

## Trevor A. Brown, Assistant Professor at the University of Waterloo

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### Research Interests

- Concurrent data structures
- Non-blocking algorithms
- Memory management
- Non-volatile memory
- Transactional memory

### Education

**University of Toronto**, Toronto, Canada, Jan. 2013 – Jun. 2017

Ph.D. Computer Science (supervised by Faith Ellen); A+ GPA

Thesis: Techniques for constructing efficient lock-free data structures (312 pages)

**University of Toronto**, Toronto, Canada, Sep. 2011 – Jan. 2013

M.Sc. Computer Science (supervised by Faith Ellen); A+ GPA

Thesis: Pragmatic primitives for non-blocking data structures

**York University, First Class with Distinction**, Toronto, Canada, 2006 – 2011

B.Sc. Hons. Major Computer Science, Hons. Minor Mathematics; A+ GPA

### Employment

**Assistant Professor.** University of Waterloo (Sep 2018 - present).

Affiliated with Algorithms and Complexity, Systems and Networking, and Programming Languages. Heading the [Multicore Lab](#).

**Postdoctoral Researcher.** IST Austria (Oct 2017 – Aug 2018).

Working with Professor Dan Alistarh.

**Postdoctoral Researcher.** Technion, Israel Institute of Technology (Mar – Oct 2017).

Worked with Professor Hagit Attiya. (A short reciprocal visit to work with Maya Arbel.)

**Research Intern.** Oracle Labs East, Scalable Synchronization Group (Summer 2015).

Designed and implemented adaptive transactional lock-elision algorithms and work delegation algorithms for large scale systems with non-uniform memory architectures.

**Application Developer.** UPS Canada (2005 – 2006, 2008 – 2009).

Redesigned internal software to scale under a 15x larger user load (regional → world).

Contributed 200,000 lines of production code.

## Recognition

- **Best paper candidate** (top 4) at SPAA (2022).
- **Best artifact** at PPOPP (2022).
- **Best artifact** at PPOPP (2021).
- **Best paper candidate** (top 4) at PPOPP (2021).
- **Best paper** at PPOPP (2020).
- Approaching \$1M in research funding.
- *Nominated* for Governor General's Gold Medal (U of T, 2017)  
(I did *not* win, but a school can only nominate one CS student annually)
- Award for Excellence in Teaching Assistance (U of T CS Student Union, 2014).
- Other: York Faculty of Science and Engineering Silver Medal, Ruth Hill Memorial Award (top student in the faculty), Canadian scholarships worth \$200,000+.

## Summary of Contributions

	In prep / submitted	Published / completed	
		Since 2018	All time
Conference paper	3	12*	23
Journal paper	2		1
Short paper / poster		2	9
Full manuscript / tech report		4	13
Book	1		
Patent		1	1
<b>Total</b>	<b>8</b>	<b>19</b>	<b>46</b>
Conference / workshop talks		4	18
Invited talks		2†	3†
Guest lectures		1	3
Seminars / other		7	14
<b>Total</b>		<b>13</b>	<b>38</b>

\* includes awards for **best paper**, **2x best paper candidate** and **2x best artifact**

† was also invited to give **two** additional talks at conferences, but had to decline

## In Preparation and Under Submission

1. **Shared Memory Synchronization (2<sup>nd</sup> edition). Morgan Claypool.**  
Michael Scott and Trevor Brown.  
[**Book**] in preparation.
2. **Practical fully-concurrent Euler tour trees.**  
Alexander Fedorov, Dan Alistarh and Trevor Brown.  
[**Conference paper**] under submission.

3. **The fence complexity of persistent sets.**  
Gaetano Coccimiglio, Trevor Brown and Srivatsan Ravi.  
[Conference paper] under submission.
4. **Efficient hardware primitives for immediate memory reclamation in optimistic data structures.**  
Ajay Singh, Trevor Brown and Michael Spear.  
[Conference paper] under submission.
5. **NBR: Neutralization based reclamation.**  
Ajay Singh, Trevor Brown and Ali Mashtizadeh.  
[Journal paper] under submission to TPDS (Oct'22).
6. **Cost of concurrency in hybrid transactional memory.**  
Trevor Brown and Srivatsan Ravi.  
[Journal paper] under submission to JPDC (Jun'22).

