

ALFIE KUNZ

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KEY SKILLS: **Programming:** C#, Python, VB.NET, HLSL. **Tools & Frameworks:** Unity Engine, WinForms, Git, LaTeX, Tikz, Visual Studio.
Core Competencies: High Performance Computing, (GPU) Agent-based Modelling, Mathematical Modelling, Machine Learning (Neural Networks), Fluid Dynamics, Technical Writing.

EDUCATION

UNIVERSITY OF WARWICK: Full-Time Student of Mathematics & Physics (MMathPhys) 2023 – 2027

- ❖ Achieved an **overall weighted average grade of 82.4%** across Years 1-3:
- ❖ Year 1 Grade of 88.0% ('Top 5' in the Cohort). Year 2 Grade of 85.4% (placement pending). Year 3 Grade of 78.5% (placement pending).
- ❖ Years 1-2 Module breadth: Mathematical Analysis, Applied Modelling and Algebra, Mathematics of Asymptotics, Physics of Quantum Mechanics, Applied Mathematics, Fluids and Electrodynamics, Computational Modelling, Programming, and Algorithms.
- ❖ 3rd Year Specialism through modules such as Computational Modelling, Mathematical Modelling of PDEs, Fluid Dynamics, Neural Computing.

BECKFOOT SCHOOL: A-Level & GCSE Student 2016 – 2023

- ❖ A-Level Grades: **A*A*A*A** for Mathematics, Further Mathematics, Physics, Computer Science, EPQ (Astrophysics-based: "How Does a Neutron Star Remain a Stable Entity?"). #1 in Cohort. GCSE Grades: Ten Grade 9s, as well as a Distinction in Music BTEC.
- ❖ Highlights & Achievements: Founder & Treasurer of the ~~School Chess Club~~, served as **featured Alumni** for Open Days & Showcases.

PROFILE: Proactive computational researcher, ranked in the **'Top 5' of my university cohort**, specialising in fluid dynamics, numerical simulations, and emergent behaviours in biophysics. Proven success in translating cutting-edge mathematical theory into **commercial-grade, high-performance software**. Inventive science communicator, puzzle designer, and believer in the idea that the most complex behaviours stem from elegantly simple rules.

KEY STRENGTHS: **Charismatic Leadership** & Operational Initiative, **Creative Reasoning** & Problem Solving, **Technical & Interpersonal Communication**, Mentorship & Coaching, Adaptability & High-Pressure Composure, **Self-Direction**.

PROJECT EXPERIENCE

Drop Collisions, and their Collective Behaviour (in Collaboration with the Met Office) 2026 – 2027

University of Warwick (Associated with Prof James Sprittles, under the PX402 Physics Project Module)

- ❖ Currently undertaking a research project on computationally predicting the boundaries between bouncing and merging of liquid drops, by developing a **reduced-order 'boundary integral' numerical model**. These multiphase flow dynamics become crucial for studying cloud formation, and thus weather and climate modelling. Project in collaboration with partners including the **Met Office**, **NCAR**, and **Syngenta**.

APIC Computational Fluid Dynamics (CFD) Research Project & Simulation 2025 – 2026

University of Warwick (Associated with Prof Radu Cimpanu, under the MA369 Essay Module) (C#, HLSL, Python, Unity)

- ❖ Identified a **novel Reynolds Number value of 5420** for the APIC CFD regime, in a Taylor-Green Vortex – justifies the report as a worthwhile contribution to the industry. Achieved by self-directing original CFD research, applying cutting-edge technologies in novel scenarios to investigate high-performance, momentum-conserving vortices.
- ❖ Independent derivation and implementation of a real-time **Eulerian-Lagrangian APIC system** (C#, Unity), using techniques such as Conjugate Gradient Method with MICT-0 Preconditioning, and GPU parallelism. Optimised rendering via Instanced Procedural Drawing.
- ❖ Automated post-processing, data analysis, and visualisation pipelines in Python.
- ❖ **Authored a rigorous, well-referenced technical essay**, on my contributions to the field, using LaTeX and Tikz figures. Demonstrated strong scientific communication by **presenting my findings** to two specialist Warwick professors (with no prior exposure to the implementation). Received a **grade of 87%** for this work – the highest of all my 3rd Year maths results; one of my **proudest measurable academic outcomes**.
- ❖ **Outcome:** identifying, documenting, and presenting highly technical work (to two specialists) gave confidence in both **communicating complex ideas under scrutiny** (a skill I've since relied on as a ~~Student Ambassador~~) and **academic writing** (providing a fantastic foundation for my upcoming dissertation).

Chess Artificial Intelligence & Interface 2021 – Present

Beckfoot School A-Level Project (+ Self-Motivated Continuation)

(VB.NET, WinForms)

- ❖ Architected an **'International Master' Elo** (~2850, as of v10.0), commercial-quality Chess AI project, designed a stylish chess-playing interface to support the AI (for example, training and ranking via a hand-selected puzzle database & infrastructure) and user interactions.
- ❖ **Awarded 100%** on the initial A-Level CS NEA; recognised by the project supervisor as the 'best he had seen' in his years of teaching.
- ❖ Robustly engineered and optimised a custom **NegaMax heuristic AI algorithm**, using techniques such as Alpha-Beta Pruning, Zobrist Hashing, Iterative Deepening, and Dynamic Aspiration Windows.
- ❖ Evaluated against a vast breadth of previous variations & models, by integrating models into a sophisticated, custom-made swiss-style **benchmarking system** with a 'plug & play' ecosystem. Includes a custom Zobrist hashing engine for robust game-ending detection, and colourful live visuals.
- ❖ Contributed an open-source, easy-to-use, and highly-customisable ~~opening book builder~~ (made from millions of open-source games) as a GitHub repository to support the engine, in an area lacking of high-quality, easy-to-access code. Contains features such as automatic PGN parsing, built-in move validation, and automatic negligible move pruning.
- ❖ **Outcome:** demonstrated clear evidence of **motivated, self-directed operational initiative** towards a highly technical, production-grade product which I am still improving. Re-shaped my academic specialities as a performance-oriented, open-source driven programmer with **strong knowledge of code profiling**.

