Richard Garner

Contact details

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Employment

2017– ARC Future Fellow, Macquarie University
2015– Senior Lecturer, Macquarie University
2013–15 Lecturer, Macquarie University
2011–15 ARC Australian Research Fellow, Macquarie University
2008–10 Junior Research Fellow, St John's College, Cambridge
2006–08 EU Marie Curie Intra-European Fellow, Uppsala University.

Studies

2003–06 Ph. D. in Mathematics, University of Cambridge.
2002–03 Certificate of Advanced Studies in Mathematics ("Part III"), University of Cambridge.
2000–03 M. A. Hons in Mathematics (1st Class), University of Cambridge.

Awards

2017 Medal of the Australian Mathematical Society

Publications

[1] Richard Garner, *Double clubs*, Cahiers de Topologie et Géométrie Différentielle Catégoriques 47 (2006), no. 4, pages 261–317. Available at: `http://www.numdam.org/item?id=CTGDC_2006__47_4_261_0`.

[2] Richard Garner, *Polycategories via pseudo-distributive laws*, Advances in Mathematics 218 (2008), no. 3, pages 781–827. Available at: `http://dx.doi.org/10.1016/j.aim.2008.02.001`.

[3] Nicola Gambino and Richard Garner, *The identity type weak factorisation system*, Theoretical Computer Science 409 (2008), no. 1, pages 94–109. Available at: `http://dx.doi.org/10.1016/j.tcs.2008.08.030`.

[4] Richard Garner and Nick Gurski, *The low-dimensional structures formed by tricategories*, Mathematical Proceedings of the Cambridge Philosophical Society 146 (2009), no. 3, pages 551–589. Available at: `http://dx.doi.org/10.1017/S0305004108002132`.

[5] Richard Garner, *Understanding the small object argument*, Applied Categorical Structures 17 (2009), no. 3, pages 247–285. Available at: `http://dx.doi.org/10.1007/s10485-008-9137-4`.

[6] Richard Garner, *On the strength of dependent products in the type theory of Martin-Löf*, Annals of Pure and Applied Logic 160 (2008), no. 1, pages 1–12. Available at `http://dx.doi.org/10.1016/j.apal.2008.12.003`.

[7] Richard Garner, Tom Hirschowitz, Aurélien Pardon, *Variable binding, symmetric monoidal closed theories, and bigraphs*, Proceedings of CONCUR 2009, Springer Lecture Notes in Computer Science 5710 (2009), pages 321–337. Available at: `http://dx.doi.org/10.1007/978-3-642-04081-8_22`.

[8] Richard Garner, *A homotopy-theoretic universal property of Leinster's operad for weak ω-categories*, Mathematical Proceedings of the Cambridge Philosophical Society 147 (2009), no. 3, pages 615–628. Available at: `http://dx.doi.org/10.1017/S030500410900259X`.

[9] Richard Garner, *Two-dimensional models of type theory*, Mathematical Structures in Computer Science 19 (2009), no. 4, pages 687–736. Available at: `http://dx.doi.org/10.1017/S0960129509007646`.

[10] Richard Garner, *Homomorphisms of higher categories*, Advances in Mathematics 224 (2010), no. 6, pages 2269–2311. Available at: `http://dx.doi.org/10.1016/j.aim.2010.01.022`.

[11] Benno van den Berg and Richard Garner, *Types are weak ω-groupoids*, Proceedings of the London Mathematical Society 102 (2011), no. 2, pages 370–394. Available at `http://dx.doi.org/10.1112/plms/pdq026`.

[12] Richard Garner (editor), *The homotopy interpretation of constructive type theory*, Oberwolfach Reports 8 (2011), no. 1, pages 609–638. Available at: `http://dx.doi.org/10.4171/OWR/2011/11`.

[13] Benno van den Berg and Richard Garner, *Topological and simplicial models of identity types*, Transactions of the ACM on Computational Logic 13 (2012), no. 1, pages 3:1–3:44. Available at `http://dx.doi.org/10.1145/2071368.2071371`.

[14] Richard Garner and Stephen Lack, *Lex colimits*, Journal of Pure and Applied Algebra 216 (2012), no. 6, pages 1372–1396. Available at: `http://dx.doi.org/10.1016/j.jpaa.2012.01.003`.

