

Henry Towsner (February 8, 2019)

CONTACT INFORMATION

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PROFESSIONAL EXPERIENCE

2018-Present: Associate Professor, University of Pennsylvania
2012-2018: Assistant Professor, University of Pennsylvania
2011-2012: Assistant Professor, University of Connecticut
2009-2011: Hedrick Assistant Adjunct Professor, University of California at Los Angeles
Fall 2008: Postdoctoral Fellow, Mathematical Sciences Research Institute,
Program in Ergodic Theory and Additive Combinatorics

EDUCATION

2003-2008: Carnegie Mellon University, Ph.D., Mathematical Sciences
Dissertation: *Some Results in Logic and Ergodic Theory*
Advisor: Jeremy Avigad
1999-2003: Stanford University, B.S. with honors and distinction,
Mathematical and Computational Science

GRANTS

2016-2019: National Science Foundation Research Grant,
"Proof Theory: Finite Data from Infinite Mathematics"
2010-2014: National Science Foundation Research Grant,
"Proof Theoretic Aspects of Ergodic Ramsey Theory"

PROFESSIONAL SERVICE

Member, Association for Symbolic Logic (ASL) Committee on Logic in North America, 2014-Present

Organizer, Special Session on Proof Theory, ASL North American Annual Meeting, 2018, University of Western Illinois, Macomb

Reviews Editor, Bulletin of Symbolic Logic, 2015-2017

Member, Program Committee for 13th International Conference on Computability, Complexity, and Randomness, 2018, Santiago, Chile

Member, Program Committee for 11th International Conference on Computability, Complexity, and Randomness, 2016, University of Hawaii, Manoa

Member, Program Committee for the ASL North American Annual Meeting, 2015, University of Illinois, Urbana-Champaign

Member, Program Committee for the ASL North American Annual Meeting, 2014, University of Colorado, Boulder

Organizer (with Jeremy Avigad and Ulrich Kohlenbach). "Logic and Analysis" AMS/ASL special session, American Mathematical Society (AMS) Annual Meeting, 2011, New Orleans

PUBLICATIONS

Journals (published)

“A Short Nonalgorithmic Proof of the Containers Theorem for Hypergraphs”, with A. Bernshteyn, M. Delcourt, and A. Tserunyan, *Proceedings of the American Mathematical Society*, to appear

“Proof Mining and Effective Bounds in Differential Polynomial Rings”, with W. Simmons, *Advances in Mathematics*, 343: 567–623, 2019

“Explicit Sentences Distinguishing McDuff’s Π_1 Factors”, with I. Goldbring and B. Hart, *Israel Journal of Mathematics*, 227(1): 365–377, 2018

“Relative Exchangeability with Equivalence Relations”, with H. Crane, *Archive for Mathematical Logic*, 57:533–556, 2018

“Epsilon Substitution for ID_1 via Cut-Elimination”, *Archive for Mathematical Logic*, 57:497–531, 2018

“Relatively Exchangeable Structures”, with H. Crane, *Journal of Symbolic Logic*, 83(2): 416–442, 2018

“An Inverse Ackermannian Lower Bound on the Local Unconditionality Constant of the James Space”, *Houston Journal of Mathematics*, 44: 873–885, 2018

“An Analytic Approach to Sparse Hypergraphs: Hypergraph Removal”, *Discrete Analysis*, 2018:3, 47pp, 2018

“Computable Ramsey’s Theorem for Pairs Needs Infinitely Many Π_2^0 Sets”, with Greg Igusa, *Archive for Mathematical Logic*, 56(1): 155–160, 2017

“ σ -Algebras for Quasirandom Hypergraphs”, *Random Structures & Algorithms*, 50(1): 114–139, 2017

“Separating principles below WKL_0 ”, with Stephen Flood, *Math. Logic Quarterly*, 62(6): 507–529, 2016

“Dividing and weak quasidimensions in arbitrary theories”, with Isaac Goldbring, *Archive for Mathematical Logic* 54(7-8): 915–920, 2015