## Conference and Journal Publications

7. **Performance Anomalies in Concurrent Data Structure Microbenchmarks.**  
Rosina Kharal and Trevor Brown.  
26<sup>th</sup> International Conf. on Principles of Distributed Systems (**OPODIS'22**).  
(CORE B-rank, Qualis B2-rank, ERA B-rank)
8. **PREP-UC: A practical replicated persistent universal construction.**  
Gaetano Coccimiglio, Trevor Brown and Srivatsan Ravi. [Paper]  
34<sup>th</sup> ACM Symposium on Parallelism in Algorithms and Architectures (**SPAA'22**), 13  
pages. (24.6% acceptance; CORE A-rank, Qualis A2-rank, ERA A-rank)  
**Best paper candidate (top 4 papers).**
9. **Elimination (a,b)-trees with fast, durable updates.**  
Anubhav Srivastava and Trevor Brown. [Paper] [Artifact] [Video]  
27<sup>th</sup> ACM Symp. on Princ. And Practice of Parallel Programming (**PPoPP'22**), 12 pages.  
(accepted w/o conditions - 18.6% of papers; CORE A-rank, Qualis A2-rank, ERA A-rank)
10. **PathCAS: an efficient middle ground for concurrent search data structures.**  
Trevor Brown, William Sigouin and Dan Alistarh. [Paper] [Slides] [Video] [Artifact]  
27<sup>th</sup> ACM Symp. on Princ. And Practice of Parallel Programming (**PPoPP'22**), 12 pages.  
(24.6% acceptance; CORE A-rank, Qualis A2-rank, ERA A-rank)  
**Received the best artifact award.**
11. **NBR: Neutralization based reclamation.**  
Ajay Singh, Trevor Brown and Ali Mashtizadeh. [Paper] [Video] [Artifact]  
26<sup>th</sup> ACM Symp. on Princ. and Practice of Parallel Programming (**PPoPP'21**), 16 pages.  
(17% acceptance; CORE A-rank, Qualis A2-rank, ERA A-rank.)  
**Best paper candidate (top 4 papers).**  
**Received the best artifact award** [ACM announcement tweet] [ACM DL page].
12. **Memory tagging: minimalist synchronization for scalable concurrent data structures.**  
Dan Alistarh, Trevor Brown and Nandini Singhal. [Paper] [Slides] [Video]

- 32<sup>nd</sup> ACM Symp. on Parallelism in Algorithms and Architectures (**SPAA'20**), pp 37-49.  
(32% acceptance; CORE A-rank, Qualis A2-rank, ERA A-rank)
13. **Non-blocking interpolation search trees with doubly-logarithmic running time.**  
Trevor Brown, Aleksandar Prokopec and Dan Alistarh. [[Paper](#)] [[Slides](#)] [[Audio](#)] [[Code](#)]  
25<sup>th</sup> ACM Symp. On Princ. and Pract. of Parallel Programming (**PPoPP'20**), pp 4:(1-16)  
(23% acceptance; CORE A-rank, Qualis A2-rank, ERA A-rank)  
**Received the [best paper award](#).**
14. **Snapshot-based synchronization: a fast replacement for hand-over-hand locking.**  
Eran Gilad, Trevor Brown, Mark Oskin and Yoav Etsion. [[Paper](#)]  
24<sup>th</sup> Intl. European Conf. on Parallel and Distr. Computing (**EUROPAR'18**), pp 465-479.  
(29% acceptance; Qualis A2-rank, ERA A-rank)
15. **Relaxed schedulers efficiently parallelize sequential algorithms.**  
Dan Alistarh, Trevor Brown, Justin Kopinsky and Giorgi Nadiradze. [[Paper](#)]  
37<sup>th</sup> ACM Symp. on the Principles of Distributed Computing (**PODC'18**), pp 377-386.  
(25% acceptance; CORE A\*-rank, Qualis A1-rank, ERA A-rank)
16. **Distributionally linearizable data structures.**  
Dan Alistarh, Trevor Brown, Justin Kopinsky, Giorgi Nadiradze and Jerry Li. [[Paper](#)]  
30<sup>th</sup> ACM Symp. on Parallelism in Algorithms and Architectures (**SPAA'18**), pp 133-142.  
(30% acceptance; CORE A-rank, Qualis A2-rank, ERA A-rank)
17. **Getting to the root of concurrent search tree performance.**  
Maya Arbel-Raviv, Trevor Brown and Adam Morrison. [[Paper](#)] [[Slides](#)] [[Audio](#)]  
2018 USENIX Annual Technical Conference (**USENIX ATC'18**), pp 295-306.  
(20% acceptance; CORE A-rank, Qualis A1-rank, ERA A-rank)
18. **Harnessing epoch-based reclamation for efficient range queries.**  
Maya Arbel-Raviv and Trevor Brown. [[Paper](#)] [[Slides](#)] [[Code](#)]  
23<sup>rd</sup> ACM Symp. on Princ. and Practice of Parallel Programming (**PPoPP'18**), pp 14-27.  
(20% acceptance; CORE A-rank, Qualis A2-rank, ERA A-rank.)
19. **Reuse, don't recycle: transforming lock-free algorithms that throw away descriptors.**  
Maya Arbel-Raviv and Trevor Brown. [[Paper](#)] [[Slides](#)] [[Video](#)] [[Code](#)]  
31<sup>st</sup> ACM Symposium on Distributed Computing (**DISC'17**), pp 4:(1-16).  
(24% acceptance; CORE A-rank, Qualis A2-rank, ERA A-rank)
20. **Cost of concurrency in hybrid transactional memory.**  
Trevor Brown and Srivatsan Ravi. [[Paper](#)] [[Slides](#)] [[Code](#)]  
31<sup>st</sup> ACM Symposium on Distributed Computing (**DISC'17**), pp 9:(1-16).  
(24% acceptance; CORE A-rank, Qualis A2-rank, ERA A-rank)
21. **A template for implementing fast lock-free trees using HTM.**  
Trevor Brown. [[Paper](#)] [[Slides](#)] [[Code](#)]  
36<sup>th</sup> ACM Symp. on the Principles of Distributed Computing (**PODC'17**), pp 293-302.  
(25% acceptance; CORE A\*-rank, Qualis A1-rank, ERA A-rank)