[15] Richard Garner and Stephen Lack, *Grothendieck quasitoposes*, Journal of Algebra 355 (2012), no. 1, pages 111–126. Available at: `http://dx.doi.org/10.1016/j.jalgebra.2011.12.016`.

[16] Richard Garner, *Remarks on exactness notions pertaining to pushouts*, Theory and Applications of Categories 27 (2012), no. 1, pages 2–9. Available at: `http://www.tac.mta.ca/tac/volumes/27/1/27-01abs.html`.

[17] Richard Garner, *An abstract view on syntax with sharing*, Journal of Logic and Computation 22 (2012), no. 6, pages 1427–1452. Available at: `http://dx.doi.org/10.1093/logcom/exr021`.

[18] Richard Garner, *Ionads*, Journal of Pure and Applied Algebra 216 (2012), no. 8, pages 1734–1747. Available at `http://dx.doi.org/10.1016/j.jpaa.2012.02.013`.

[19] Richard Garner and Stephen Lack, *On the axioms for adhesive and quasiadhesive categories*, Theory and Applications of Categories 27 (2012), no. 3, pages 27–46. Available at `http://www.tac.mta.ca/tac/volumes/27/3/27-03abs.html`.

[20] John Bourke and Richard Garner, *On semiflexible, flexible and pie algebras*, Journal of Pure and Applied Algebra 217 (2013), no. 2, pages 293–321. Available at `http://dx.doi.org/10.1016/j.jpaa.2012.06.002`.

[21] Richard Garner, *A characterisation of algebraic exactness*, Journal of Pure and Applied Algebra 217 (2013), no. 8, pages 1421–1426. Available at: `http://dx.doi.org/10.1016/j.jpaa.2012.11.003`.

[22] Robin Cockett and Richard Garner, *Restriction categories as enriched categories*, Theoretical Computer Science 523 (2014), pages 37–55. Available at: `http://dx.doi.org/10.1016/j.tcs.2013.12.018`.

[23] Pierre-Louis Curien, Richard Garner, and Martin Hofmann, *Revisiting the categorical interpretation of dependent type theory*, Theoretical Computer Science 546 (2014), pages 99–119. Available at `http://dx.doi.org/10.1016/j.tcs.2014.03.003`.

[24] John Bourke and Richard Garner, *Two-dimensional regularity and exactness*, Journal of Pure and Applied Algebra 218 (2014), no. 7, pages 1346–1371. Available at `http://dx.doi.org/10.1016/j.jpaa.2013.11.021`.

[25] Richard Garner, *Lawvere theories, finitary monads and Cauchy-completion*, Journal of Pure and Applied Algebra 218 (2014), no. 11, pages 1973–1988. Available at `http://dx.doi.org/10.1016/j.jpaa.2014.02.018`.

[26] Richard Garner, *Topological functors as total categories*, Theory and Applications of Categories 29 (2014), no. 15, pages 406–422. Available at: `http://www.tac.mta.ca/tac/volumes/29/15/29-15abs.html`.

[27] Richard Garner, *Diagrammatic characterisation of enriched absolute colimits*, Theory and Applications of Categories 29 (2014), no. 26, pages 775–780. Available at `http://www.tac.mta.ca/tac/volumes/29/26/29-26abs.html`.

[28] Richard Garner, *Combinatorial structure of type dependency*, Journal of Pure and Applied Algebra 219 (2015), no 6, pages 1885–1914. Available at: `http://dx.doi.org/10.1016/j.jpaa.2014.07.015`.

[29] Mitchell Buckley, Richard Garner, Stephen Lack and Ross Street, *The Catalan simplicial set*, Mathematical Proceedings of the Cambridge Philosophical Society 158 (2015), no. 2, pages 211–222. Available at: `http://dx.doi.org/10.1017/S0305004114000498`.

[30] Richard Garner, *The Isbell monad*, Advances in Mathematics 274 (2015), pages 516–537. Available at `http://dx.doi.org/10.1016/j.aim.2015.01.015`.

