

# Alex Rice

Research Associate

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## Experience

### Postdoctoral Researcher

University of Edinburgh

Working in the Quantum Software Lab/LFCS group with Chris Heunen for 3 projects:

- RoaRQ: “A unified noise-aware compiler stack for NISQ”,
- RubberDUQ: “Flexible Dynamic Universal Quantum programming”,
- IAA grant: “Orchestration of heterogeneous quantum computers” partnered with Fujitsu.

2024-2026

### Internship

Huawei Research Lab, Edinburgh

Planned and developed an interactive visualisation tool for hierarchical hypergraphs.

2023

### Internship

Quantinuum, Cambridge

Added new features to a runtime for hybrid classical/quantum programs.

2022

### Organisation of Applied Category Theory

University of Cambridge

Co-organised a fully hybrid conference despite Covid-19 restrictions.

2021

## Education

### PhD in Computer Science

University of Cambridge

Defended thesis "A type-theoretic approach to semistrict higher categories" supervised by Jamie Vicary.

2019 - 2025

### Masters in Mathematics and Computer Science

University of Oxford

Awarded a first class degree.

2015 - 2019

### Secondary Education

The Judd School, Tonbridge

Achieved 4 A\*s and 1 A at A-Level as well achieving S,S,S in Sixth Term Entrance Papers (STEP).

2008 - 2015

## Papers

### Quantum Circuits are Just a Phase

POPL

with Chris Heunen, Christopher McNally, and Louis LEMONNIER

2026

### A Syntax for Strictly Associative and Unital $\infty$ -Categories

LICS

with Eric Finster and Jamie Vicary

2024

### A Type Theory for Strictly Unital $\infty$ -Categories

LICS

with Eric Finster, David Reutter, and Jamie Vicary

2022

### New minimal linear inferences in Boolean logic independent of switch and medial

LMCS

with Anupam Das

2023

## Teaching

### Lecturing

University of Edinburgh

Guest lecture for “Introduction to Quantum Programming and Semantics”

2026

### Lecturing

University of Cambridge

Guest lecture for “Advanced Topics in Category Theory”

2024

### Supervisions

University of Cambridge

Supervised courses on prolog, probability, semantics, and object oriented programming

2020-2023

### Teaching Assistant

University of Birmingham

Ran classes for “Advanced Functional Programming” and “Logic and Computation”

2020

## Selected Talks

### Quantum Orchestras

Birmingham theory group seminar

A monad for representing quantum computation as an effect in the presence of classical recursion

2026

## Implementing a Typechecker for an Esoteric Language

Describing my experiences implementing a typechecker for an unusual dependently typed language

TYPES

2025

## Defining and verifying MLIR operation with constraints

A talk about ongoing work in xDSL to define operations using a constraint system.

EuroLLVM

2025

## Selected Software Contributions

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<b>Inconspicuous</b>	Hybrid quantum-classical compiler toolkit, which featured in UnitaryHack 2025.
<b>xDSL</b>	Core contributor (291 commits) to this MLIR-inspired compilation framework.
<b>Catt interpreter</b>	Interpreter for $\text{Catt}_{\text{SUA}}$ , the language defined in my thesis.
<b>Catt-agda</b>	Agda formalisation for metatheory of Catt and its semistrict variants.
<b>sd-visualiser</b>	A tool for visualising and interacting with hypergraphs.
<b>Syllepsis in Agda</b>	Literate agda formalisation of the Syllepsis, following proof of Kavvos and Sojakova.

## Awards

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- **Hoare Prize:** For best overall performance in Part C (4<sup>th</sup> year exams)
- **BT Prize:** Highest overall mark in Part B (2<sup>nd</sup> and 3<sup>rd</sup> year exams).