22. **PHyTM: persistent hybrid transactional memory.**  
Hillel Avni and Trevor Brown. [[Paper](#)] [[Slides](#)]  
Very Large Data Bases Journal (**VLDBJ'16 / VLDB'16**) Volume 10(4), 12 pages.  
(CORE A\*-rank, ERA A-rank. Typically 15-18% acceptance rate.)  
*Also appeared at the 43<sup>rd</sup> Int. Conference VLDB'17.*
23. **Investigating the performance of hardware transactions on a multi-socket machine.**  
Trevor Brown, Alex Kogan, Yossi Lev and Victor Luchangco. [[Paper](#)] [[Slides](#)]  
28<sup>th</sup> ACM Symp. on Parallelism in Algorithms and Architectures (**SPAA'16**), pp 121-132.  
(24% acceptance in 2017. 2016 unknown. CORE A-rank, Qualis A2-rank, ERA A-rank.)
24. **Reclaiming memory for lock-free data structures: there has to be a better way.**  
Trevor Brown. [[Paper](#)] [[Slides](#)] [[Code](#)]  
34<sup>th</sup> ACM Symp. on the Principles of Distributed Computing (**PODC'15**), pp 261-270.  
(24% acceptance; CORE A\*-rank, Qualis A1-rank, ERA A-rank)
25. **B-slack trees: space efficient B-trees.**  
Trevor Brown. [[Paper](#)] [[Slides](#)] [[Code](#)]  
14<sup>th</sup> Scandinavian Symp. and Workshops on Algorithm Theory (**SWAT'14**), pp 122-133.  
(24% acceptance; CORE B-rank, Qualis B1-rank, ERA B-rank)
26. **A general technique for non-blocking trees.**  
Trevor Brown, Faith Ellen and Eric Ruppert. [[Paper](#)] [[Slides](#)] [[Code](#)]  
19<sup>th</sup> ACM Symp. on Princ. and Practice of Parallel Programming (**PPoPP'14**), pp 329-342.  
(15% paper acceptance; CORE A-rank, Qualis A2-rank, ERA A-rank)
27. **Pragmatic primitives for non-blocking data structures.**  
Trevor Brown, Faith Ellen and Eric Ruppert. [[Paper](#)] [[Slides](#)] [[Code](#)]  
31<sup>st</sup> ACM Symposium on the Principles of Distributed Computing (**PODC'13**), pp 13-22.  
(23% paper acceptance; CORE A\*-rank, Qualis A1-rank, ERA A-rank)
28. **Range queries in non-blocking k-ary search trees.**  
Trevor Brown and Hillel Avni. [[Paper](#)] [[Code](#)]  
16<sup>th</sup> International Conf. on Principles of Distributed Systems (**OPODIS'12**), pp 31-45.  
(27% acceptance; CORE B-rank, Qualis B2-rank, ERA B-rank)
29. **Non-blocking k-ary search trees.**  
Trevor Brown and Joanna Helga. [[Paper](#)] [[Slides](#)] [[Video](#)] [[Code](#)]  
15<sup>th</sup> International Conf. on Principles of Distributed Systems (**OPODIS'11**), pp 207-221.  
(CORE B-rank, Qualis B2-rank, ERA B-rank) [During undergrad]

## Workshop Papers

30. **Cost of concurrency in hybrid transactional memory.**  
Trevor Brown and Srivatsan Ravi. [[Paper](#)] [[Slides](#)]  
12<sup>th</sup> ACM SIGPLAN Workshop on Transactional Computing (**TRANSACT'17**), 8 pages.  
(Competitive peer-review, but no statistics. Only 6 accepted papers.)  
*Preliminary version of the conference paper at DISC'17.*

**31. Persistent hybrid transactional memory.**

Hillel Avni and Trevor Brown. [[Paper](#)] [[Slides](#)]

11<sup>th</sup> ACM SIGPLAN Workshop on Transactional Computing (**TRANSACT'16**), 8 pages.  
(Competitive peer-review, but no statistics. Only 9 accepted papers.)

*Preliminary version of the conference paper at VLDB'17.*

**32. Investigating the performance of hardware transactions on a multi-socket machine.**

Trevor Brown, Alex Kogan, Yossi Lev and Victor Luchangco. [[Paper](#)] [[Slides](#)]

11<sup>th</sup> ACM SIGPLAN Workshop on Transactional Computing (**TRANSACT'16**), 8 pages.  
(Competitive peer-review, but no statistics. Only 9 accepted papers.)