“Limits of Sequences of Markov Chains”, *Electronic Journal of Probability*, 20:no. 77, 1–23, 2015

“On Maximum Conservative Extensions”, *Computability*, 4:57–68, 2015

“An Approximate Logic for Measures”, with Isaac Goldbring, *Israel Journal of Mathematics*, 199(2):867–913, 2014

“Randomness and Non-ergodic Systems”, with Johanna Franklin, *Moscow Journal of Mathematics*, 14(4):711–744, 2014

“Ultrafilters in Reverse Mathematics”, *Journal of Mathematical Logic*, 14(01):1450001, 2014

“Separating principles below Ramsey’s Theorem for Pairs”, with Manuel Lerman and Reed Solomon, *Journal of Mathematical Logic*, 13:2, 2013

“Partial Impredicativity in Reverse Mathematics”, *Journal of Symbolic Logic*, 78:459–488, 2013

“Transfinite approximation of Hindman’s theorem”, with Mathias Beiglböck, *Israel Journal of Math-*

ematics, 191:41–59, 2012

“A simple proof and some difficult examples for Hindman’s theorem”, *Notre Dame Journal of Formal Logic*, 53:53–66, 2012

“A correspondence principle for the Gowers uniformity norm”, *Journal of Logic and Analysis*, 4:4, 2012

“A combinatorial proof of the dense Hindman’s theorem”, *Discrete Mathematics*, 311:1380–1384, 2011

“Hindman’s theorem: an ultrafilter argument in second order arithmetic”, *Journal of Symbolic Logic*, 76:353–360, 2011

“Metastability in the Furstenberg-Zimmer tower”, with Jeremy Avigad, *Fundamenta Mathematicae*, 210:243–268, 2010

“Functional interpretation and inductive definitions”, with Jeremy Avigad, *Journal of Symbolic Logic*, 74:1100–1120, 2009

“Convergence of diagonal ergodic averages”, *Ergodic Theory and Dynamical Systems*, 29:1309–1326, 2009

“Ordinal analysis by transformations”, *Annals of Pure and Applied Logic*, 157:269–280, 2009

“Local stability of ergodic averages”, with Jeremy Avigad and Philipp Gerhardy, *Transactions of the AMS*, 362:261–288, 2010

“Epsilon substitution for transfinite induction”, *Archive for Mathematical Logic*, 44:397–412, 2005

“A realizability interpretation for classical analysis”, *Archive for Mathematical Logic*, 43:891–900, 2004

Journals (in press)

“An Inverse Ackermannian Lower Bound on the Local Unconditionality Constant of the James Space”, 11pp, *Houston Journal of Mathematics*

“Epsilon Substitution for ID_1 via Cut-Elimination”, 36pp, *Archive for Mathematical Logic*

“Explicit Sentences Distinguishing McDuff’s Π_1 Factors”, with Isaac Goldbring and Bradd Hart, 10pp, *Israel Journal of Mathematics*

“Relatively Exchangeable Structures”, with Harry Crane, 31pp, *Journal of Symbolic Logic*

“Relative Exchangeability with Equivalence Relations”, with Harry Crane, 23pp, *Archive for Mathematical Logic*

Journals (under review)

“Realism in Mathematics: The Case of the Hyperreals”, with Kenny Easwaran, 18pp, *Review of Symbolic Logic*

“More or Less Uniform Convergence”, 10pp, *Journal of Logic and Analysis*

“Hanf Locality and Invariant Elementary Definability”, with Steven Lindell and Scott Weinstein, 9pp, *Bulletin of Symbolic Logic*

“Constructing Sequences One Step at a Time”, 49pp, *Journal of Mathematical Logic*

“The Structure of Combinatorial Markov Processes”, with Harry Crane, 58pp, *Fundamenta Mathematicae*

Book Chapters (published)

“Towards an Effective Theory of Absolutely Continuous Measures”, in *New Studies in Weak Arithmetics* Volume 3, edited by Patrick Cégielski, Ali Enayat, and Roman Kossak, CSLI Publishing (Stanford University), 2016

