

Thomas Lidbetter

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EDUCATION

PhD in Mathematics, London School of Economics 2009-2013

2013 Doctoral Dissertation Award, OR Society, UK
Thesis title: Hide-and-seek and other Search Games
Supervisors: Prof Steve Alpern, Prof Bernhard von Stengel

MSc in Operational Research (Distinction), London School of Economics 2007-2009

Best total mark in cohort
Dissertation: 'Using data mining techniques to analyse a large financial dataset' (Distinction)
Courses included: Search Games, Mathematical Programming, Combinatorial Optimisation, Techniques of Operational Research

Mmath in Mathematics (Part III), University of Cambridge (Trinity Hall) 2004-2005

Essay: 'The Lagrangian of a Hypergraph' (Distinction)
Courses included: Functional Analysis, Banach Spaces, Extremal Combinatorics, Probabilistic Combinatorics

MA in Mathematics (2.i), University of Cambridge (Trinity Hall) 2001-2004

AWARDS AND FUNDING

- 2019-20 – appointment as Dean's Young Research Fellow
- 2019 – Research award of \$276,587 from NSF for the project "Continuous Search and Patrolling on Networks"
- 2019 – Research award of \$141,773 from NSF for the project "Minimum-Cost Strategies for Sequential Search and Evaluation"
- 2019 – Funding of €5000 from *Fondation Mathematique Jacques Hadamard* for PGMO project "Searching with a hint" (with Spyros Angelopoulos and Steve Alpern)
- 2019 Rutgers Business School Junior Faculty Research Excellence Award
- 2016 – LSE Teaching and Learning Centre Teaching Prize
- 2015 – Funding of €7000 from *Fondation Mathematique Jacques Hadamard* for project PGMO 2015 - 2015-3831H, "Search and surveillance games: theory, algorithms and applications" (with Spyros Angelopoulos and Katerina Papadaki)
- 2013 Doctoral Dissertation Award for the most distinguished body of research leading to a doctorate in the field of Operational Research, from UK OR Society
- 2013 – LSE Department of Mathematics Class Teacher Prize
- 2011-2013 – LSE Department of Mathematics Research Studentship Award
- 2009 – Prize for best mark in cohort for MSc in Operational Research at the LSE

RESEARCH INTERESTS

Search theory and algorithms, game theory, discrete optimization, scheduling, graph processes, mathematical biology

CAREER HISTORY

- August 2022-date – Assistant Professor, Department of Engineering Systems and Environment, University of Virginia
- July 2022-date – Associate Professor (with tenure), Department of Management Science and Information Systems, Rutgers Business School
- August 2022-date – Visiting Senior Fellow, London School of Economics, Department of Mathematics
- September 2016-June 2022 – Assistant Professor, Department of Management Science and Information Systems, Rutgers Business School
- September 2016-August 2022 – Visiting Fellow, London School of Economics, Department of Mathematics
- September 2013-August 2016 – LSE Fellow, London School of Economics, Department of Management/Department of Mathematics
- September 2011 – June 2013 – Graduate Teaching Assistant, Department of Mathematics, London School of Economics
- April 2009 - September 2011 – Operational Research Analyst, Home Office, UK Civil Service
- September 2005 – June 2007 – Supervisor of Mathematics, Trinity Hall, University of Cambridge

JOURNAL ARTICLES

Alpern, S., Lidbetter, T. and Papadaki, K. (2022) Continuous Patrolling Games, *Operations Research* (in press)

Hellerstein, L. and Lidbetter, T. (2022) A game theoretic approach to a problem in polymatroid maximization, *European Journal of Operational Research*, doi.org/10.1016/j.ejor.2022.06.018

Happach, F., Hellerstein, L. and Lidbetter, T. (2022) A General Framework for Approximating Min Sum Ordering Problems, *Inform's Journal on Computing*, 34(3):1437-1452

Angelopoulos, S. and Lidbetter, T. (2020) Competitive search in a network, *European Journal of Operational Research*, 286(2):781-790

Agnetis, A. and Lidbetter T. (2020) The Largest-Z-ratio-First algorithm is 0.8531-approximate for scheduling unreliable jobs on m parallel machines, *Operations Research Letters*, 48(4):405-409