*Preliminary version of the conference paper at SPAA'16.*

## Short Papers and Posters

**33. Unexpected scaling in path copying trees.**

Vitaly Aksenov, Trevor Brown, Alexander Fedorov and Ilya Kokorin.

28<sup>th</sup> ACM Symp. on Princ. And Practice of Parallel Programming (**PPoPP'23**).

(Qualis A2-rank, ERA A-rank)

*Poster and short paper (3 pages).*

**34. Performance Anomalies in Concurrent Data Structure Microbenchmarks.**

Rosina Kharal and Trevor Brown.

36<sup>th</sup> ACM Symposium on Distributed Computing (**DISC'22**). [[Paper](#)]

(Qualis A2-rank, ERA A-rank)

*Short version (3 pages) of conference paper at OPODIS'22.*

**35. Reuse, don't recycle: transforming lock-free algorithms that throw away descriptors.**

Maya Arbel-Raviv and Trevor Brown. [[Paper](#)] [[Poster](#)]

22<sup>nd</sup> ACM Symp. on Princ. and Practice of Parallel Programming (**PPoPP'17**), pp 429-430.

(22% acceptance; Qualis A2-rank, ERA A-rank)

*Poster and short version of conference paper at DISC'17.*

**36. Concurrent data structures.**

Faith Ellen and Trevor Brown. [[Paper](#)] [[Slides](#)]

35<sup>th</sup> ACM Symp. on the Principles of Distributed Computing (**PODC'16**), pp 151-153.

*Short paper to accompany an invited talk by Faith Ellen at PODC'16.*

**37. Faster data structures in transactional memory using three paths.**

Trevor Brown. [[Paper](#)] [[Slides](#)] [[Code](#)]

29<sup>th</sup> ACM Symposium on Distributed Computing (**DISC'15**), pp 671-672.

(31% acceptance; Qualis A2-rank, ERA A-rank)

*Short version of conference paper at PODC'17.*

**38. A general technique for non-blocking trees.**

Trevor Brown, Faith Ellen and Eric Ruppert. [[Paper](#)] [[Slides](#)] [[Code](#)]

27<sup>th</sup> ACM Symposium on Distributed Computing (**DISC'13**), pp 567-568.

(26% acceptance; Qualis A2-rank, ERA A-rank)

*Short version of conference paper at PPoPP'14.*

## Articles and Technical Reports

39. **Elimination (a,b)-trees with fast, durable updates (2022).**  
Anubhav Srivastava and Trevor Brown. [[Paper](#)]  
ArXiv Computing Research Repository (CoRR), abs/2112.15259, 22 pages.  
*Full version of (10 page) conference paper at PPOPP'22.*
40. **NBR: neutralization based reclamation (2021).**  
Ajay Singh, Trevor Brown and Ali Mashtizadeh. [[Paper](#)]  
ArXiv Computing Research Repository (CoRR), abs/2012.14542, 22 pages.  
*Full version of (10 page) conference paper at PPOPP'21.*
41. **Analysis and evaluation of non-blocking interpolation search trees (2020).**  
Aleksandar Prokopec, Trevor Brown and Dan Alistarh. [[Paper](#)]  
ArXiv Computing Research Repository (CoRR), abs/2001.00413, 17 pages.  
*Extended correctness and complexity proofs and experimental results for PPOPP'20 paper.*
42. **On the cost of concurrency in hybrid transactional memory (2019).**  
Trevor Brown and Srivatsan Ravi. [[Paper](#)]  
ArXiv Computing Research Repository (CoRR), abs/1907.02669, 17 pages.  
*Full version of (10 page) conference paper at DISC'17.*
43. **Reuse, don't recycle: transforming lock-free algo. that throw away descriptors (2017).**  
Maya Arbel-Raviv and Trevor Brown. [[Paper](#)]  
ArXiv Computing Research Repository (CoRR), abs/1708.01797, 32 pages.  
*Full version of (16 page) conference paper at DISC'17.*
44. **A template for implementing fast lock-free trees using HTM (2017).**  
Trevor Brown. [[Paper](#)]  
ArXiv Computing Research Repository (CoRR), abs/1708.04838, 20 pages.  
*Full version of (10 page) conference paper at PODC'17.*
45. **Techniques for constructing efficient lock-free data structures (2017).**  
PhD thesis, University of Toronto. [[Paper](#)]  
Committee: Faith Ellen (University of Toronto), Azadeh Farzan (University of Toronto), Vassos Hadzilacos (University of Toronto), Maurice Herlihy (Brown University), Ryan Johnson (University of Toronto), Sam Toueg (University of Toronto).  
ArXiv Computing Research Repository (CoRR), abs/1712.05406, 312 pages.
46. **Reclaiming memory for lock-free data structures: there has to be a better way (2017).**  
Trevor Brown. [[Paper](#)]  
ArXiv Computing Research Repository (CoRR), abs/1712.01044, 27 pages.  
*Full version of (10 page) conference paper at PODC'15.*
47. **B-slack trees: space efficient B-trees (2017).**  
Trevor Brown. [[Paper](#)]  
ArXiv Computing Research Repository (CoRR), abs/1712.05020, 19 pages.  
*Full version of (12 page) conference paper at SWAT'14.*