“Infinitary methods in finite model theory”, with Steven Lindell and Scott Weinstein, *Logic without Borders*, a special volume in honour of Jouko Väänänen’s Sixtieth Birthday, edited by Juliette Kennedy, Roman Kossak, Tapani Hyttinen, Andrés Villaveces and Meeri Kesälä, 2014

“Priority arguments and epsilon substitution”, to appear in Solomon Feferman, Wilfried Sieg, eds., *Proofs, Categories, and Computations: Essays in Honor of Grigori Mints*, College Publications, 2010

Book Chapters (under review)

“Algorithmic Randomness in Ergodic Theory”, one of two sample chapters for a proposed book on algorithmic randomness tentatively accepted to be published in the Lecture Notes in Logic series

REVIEWS

“Review of Kahle Reinhard and Rathjen Michael, editors, Gentzen’s Centenary: The Quest for Consistency, Springer, 2015”, *Bulletin of Symbolic Logic*, 22:525–526, 2016

“Three papers on the reverse mathematics of Jullien’s Indecomposability Theorem”, *Bulletin of Symbolic Logic*, 20:366–368, 2014

“Review of Elements of Logical Reasoning by Jan von Plato”, *Mathematical Intelligencer*, 37:108–109, 2015

INVITED PRESENTATIONS IN CONFERENCES AND WORKSHOPS

“Regularity Lemmas in the Limit”, Session on Regularity Lemma, Joint Mathematics Meetings, Baltimore, January 2019

“Generalizing VC dimension to higher arity”, RaTLoCC (Ramsey Theory in Logic, Combinatorics and Complexity) 2018, Bertinoro, July 2018

“The complexity of the set of validities of a theory”, Workshop on Ramsey Theory and Computability, Rome, July 2018

“Generalizing VC Dimension to Higher Arity”, Combinatorial and Additive Number Theory, CUNY Graduate Center, May 2018

“Disentangling the complexity of Ramsey’s Theorem, the first-order part”, Session on Computability, ASL North American Annual Meeting, University of Western Illinois, May 2018

“How uniform is provable convergence?”, Mathematical Logic: Proof theory and Constructive Math-

ematics, Oberwolfach, November 2017

“How uniform is provable convergence?”, Session on Interactions Between Model Theory and Analysis and Topology, Mathematical Congress of the Americas, Montréal, July 2017

“If a sequence converges, how computable should the rate be?”, Session on Computability Theory: Pushing the Boundaries, AMS Eastern Sectional Meeting, Hunter College CUNY, May 2017

“What do ultraproducts remember about the original models”, Session on Continuous Model Theory, ASL North American Annual Meeting, Boise State University, March 2017

“Constructing Chains and Antichains in Partial Orders”, Workshop on Computability Theory, Schloss Dagstuhl, February 2017

“Hypergraph Regularity, Ultraproducts, and a Game Semantics”, ASL Winter Meeting/Joint Mathematics Meetings, Atlanta, January 2017

“Birkhoff’s ergodic theorem for measure-preserving transformations: the harder part”, with Johanna Franklin, Workshop: Algorithmic Randomness Interacts with Analysis and Ergodic Theory, Banff International Research Station CMO, December 2016

“A Concrete View of Ultraproducts”, Logic Colloquium 2016, Leeds, August 2016

“Information from Ultraproducts”, Mathematics 4 Computation, Lower Bavaria, May 2016

“Computable Information from Ultraproducts”, AMS Central Sectional Meeting, Loyola University, September 2015

“Infinite Model Theory in Finite Model Theory”, Journées sur les Arithmétiques Faibles (Weak Arithmetic Days/MAMLS), CUNY, July 2015

“Computability and Stability for the Ergodic Theorem”, SEALS, University of Florida, January 2015

“Randomness in the Limit”, Session on Model Theory and Combinatorics, Eastern Division Meeting of the American Philosophical Association, Philadelphia, December 2014