Machine Learning & Biophysical Modelling Experiments

2023 , 2024

Independent Research Projects

(C#, HLSL, VB.NET)

- ❖ **Emergence from Evolving Slime Trails:** Simulated millions of atomic agents in real-time on the GPU (massively parallelised as a compute shader) to conduct biophysical research on agent-based physarum transport networks under a '**Patlak-Keller-Segel**'-type couple system, and their evolution into emergent ecosystems. Self-taught C# and HLSL, under the Unity Game Engine.
- ❖ **Hand-drawn Doodle & Digit Recognising Neural Network (NN):** Achieves **~98% accuracy on the MNIST dataset, and ~92% on the Google 'Quick Draw' database** (12 categories) in under 2 minutes of training. Employs high-level ML concepts such as back propagation, regularisation, and overfitting regulation. Augments database images for strong resilience against user-drawn images.
- ❖ **Outcome:** proved **academic prowess** and **self-directedness** by self-teaching languages, modules, and graphics pipelines from scratch. Provided necessary experience for third-year university modules (Computational Modelling and Neural Computing) and the technicalities of my CFD research project.

Photography and Academic Web-based Portfolio

2025 - Present

Independent Research Project

(HTML, CSS, JS, Python)

- ❖ Overhauled and re-engineered a baseline template into a **bespoke academic and photography portfolio**, which serves as a home for both photography advertisement and career building.
- ❖ Developed custom JavaScript modules for dynamic JSON gallery rendering and hosting, AES-256 encrypted client-side delivery, custom non-linear phase modulation background, and integration with GitHub repositories.
- ❖ **Outcome:** proven success in receiving contracted photography work, and CV building through easy access to my entire project library.

OTHER AWARDS: 4-time Distinction & Gold Award Achiever in 'Bebras' Computing Challenge (**top 10% nationally**); 2-time Distinction holder in 'TCS Oxford Computing Challenge'. Two-time Winner of 'Beckfoot Young Musician of the Year' (piano).

RELEVANT EXPERIENCE & VOLUNTARY WORK

Teaching Assistant & GCSE Tutor: Beckfoot School

2021 - 2022 , 2025

- ❖ Mentored lower ability Year 11 students in mathematics & science, involving **one-on-one interpersonal support** with strong client communication (with development of personalised revision plans) to tackle 'maths anxiety' and providing inspirational 'lightbulb' moments.
- ❖ Shadowed staff, and worked with diverse students, to discern the strengths of approachability and patience in tackling knowledge gaps.
- ❖ **Designed and independently delivered an A-level maths lesson** on series convergence (extending the spec to introduce Ramanujan summation and Zeno paradoxes) - achieving strong student engagement, and reinforcing my ideals of inspiration via creative teaching.
- ❖ Reflected heavily on my own performance by proactively seeking and implementing feedback from experienced staff.
- ❖ **Outcome:** being invited back to the department in 2025 (years after my initial tutoring role) gave me the confidence to thrive as an **interpersonal and science communicator**, a skill which proved vital for presenting my 3rd Year Maths Essay to two experts in the field.

Physics Student Ambassador: University of Warwick

2024 - Present

- ❖ Led and assisted **Live Chat events, Q&A panels, and Department & Campus Tours**, for prospective students. Rapport-building and adaptation to different perspectives (developed through training workshops) to provide an exciting, interactive insight into university life.
- ❖ **Outcome:** consistently positive feedback led to me being re-hired across the rest of my degree: sharpened my ability to read a wide range of cohort's energy.

Retail Sales Associate: Whittakers Schoolwear, Shipley

2023 - 2024

- ❖ Rapidly adapted to a **high-intensity retail environment during peak summer season**, whilst maintaining professionalism and composure. Expanded responsibilities to encompass till operations, database operations, online order management, and onboarding of employees.
- ❖ **Outcome:** being trusted with duties well beyond my original scope proved my **adaptability** and **credibility** - strengths I value immensely in academic work.

Chess Club Founder, Leader, Treasurer: Beckfoot School

2021 - 2023

- ❖ Founded and effectively scaled a school chess club to a **weekly crowd of 70+ young people**. Showed strong initiative and handling school resources. Involved the hiring of volunteers, organising class teaching and individual mentorship.
- ❖ Established a tournament structure to enable students to represent their school in regional competitions, **proving a concrete legacy**.
- ❖ **Outcome:** sculpted my **charismatic leadership**, effective budgeting, and asset handing. Provided the core of my energetic yet patient approach to **mentoring**.

WIDER INTERESTS: Beyond my degree, I find fulfilment in creative streams such as **Music** (self-taught pianist of 16 years, performer at weddings) and **Photography** (I particularly enjoy street & landscape photography, and regularly take on paid event work, such as society balls, corporate gigs, and weddings). I'm at my best when connecting with new people and hosting engaging problem-solving experiences - whether it's designing & running social deduction and puzzle games for groups at my University, watching in amusement as my carefully planned mechanisms unfold, or competing in board games & escape rooms with friends. I pride myself on my '**jack of all trades**' approach to life, constantly refining my non-academic interests through recent adventures such as salsa partnerwork, learning the alto saxophone, and even Ultimate Frisbee!