48. **A general technique for non-blocking trees (2017).**  
Trevor Brown, Faith Ellen and Eric Ruppert. [[Paper](#)]  
ArXiv Computing Research Repository (CoRR), abs/1712.06687, 41 pages.  
*Full version of (10 page) conference paper at PPOPP'14.*
49. **Pragmatic primitives for non-blocking data structures (2017).**  
Trevor Brown, Faith Ellen and Eric Ruppert. [[Paper](#)]  
ArXiv Computing Research Repository (CoRR), abs/1712.06688, 47 pages.  
*Full version of (10 page) conference paper at PODC'13.*
50. **Range queries in non-blocking k-ary search trees (2017).**  
Trevor Brown and Hillel Avni. [[Paper](#)]  
ArXiv Computing Research Repository (CoRR), abs/1712.05101, 18 pages.  
*Full version of (15 page) conference paper at OPODIS'12.*
51. **Non-blocking k-ary search trees (2017).**  
Trevor Brown and Joanna Helga. [[Paper](#)]  
York University Technical Report CSE-2011-04, 52 pages.  
*Full version of (16 page) conference paper at OPODIS'11.*

## Patents

52. **Adaptive techniques for improving performance of hardware transactions on multi-socket machines.** Oracle Labs, US patent 10,127,088. 34 pages.  
Alex Kogan, Yossi Lev, Victor Luchangco and Trevor Brown. [[Link](#)]



Talks (C = conference; S = seminar; I = invited; L = guest lecture)

**[C] Unexpected scaling in path copying trees.**

- 28<sup>th</sup> ACM Symp. on Princ. and Practice of Parallel Programming, Montreal, Canada (to occur Feb 2023).

**[I] Fast and simple concurrent data structures using PathCAS.**

- Invited talk (40 minutes) at the University of Windsor, Ontario, Canada (Dec 2022).  
[\[Slides\]](#)

**[C] PathCAS: An efficient middle ground for concurrent search data structures.**

- 27<sup>th</sup> ACM Symposium on Principles and Practice of Parallel Programming, Seoul, South Korea (virtual, Apr 2022). [\[Video\]](#)

**[S] The fence complexity of persistent sets.**

- 45 minute presentation at the 3<sup>rd</sup> Waterloo-Huawei Joint Innovation Workshop (311 registrants), Waterloo, Canada (Jun 2021).

**[C] Memory tagging: minimalist synch. for scalable concurrent data structures.**

- 32<sup>nd</sup> ACM Symposium on Parallel Algorithms and Architectures, *Virtual conference* (July 2020). [\[Slides\]](#) [\[Video\]](#)

**[C] Non-blocking interpolation search trees with doubly-logarithmic running time.**

- 25<sup>th</sup> ACM Symposium on Principles and Practice of Parallel Programming, San Diego, United States (Feb 2020). *Best paper award*. [\[Slides\]](#) [\[Audio\]](#)

**[I-] Invited to speak for 60 minutes at the Hydra'20 and Hydra'22 conferences** on concurrent and distributed computing. However, I had to decline due to timing. (And, in the latter case, due to war...)

**[S] Scalable infrastructure for next-generation data management systems.**

- 45 minute presentation at the 2<sup>nd</sup> Waterloo-Huawei Joint Innovation Workshop (164 registrants), Waterloo, Canada (Jun 2020).

**[I] Practical aspects of multicore programming.**

- Invited talk at the 2<sup>nd</sup> Summer School on the Practice and Theory of Distributed Computing (200+ attendees), St. Petersburg, Russia (Jul 2019). **3 hours**.  
***Rated 2<sup>nd</sup> best out of 9 invited talks*** by highly distinguished speakers, including a Turing award winner. [\[Talk\]](#) [\[Speakers list\]](#)

**[C] Getting to the root of concurrent search tree performance.**

- 2018 USENIX Annual Technical Conference, Boston, United States (Jul 2018).  
[\[Slides\]](#) [\[Audio\]](#)

**[L] Getting to the root of concurrent BSTs.**

- TU Wien, Vienna, Austria (June 2018). 90 minute guest lecture. [\[Slides\]](#)

**[S] Towards correct and efficient multicore programming.**

- University of Waterloo, Waterloo, Canada (Mar 2018). [\[Slides\]](#)  
- University of California Santa Cruz, California, United States (Feb 2018).  
- Simon Fraser University, Burnaby, Canada (Feb 2018).  
- University of Waterloo, Waterloo, Canada (Jan 2018).

