Quantum Physics and Logic 2018. *Sequential Measurement characterises Quantum Theory.*
- Quantum Physics and Logic 2018. *Purity in Euclidean Jordan Algebras.*
- Quantum Physics and Logic 2017. *Quantum Theory is a Quasi-Stochastic Process Theory.*
- Workshop on Semantic Spaces at the Intersection of NLP, Physics and Cognitive Science 2016. *Entailment Relations on Distributions.*

PUBLICATIONS

Note: In reverse chronological order.

1. Abraham Westerbaan, Bas Westerbaan and John van de Wetering. A characterisation of ordered abstract probabilities. *To appear in Proceedings of the 35th Annual ACM/IEEE Symposium on Logic in Computer Science (LICS).* 2020.
2. Louis Lemonnier, John van de Wetering and Aleks Kissinger. Hypergraph simplification: Linking the path-sum approach to the ZH-calculus. *To appear in Proceedings of the 17th International Conference on Quantum Physics and Logic (QPL).* 2020.
3. Kenta Cho, Bas Westerbaan and John van de Wetering. Dichotomy between deterministic and probabilistic models in countably additive effectus theory. *To appear in Proceedings of the 17th International Conference on Quantum Physics and Logic (QPL).* 2020.
4. John van de Wetering. Commutativity in Jordan Operator Algebras. *Journal of Pure and Applied Algebra Vol. 224, 11.* 2020.
5. Ross Duncan, Aleks Kissinger, Simon Perdrix and John van de Wetering. Graph-theoretic Simplification of Quantum Circuits with the ZX-calculus. *Quantum Vol. 4, 279.* 2020.
6. Aleks Kissinger and John van de Wetering. PyZX: Large Scale Automated Diagrammatic Reasoning. *Proceedings 16th International Conference on Quantum Physics and Logic, Chapman University, Orange, CA, USA., 10–14 June 2019.* 2019.
7. Aleks Kissinger and John van de Wetering. Universal MBQC with generalised parity-phase interactions and Pauli measurements. *Quantum Vol. 3, 134.* 2019.
8. John van de Wetering. Sequential Product Spaces are Jordan Algebras. *Journal of Mathematical Physics Vol. 60, 6.* 2019.
9. John van de Wetering. An effect-theoretic reconstruction of quantum theory. *Compositionality Vol. 1, 1.* 2019.
10. Abraham Westerbaan, Bas Westerbaan, and John van de Wetering. Pure maps between Euclidean Jordan Algebras. *Proceedings of the 15th International Conference on Quantum Physics and Logic, Halifax, Canada, 3–7th June 2018.* 2018.
11. John van de Wetering. Ordering quantum states and channels based on positive Bayesian evidence. *Journal of Mathematical Physics Vol. 59, 10,* 2018.
12. John van de Wetering. Three characterisations of the sequential product. *Journal of Mathematical Physics Vol. 59, 8,* 2018.
13. John van de Wetering. Quantum Theory is a Quasi-stochastic Process Theory. *Proceedings of the 14th International Conference on Quantum Physics and Logic, Nijmegen, The Netherlands, 3-7 July 2017.*
14. John van de Wetering. Entailment Relations on Distributions. *Proceedings of the 2016 Workshop on Semantic Spaces at the Intersection of NLP, Physics and Cognitive Science, Glasgow, Scotland. 11th June 2016.*

PREPRINTS

1. Abraham Westerbaan, Bas Westerbaan and John van de Wetering. The three types of normal sequential effect algebras *arXiv preprint arXiv:2004.12749*.
2. Miriam Backens, Hector Miller-Bakewell, Giovanni de Felice, Leo Lobski and John van de Wetering. There and back again: A circuit extraction tale. *arXiv preprint arXiv:2003.01664*.
3. Stach Kuijpers, John van de Wetering and Aleks Kissinger. Graphical Fourier Theory and the Cost of Quantum Addition. *arXiv preprint arXiv:1904.07551*.
4. John van de Wetering and Sal Wolffs. Completeness of the Phase-free ZH-calculus. *arXiv preprint arXiv:1904.07545*.
5. Aleks Kissinger and John van de Wetering. Reducing T-count with the ZX-calculus. *arXiv preprint arXiv:1903.10477*.