DANIEL WRIGHT

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Computer scientist specialising in shared memory concurrency and memory models, with particular focus on formal verification and describing information transfer across weakly synchronised programs. My doctoral thesis focuses on determining the minimal set of orderings required for a single-thread computation to be correct, and what behaviours this may cause in a concurrent setting. I am interested in both the abstract and applied sides of the field, from the details of the synchronisation guarantees made by particular hardware primitives to the representation of synchronisation and control flow in correctness proofs, and have presented work both at academic venues and at meetings of the International Standards Organisation.

EDUCATION

PhD Computer Science, University of Kent at Canterbury
Thesis: *Away From Linear Models of Concurrent Programs*
2023

BSc Computer Science, University of Kent at Canterbury
First-Class Honours, 2018

RESEARCH EXPERIENCE

Modular Relaxed Dependencies, University of Kent, 2018-2019
With Mark Batty, Marco Paviotti, Simon Cooksey, Anouk Paradis.

Contributed to the mathematical development and software tooling for the Modular Relaxed Dependencies (MRD) memory model, currently in discussion for inclusion into the ISO C++ standard. The model itself is written in pen-and-paper mathematics, while the tool is an OCaml program generating LaTeX output.

Also contributed to a formalisation in HOL4.

Symbolic MRD, University of Kent, 2019 - Present
With Mark Batty.

Rewrote the MRD model to replace exhaustive state space evaluation with symbolic evaluation, without loss of expressiveness. This is the first axiomatic memory model to handle dynamic memory allocation and pointer arithmetic. Published as part of my Doctoral thesis.

Worked on formalisation of the model in the Coq proof assistant.

Owicki Gries Reasoning for Weak Memory Programs, University of Kent, collaboration with University of Surrey, 2020
With Mark Batty and Brijesh Dongol.

Translated the axiomatic MRD model into an operational semantics for use in a program logic. Created a partially ordered program logic for verifying weak memory programs, including proofs of soundness and completeness.

Ownership Transfer with Weak Memory, University of Kent, collaboration with University of British Columbia, 2023
With Alexander Summers.

Developing a new program logic for use with weak memory concurrency, with the aim of correctly representing ownership transfer to ensure race-free use of non-atomic accesses while minimising the proof burden caused by lack of synchronisation.

PUBLICATIONS

Away From Linear Models of Concurrent Programs.
Doctor of Philosophy (PhD) thesis, University of Kent, 2023.
Daniel Wright

Owicki-Gries Reasoning for C11 Programs with Relaxed Dependencies.
24th International Symposium on Formal Methods, 2021.
Daniel Wright, Mark Batty, Brijesh Dongol

Modular Relaxed Dependencies in Weak Memory Concurrency.
29th European Symposium on Programming, 2020.
Marco Paviotti, Simon Cooksey, Anouk Paradis, Daniel Wright, Scott Owens, Mark Batty

P1780 Modular Relaxed Dependencies: A new approach to the Out-Of-Thin-Air Problem.
ISO C/C++ Standards Committee meeting, Cologne, 2019.
Mark Batty, Simon Cooksey, Scott Owens, Anouk Paradis, Marco Paviotti, Daniel Wright

TECHNICAL SKILLS

- **Programming Languages** – Proficient in OCaml and Java, with some knowledge of C/C++ and C#. Familiar with both functional and imperative paradigms, and always happy to pick up a new language.
- **Formal Proofs** – Experienced with the HOL proof assistant, with some knowledge of Coq. Also able to construct pen-and-paper proofs without mechanisation.
- **Memory Models and Language Semantics** – Can construct and review proposed models, including validating and constructing litmus tests and proving desirable properties.
- **Program Verification** – Can use, validate, and construct program logics for use in program verification over a candidate operational semantics.

OTHER SKILLS

- **Scientific Communication** – Can summarise complex technical results to both non-academic industrial audiences and laypeople, without sacrificing accuracy for the sake of simplicity.
- **Networking and Collaboration** – Can discuss approaches, techniques, and results with specialists in other fields and find both intersections and new directions for future work.
- **Problem Solving with Formalisms** – Able to understand and work with detailed and often beginner-unfriendly scientific models and notation.

REFERENCES

Prof. Mark Batty, University of Kent
Thesis supervisor, MRD project lead.
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University of Kent, CT2 7NF, United Kingdom

Dr. Simon Cooksey, NVIDIA Architecture Research Group
MRD project contributor.
Email: simon@graymalk.in
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