**[I] Good data structure experiments are R.A.R.E.**

- [Invited talk](#) at the 1<sup>st</sup> Workshop on the Theory and Practice of Concurrency, Vienna, Austria (Oct 2017). *Held in conjunction with DISC'17*. 60min. [[Slides](#)] [[Video](#)]
- Oath/Yahoo! Labs, Haifa, Israel (Sep 2017). 60min. [[Slides](#)]

**Reuse, don't recycle: transforming lock-free algorithms that throw away descriptors.**

- [C] 31<sup>st</sup> ACM Symposium on Distributed Computing, Vienna, Austria (Oct 2017). [[Slides](#)] [[Video](#)]
- [S] Riot Games, Los Angeles, California (Nov 2019) – video talk

**[C] Cost of concurrency in hybrid transactional memory.**

- 31<sup>st</sup> ACM Symposium on Distributed Computing, Vienna, Austria (Oct 2017). [[Slides](#)]

**[C] A template for implementing fast lock-free trees using HTM.**

- 36<sup>th</sup> ACM Symposium on the Principles of Distributed Computing, Washington, United States (Jul 2017). [[Slides](#)]

**[S] Techniques for Constructing Efficient Lock-free Data Structures.**

- Technion - Israel Institute of Technology, Haifa, Israel (May 2017). 60min. [[Slides](#)]
- University of Toronto, Toronto, Canada (Mar 2017). 60min. [[Slides](#)]

**[C] Investigating the perf. of hardware transactions on a multi-socket machine.**

- 28<sup>th</sup> ACM Symposium on Parallelism in Algorithms and Architectures, Monterey, United States (Jul 2016). [[Slides](#)]
- 11<sup>th</sup> ACM SIGPLAN Workshop on Transactional Computing, Barcelona, Spain (Mar 2016). [[Slides](#)]

**[C] Persistent hybrid transactional memory.**

- 11<sup>th</sup> ACM SIGPLAN Workshop on Transactional Computing, Barcelona, Spain (Mar 2016). [[Slides](#)]

**[C] Faster data structures in transactional memory using three paths.**

- 29<sup>th</sup> ACM Symposium on Distributed Computing, Tokyo, Japan (Oct 2015). [[Slides](#)]

**[S] Scalable transactions on NUMA systems.**

- Oracle Labs East, Burlington, United States (Aug 2015). [[Slides](#)]

**[C] Reclaiming memory for lock-free data structures: there has to be a better way.**

- 34<sup>th</sup> ACM Symposium on the Principles of Distributed Computing, San Sebastian, Spain (Jul 2015). [[Slides](#)]

**[S] Hardware transactional memory and the lemming effect.**

- University of Toronto, Toronto, Canada (Apr 2015). [[Slides](#)]

**[L] Java Experiments on MTL: From past mistakes to best practices.**

- York University, Toronto, Canada (Mar 2015). 90 minute guest lecture. [[Slides](#)]

**[S] Memory reclamation for lock-free data structures.**

- University of Toronto, Toronto, Canada (Aug 2014).

**[C] B-slack trees: space efficient B-trees.**

- 14<sup>th</sup> Scandinavian Symposium and Workshops on Algorithm Theory, Copenhagen, Denmark (Jun 2014). [[Slides](#)]

**[C] A general technique for non-blocking trees.**

- 19<sup>th</sup> ACM Symposium on Principles and Practice of Parallel Programming, Orlando, United States (Feb 2014). [[Slides](#)]

- 27<sup>th</sup> ACM Symposium on Distributed Computing, Jerusalem, Israel (Aug 2013). [[Slides](#)]

**Pragmatic primitives for non-blocking data structures.**

- [C] 31<sup>st</sup> ACM Symposium on the Principles of Distributed Computing, Montreal, Canada (Jul 2013). [[Slides](#)]

- [S] University of Toronto, Toronto, Canada (Jul 2013).

**[S] Building a non-blocking chromatic tree.**

- TransForm School on Research Directions in Distributed Computing, Heraklion, Crete (Jun 2013). [[Slides](#)]

**[C] Range queries in non-blocking k-ary search trees.**

- 16<sup>th</sup> International Conference on Principles of Distributed Systems, Rome, Italy (Nov 2012).

**[C] Non-blocking k-ary search trees.**

- 15<sup>th</sup> International Conference on Principles of Distributed Systems, Toulouse, France (Oct 2011). [[Slides](#)] [[Video](#)]

**[L] Experiences with Intel's Multicore Testing Lab.**

- York University, Toronto, Canada (2011). 60 minute guest lecture.

## Software Artifacts

- **PREP-UC: universal construction library in C++ (2022)**  
Automatically transforms single threaded code into multithreaded, NUMA friendly, durable linearizable code (for Intel DCPMM non-volatile RAM).  
Code artifact to accompany SPAA'22 conference paper.  
<http://prepuc.tbrown.pro>
- **PathCAS: synchronization primitive library in C++ (2022)**  
Provides new synchronization primitives in C++ for implementing concurrent data structures. Code artifact to accompany PPOPP'22 conference paper.  
<http://pathcas.tbrown.pro>
- **TMBench: transactional memory library and benchmark (2021 – present)**  
Rigorous C/C++ implementations of ten software and hybrid transactional memory algorithms. To my knowledge, this is the most complete (and possibly also performant) repository of transactional memory implementations available.  
<http://tmbench.tbrown.pro>
- **Neutralization based reclamation algorithm in C++ (2021)**  
Software artifact to accompany a PPOPP'21 conference paper.  
<http://nbr.tbrown.pro>
- **Concurrent lock-free interpolation search trees in C++ (2019)**  
Bleeding edge data structure suitable for use as an index in an in-memory database. Experimental software artifact to accompany a PPOPP'20 conference paper.  
<http://ist.tbrown.pro>