“Finitary and Infinitary Approaches to Szemerédi Regularity”, Mathematical Logic: Proof theory and Constructive Mathematics, Oberwolfach, November 2014

“(Non-)Reductions in Reverse Mathematics”, Computability Theory and Foundations of Mathematics 2014, Tokyo, February 2014

“Algorithmic Randomness in Ergodic Theory”, Session on Logic and Probability, Joint Mathematics Meetings, Baltimore, January 2014

“Pseudo-random Graphs and Structures with Good Enough Measures”, Model Theory 2013, Ravello, June 2013

“Extracting Information from Proofs of Sentences with Set Quantifiers”, MAMLS, CUNY, March 2012

“Algorithmic Randomness in Ergodic Theory”, Workshop on Computability Theory, Oberwolfach, February 2012

“Extracting complexity bounds from proofs”, Logic & Mathematics 2011, UIUC, September 2011

“Unwinding Infinitary Arguments in Combinatorics”, RaTLoCC (Ramsey Theory in Logic, Combinatorics and Complexity) 2011, Bertinoro, May 2011

“Reverse Mathematics, Ramsey Theory, and the Functional Interpretation”, Colloquium Logicum 2010, Münster, September 2010

“Amalgamation and regularity”, Session in Model Theory, Logic Colloquium '10, Paris, July 2010

“Infinite models for finite combinatorics”, ASL Annual Meeting, George Washington University, March 2010

“Hindman’s theorem: an ultrafilter proof in second-order arithmetic”, Mintsfest: A Conference in Celebration of Grigori Mints 70th Birthday, Stanford, June 2009

“How Constructive is Furstenberg’s Multiple Recurrence Theorem?”, Computability, Reverse Mathematics and Combinatorics, Banff International Research Station, December 2008

“Applications of proof theory to ergodic Ramsey theory”, Workshop in Logic, Language, and Computation, Edinburgh, Scotland, June 2008

“A constructive version of the Furstenberg structure theorem”, Methods of Proof Theory in Mathematics, Max Planck Institute, Bonn, June 2007

“Ordinal Analysis of Recursive Weak Compactness”, Session on Proof Theory and Type Theory, Logic Colloquium '06, Nijmegen, August 2006

PHD ADVISING

Simon Cho (graduating August 2017; begins postdoc at University of Michigan in fall 2017)

PhD committees: Matti Astrand (2015), Julius Poh (2015), Ying Zhan (2013), Ryan Eberhart (2013)

MS AND UNDERGRADUATE ADVISING

Keenan Friend (Honors, Mathematics, 2018)

Tianguang Zhang (MS, Mathematics, 2016)

Adam Freilich (MS, Logic, Information, and Computation, 2015)

Hannes Leipold (Honors, Logic, Information, and Computation, 2016)

TEACHING

Departmental teaching awards: Spring 2015 (Math 341: Discrete Mathematics II), Fall 2015 (Math 570: Introduction to Logic), Fall 2016 (Math 202: Proving Things (Analysis) and Math 502: Abstract Algebra I), Fall 2017 (Math 340: Discrete Mathematics)

Course coordinator: Spring 2014 (Math 103: Introduction to Calculus), Fall 2014 (Math 103: Introduction to Calculus), Fall 2015 (Math 240: Differential Equations and Linear Algebra), Fall 2017 (Math 103: Introduction to Calculus), Spring 2018 (Math 114: Calculus, part II), Fall 2018 (Math 114: Calculus, part II)

Summer course on graph theory for the Penn Summer Math Academy, Summer 2016 and Summer 2018

Received SAIL course development grant, 2014-2015

Taught an intensive three week course, “Computability and complexity”, at UCLA’s Undergraduate Summer School in Logic, July 5-July 23, 2010

Taught an intensive three week course, “First-order logic and Gödel’s incompleteness theorem”, at UCLA’s Undergraduate Summer School in Logic, July 13-July 31, 2009

Taught (with Jeremy Avigad) a two week short-course in proof theory at Notre Dame, under NSF grant “Two Conferences in Logic at Notre Dame,” June 6-17, 2005