[31] John Bourke and Richard Garner, *Algebraic weak factorisation systems I: accessible AWFS*, Journal of Pure and Applied Algebra 220 (2016), pages 108–147. Available at `http://dx.doi.org/10.1016/j.jpaa.2015.06.002`.

[32] John Bourke and Richard Garner, *Algebraic weak factorisation systems II: categories of weak maps*, Journal of Pure and Applied Algebra 220 (2016), pages 148–174; available at `http://dx.doi.org/10.1016/j.jpaa.2015.06.003`.

[33] Richard Garner and Ignacio López Franco, *Commutativity*, Journal of Pure and Applied Algebra 220 (2016), pages 1707–1751; available at: `http://dx.doi.org/10.1016/j.jpaa.2015.09.003`.

[34] Richard Garner and Michael Shulman, *Enriched categories as a free cocompletion*, Advances in Mathematics 289 (2016), pages 1–94; available at `http://dx.doi.org/10.1016/j.aim.2015.11.012`.

[35] Richard Garner and Daniel Schäppi, *When coproducts are biproducts*, Mathematical Proceedings of the Cambridge Philosophical Society 161 (2016), pages 47–51; available at `http://dx.doi.org/10.1017/S0305004116000104`.

[36] Mitchell Buckley and Richard Garner, *Orientals and cubes, inductively*, Advances in Mathematics 303 (2016), pages 175–191; available at `http://dx.doi.org/10.1016/j.aim.2016.07.026`.

[37] Richard Garner and Ross Street, *Coalgebras governing both weighted Hurwitz products and their pointwise transforms*, Bulletin of the Belgian Mathematical Society 23 (2016), pages 643–666; available at `http://projecteuclid.org/euclid.bbms/1483671619`.

[38] Richard Garner, Stephen Lack and Paul Slevin, *Hochschild homology, lax codescent, and duplicial structure*, Annals of K-Theory 3-1 (2018), pages 1–31; available at `http://dx.doi.org/10.2140/akt.2018.3.1`.

[39] Richard Garner and Tom Hirschowitz, *Shapely monads and analytic functors*, Journal of Logic and Computation, published online 2 November 2017; available at `http://doi.org/10.1093/logcom/exx029`.

[40] Richard Garner, *An embedding theorem for tangent categories*, Advances in Mathematics 323 (2018), pages 668–687; available at `http://doi.org/10.1016/j.aim.2017.10.039`.

[41] Richard Garner and John Power, *An enriched view on the finitary monad–Lawvere theory correspondence*, Logical Methods in Computer Science, accepted 2 January 2018; available at `http://arxiv.org/abs/1707.08694`.

[42] Richard Garner and Daniel Lin, *Cocompletion of restriction categories*, under review; available at `http://arxiv.org/abs/1610.07164`.

[43] Scott Balchin and Richard Garner, *Bousfield localisation and colocalisation of one-dimensional model structures*, under review; available at `https://arxiv.org/abs/1801.02775`.

RECENT INVITED TALKS – CONFERENCES AND WORKSHOPS

Feb '18 Workshop on Logic, Algebra and Category Theory, Melbourne
Aug '17 Logic Colloquium 2017, Stockholm
Aug '16 Logic Colloquium 2016, Leeds
Jun '15 Category Theory 2015, Aveiro
Feb '14 Recent Developments in Proof Theory, Lyon
Sep '13 Type Theory, Homotopy Theory and Univalent Foundations, Barcelona
Jul '11 Category Theory 2011, Vancouver

COMPETITIVE GRANT FUNDING

RESEARCH STUDENTS - PHD

2015– Edoardo Lanari (principal supervisor).
2015– Daniel Lin (principal supervisor).
2015– Charles Walker (principal supervisor).
2012–15 Matthew Burke (principal supervisor). Thesis "Synthetic Lie theory".
2012–15 Mitchell Buckley (associate supervisor). Thesis "Three studies in higher category theory: fibrations, skew monoidal structures and excision of extremals".