- **Setbench: data structure test harness & benchmark (2018 - present)**  
 Introduced a rigorous performance test bed with micro and macro benchmarks.  
 Provides tools for avoiding common mistakes made in previous test beds.  
 Fixes errors in popular concurrent sets and implements correct memory reclamation.  
 Includes tools for validating and explaining experimental results.  
<http://setbench.tbrown.pro>
- **LLX/SCX primitives for C++ (2018)**  
 This is the state of the art implementation of the LLX and SCX synchronization primitives, with many improvements over the original.  
<http://scx.tbrown.pro>
- **Reusable descriptors for lock-free data structures in C++ (2018)**  
 Provided a lock-free reusable descriptor library.  
 Used this library to accelerate four advanced lock-free data structures.  
<http://weak-descriptors.tbrown.pro>
- **Support for range query operations in C++ (2018)**  
 Produced three novel algorithms for adding range query operations to data structures.  
 Augmented seven different data structures with range query support (producing up to five variants of each data structure).  
 Used these data structures to accelerate an in-memory database (DBx1000).  
<http://range-queries.tbrown.pro>
- **C++ hardware transactional lock-free data structure library (2017)**  
 Implemented unbalanced BSTs and relaxed (a,b)-trees using LLX and SCX.  
 Produced four different transactional memory based algorithms for each data structure.  
<http://3path-htm.tbrown.pro>
- **Lock-free memory reclamation in C++ (2015)**  
 Provided a record manager library with allocation, reclamation and object pooling plugins (including five allocators and four memory reclamation algorithms).  
 Implemented lock-free BSTs and Chromatic trees using this library.  
<http://debra.tbrown.pro>
- **Java lock-free data structure library (2014)**  
 Produced the first lock-free unbalanced binary search tree implementation.  
 Produced the first implementation of LLX and SCX synchronization primitives.  
 Also introduced: k-ary search trees, relaxed AVL trees, Chromatic trees, b-slack trees.  
 Includes experimental test harness with support for 13 competing data structures.  
<http://java.tbrown.pro>

## Teaching

- *Instructor – University of Waterloo* (2018 – present)
  - W23 CS798 multicore programming
  - S22 CS341 algorithms (two sections – **4.8/5** and **4.3/5** evaluations, resp.)
  - F21 CS341 algorithms (two sections – **4.5/5** average evaluation)
  - W21 CS798-043 multicore programming, 26 students
    - course generated high interest: 32 initially enrolled, plus 36 waitlisted
    - piazza participation: 1533 student posts (59 per student!), 255 by instructor
    - avg teaching evaluation of **4.7/5**
  - W20 CS341 algorithms (two sections, 177 students, **4.6/5** eval. in section 1)
  - F19 CS798-003 [multicore programming](#) (18 students, **4.9/5** average evaluation)
  - W19 CS341 algorithms (87 students, **4.3/5** average evaluation)
  - F18 CS798 multicore programming (20 students, **4.8/5** average evaluation)  
[Reading Group](#) attended by up to 15 students from multiple research groups
- *Teaching Assistant – University of Toronto* (2011 – 2014)
  - CSC2221 (graduate) theory of distributed computing (2013)
  - CSC263 data structures and analysis (2011, 2012, 2013, 2014)
    - Gave approximately **60 lectures**, each an hour long
    - 2014 teaching evaluation average was 4.9+ out of 5
  - CSC369 principles of operating systems (2012)
  - CSC265 enriched data structures and analysis (2011)
- *Programming contest coach – York University* (2009)

## Research Funding (My share: **\$926,755.00**)

<b>NSERC</b> Collaborative Research and Development (\$209,700)	2020 – 2023
Trevor Brown (75%) and Ali Mashtizadeh (25%)	
I <b>declined</b> additional NSERC CRD COVID relief funds.	
<b>Huawei</b> Research Gift (\$120,000)	2021 – 2022
<b>Huawei</b> Waterloo Joint Innovation Grant (\$190,000)	2019 – 2021
Trevor Brown (75%) and Ali Mashtizadeh (25%)	
<b>Ontario</b> Research Fund: Research Infrastructure (\$101,000)	2020 – 2021
Trevor Brown (25%) and Ali Mashtizadeh (75%)	
<b>CFI</b> John Evans Leaders Fund Grant (\$101,000)	2020 – 2021
Trevor Brown (25%) and Ali Mashtizadeh (75%)	
<b>NSERC</b> Discovery Grant (\$234,000) [39k/y]	2019 – 2024
<b>NSERC</b> Discovery Launch Supplement (\$12,500)	2019 – 2023
<b>Waterloo</b> Startup Grant (\$120,000)	2018 – 2022
<b>NSERC</b> Postdoctoral fellowship (\$90,000)	2017 – 2018
<b>Second highest ranked applicant in Canada</b>	

## Supervision

- Alexander Fedorov: intern (UW & IST Austria, to occur W2023)
- Mohammad Khalaji: PhD\*\* (UW, W2022 – present)
- Gaetano Coccimiglio: PhD\* (UW, F2021 – present)
- Gautam Pathak: MMath (UW, F2021 – present)
- Gaurav Gupta: intern (USC, S2021 – S2021)
- Abhirup Das: intern (UW, F2020 – W2021)
- Daewoo Kim: MMath (UW, F2020 – present)
- Anubhav Srivastava: MMath (UW, S2020 – S2021). Now at Yugabyte.
- Gaetano Coccimiglio: MMath (UW, F2019 – S2021). Continued to PhD.
- Ajay Singh: PhD\* (UW, F2019 – present)
- Rosina Kharal: PhD\* (UW, F2019 – present)
- William Sigouin: MMath (UW, W2018 – W2020). Now at Huawei.
- Gautam Pathak: intern (UW, W2020 – S2020). Joined for an MMath.
- Daewoo Kim: intern (UW, W2019 – S2019). Joined for an MMath.
- Jialin Song: intern (University of Toronto, S2014)
- Kenneth Hoover: intern (University of Toronto, S2013)

\*Co-supervised (as required by UW) with Peter Buhr, \*\*with Khuzaima Daudjee

## Service

- **Program committee member** for
  - SPAA'22 (10 papers)
  - SIROCCO'22 (5 papers)
  - [ICDCS'21](#) (2 papers) [duties curtailed because of hospitalization]
  - [PPoPP'21](#) (10 papers)
  - [PODC'21](#) (17 papers)
  - [PODC'20](#) (19 papers)
  - [PODC'19](#) (23 papers)
  - [PPoPP'19](#) (extended review committee)
  - [ICDCS'18](#)
  - Additionally was invited to ICDCS'23 PC, SPAA'23, DISC'22, PODC'22, OPODIS'22, SPAA'21, SPAA'20 (but declined due to timing)
- **Publication chair** for [PPoPP'19](#).  
A [rough guide that I wrote for subsequent publication chairs](#) (currently in use).
- **Artifact evaluation committee member** for [PPoPP'16](#).
- **Conference paper reviews** for PODC'11, DISC'12, PODC'13, DISC'14, PODC'14, PPoPP'16, SIROCCO'16, SPAA'16, DISC'16, SPAA'17, RANDOM'17, DISC'17, PODC'18 (4x), DISC'18 (3x), SPAA'19, ESA'19 (2x), DISC'19 (2x), APLAS'20, DISC'20, DISC'22.
- **Journal reviews** for the Journal of the ACM (JACM), the ACM Journal of Distributed Computing (DIST) [5x], the IEEE Journal of Transactions on Parallel and Distributed

Systems (TPDS) [3x], and the Elsevier Journal of Logical and Algebraic Methods in Programming (JLAMP).

- **Committees**
  - Graduate recruiting committee (Waterloo, F2022-present)
  - School advisory committee on faculty appointments (Waterloo, F2021-W2022)
  - Graduate recruiting committee (Waterloo, F2020-S2021)
  - School advisory committee on faculty appointments (Waterloo, 2019)
  - Graduate recruiting committee (Waterloo, 2018)
  - CS Chair search committee (Toronto, 2015)
- **Thesis committee member / reader** for
  - Ahmed Fahmy (PhD, University of Waterloo, to occur November 2022)
  - Thierry Delisle (PhD, University of Waterloo, to occur November 2022)
  - Zuanhao Wu (PhD, University of Waterloo, proposal June 2022)
  - Mubeen Zulfiqar (MMath, University of Waterloo, 2022)
  - Sakib Chowdhury (MMath, University of Waterloo, 2021)
  - Basil Alkhatib (MMath, University of Waterloo, 2021)
  - Anastasia Postnikova (BSc, ITMO University, 2021)
  - Bryce Sandlund (PhD, University of Waterloo, 2021)
  - Diego Cepada (MMath, University of Waterloo, 2020)
  - Nan Li (MMath, University of Waterloo, 2020)
  - Mehrdad Giv (MSc, Calgary, 2020)
- **Discussion panel member** for
  - Graduate recruiting student panel (University of Waterloo, Apr 2021)
  - Graduate skills seminars (University of Waterloo, Sep 2020)
  - UROC undergraduate research conference (University of Waterloo, Sep 2019)
- **Student reference letters for graduate school**
  - three students in fall 2022
  - three students in fall 2021 [20-30 applications total]
- **Tenure recommendation letters (2x)**, York University (2010)

## Other

- Invited to participate in the Google Scalable Algorithms for Semi-supervised and Unsupervised Learning Workshop 2021
- Invited to BIRS CMO Workshop on the Complexity and Analysis of Distributed Algorithms, in Oaxaca Mexico, 2016