RESEARCH STUDENTS - MASTERS

2015 Daniel Lin (principal supervisor). Thesis "Restriction categories and their free cocompletion".

2015 Charles Walker (principal supervisor). Thesis "Local reflections between relations, polynomials and spans".

TEACHING

2017 Category theory and computer science, AMSI Summer School.

2016–17 MATH300 Topology and Geometry (3rd year), Macquarie University

2016 MATH133 Mathematics IB (Advanced) (1st year), Macquarie University

2016 MATH288/388 Advanced Topics in Mathematics (2nd/3rd year), Macquarie University

2011–16 MATH706 Category Theory (4th year), Macquarie University

2008 Part III Category Theory (4th year), University of Cambridge

2006 Algebra MN3 (3rd year), Uppsala University

In 2017, my MATH300 students nominated me for a Macquarie University Teaching Awards; the citation text read: "Being excited to lecture every week creating an engaging environment, providing clear explanations of concepts and worked examples".

PROFESSIONAL SERVICE

2017 Treasurer & organising committee member for 2017 AustMS meeting.

2017 Examiner for PhD dissertation of Tobias Columbus, Karlsruhe University.

2016– Editor for Higher Structures, Mathematical Structures in Computer Science, Applied Categorical Structures

2016 Organizer of Homotopy Type Theory workshop as part of "Higher Structures in Geometry and Physics" (Max Planck Institute, Bonn, Jan–Mar 2016).

2015 Programme Committee member for Computer Science Logic 2015.

2014 Examiner for PhD dissertation of Mike Stay, University of Auckland.

2013 Co-organizer (with Steve Lack and Dominic Verity) of the conference Category Theory 2013, Sydney.

2011 Co-organizer (with Steve Awodey, Per Martin-Löf and Vladimir Voevodsky) of workshop "The homotopy interpretation of type theory", Oberwolfach.

2010 Examiner for PhD dissertation of Peter Lumsdaine, Carnegie Mellon University

DEPARTMENTAL SERVICE

2017 Member of first year textbook review working party. Duties: examine and report on several major calculus textbooks and their online offerings.

2016– Organiser of undergraduate mathematics seminar. Duties: arranging interesting and accessible talks to entertain and inspire students with an interest in mathematics.

2016– Mentor for Merit students in Mathematics. Duties: advising and inspiring high-performing students who may be interested in pursuing further studies in mathematics.

2015– Board member of CoACT (Centre for Australian Category Theory), one of Macquarie University's Research Centres. Duties: administration of CoACT finances and visitor programme, shaping the narrative of our ARC grant applications.

2011–17 Maintainer of CoACT webpages (`http://research.science.mq.edu.au/coact`). This includes maintaining a database of past and present talks at AusCat.

2011–16 Organiser of the Australian Category Seminar (AusCat). Duties: soliciting talks, inviting visitors and ensuring the smooth running of the practical aspects of the seminar from week to week.

Outreach

2017 Talk to Sydney Type Theory Meetup at Commonwealth Bank, titled "Parametric polymorphism".

2017 Talk to Macquarie University Undergraduate Maths Society, titled "Cataloguing the Alhambra".

2016 Talk to Macquarie University WISE (Women in Science and Engineering) evening on mathematics, learning and gender

2016 Talk to Sydney University and Macquarie University Undergraduate Maths Societies, titled "Dithering, uncertainty and loping basslines"

2016 Guest lecture in Macquarie University MATH103 Unit, titled "Sex: cellular automata and the Game of Life"

2013 Talk to SAPLING (Sydney Area Programming Languages Interest Group), titled "Homotopy Type Theory".

2011 Talk to FP-SYD (Sydney Functional Programming interest group) at Google, titled "Dependent type theory".

Refereeing activities

Transactions of the AMS; Publications mathématiques de l'IHÉS; Selecta Mathematica; Compositio Mathematica; Mathematical Proceedings of the Cambridge Philosophical Society; Advances in Mathematics; American Mathematical Monthly; Journal of Pure and Applied Algebra; Theory and Application of Categories; Applied Categorical Structure; Annals of Pure and Applied Logic; Transactions of the ACM on Computational Logic; Theoretical Computer Science; Computer Science Logic; Typed Lambda Calculus and Applications; Logical Methods in Computer Science; Logic in Computer Science; Algebraic & Geometric Topology; Homotopy, Homology and Applications.