Lidbetter, T. and Lin, K.Y. (2020) A search game on a hypergraph with booby traps, *Theoretical Computer Science*, 821:57-70

Lidbetter, T. (2020) Search and rescue in the face of uncertain threats, *European Journal of Operational Research*, 285(3):1153-1160

Alpern, S. and Lidbetter, T. (2020) Search and delivery man problems: when are depth-first paths optimal? *European Journal of Operational Research*, 285(3):965-976

- Fokkink, R., Lidbetter T. and Véggh, L. (2019) On submodular search and machine scheduling, *Mathematics of Operations Research*, 44(4):1145-1509
- Lidbetter, T., Lin, K.Y. (2019) Searching for multiple objects in multiple locations, *European Journal of Operational Research*, 278(2):709-720
- Hellerstein, L., Lidbetter, T. and Pirutinsky, D. (2019) Solving zero-sum games using best response oracles with applications to search games, *Operations Research*, 67(3):731-743
- Angelopoulos, S., Dürr, C. and Lidbetter, T. (2019) The expanding search ratio of a graph, *Discrete Applied Mathematics*, 260:51-65
- Alpern, S., Lidbetter, T. and Papadaki, K. (2019) Optimizing periodic patrols against short attacks on the line and other networks, *European Journal of Operational Research*, 273(3):1065-1073
- Alpern, S. and Lidbetter, T. (2019) Approximate solutions for expanding search games on general networks, *Annals of Operations Research*, 275(2):259-279
- Bonato, A., Lidbetter, T. (2019) Bounds on the burning numbers of spiders and path-forests, *Theoretical Computer Science*, 794:12-19.
- Lidbetter, T. (2017) On the approximation ratio of the random Chinese postman tour for network search, *European Journal of Operational Research* 263(3):782-788
- Papadaki, K., Alpern, S., Lidbetter, T. and Morton, A. (2016) Patrolling a border, *Operations Research* 64(6):1256-1269
- Csóka, E. and Lidbetter, T. (2016) The solution to an open problem for a caching game, *Naval Research Logistics* 63(1):23-31
- Lidbetter, T. (2015) A caching game with infinitely divisible hidden material, *SIAM Journal on Control and Optimization* 52(5):3040-3056
- Alpern, S., Lidbetter, T. (2015) Optimal trade-off between speed and acuity when searching for a small object. *Operations Research* 63(1):122-133
- Alpern, S. and Lidbetter, T. (2014) Searching a variable speed network. *Mathematics of Operations Research*, 39(3):697-711
- Lidbetter, T. (2013) Search games with multiple hidden objects. *SIAM Journal on Control and Optimization* 51(4):3056–3074
- Alpern, S. and Lidbetter, T. (2013) Mining coal or finding terrorists: the expanding search paradigm. *Operations Research*, 61(2):265-279
- Alpern, S., Fokkink, R., Lidbetter, T. and Clayton, N. (2012) A search game model of the scatter hoarder's problem. *Journal of the Royal Society Interface*, 9(70):869-879

BOOK CHAPTERS

Lidbetter, T. (2013) Search games for an immobile hider. Alpern, S., Fokkink, R., Gasieniec, L., Lindelauf, R., Subrahmania, V.S. (ed.) *Search Theory: A Game Theoretic Perspective*, pp.17-28

CONFERENCE PROCEEDINGS

Alpern, S., Lidbetter, T., Morton, A., Papadaki, K. Patrolling a pipeline. In *International Conference on Decision and Game Theory for Security 2016* Nov 2 (pp. 129-138). Springer International Publishing.

Angelopoulos, S., Dürr, C. and Lidbetter, T. The expanding search ratio of a graph, in *The 33rd International Symposium on Theoretical Aspects of Computer Science (STACS)*, 2016

Alpern, S., Fokkink, R., Op Den Kelder, J. and Lidbetter, T. (2010) Disperse or unite? A mathematical model of coordinated attack, in *Decision and Game Theory for Security - First International Conference, GameSec 2010*, Berlin, Germany, November 22-23, 2010. Proceedings; 01/2010

WORKING PAPERS

Hellerstein, L., Lidbetter, T. and Witter, T. A Local Search Algorithm for the Min-Sum Submodular Cover Problem (submitted)

Lidbetter, T. and Xie, Y. The search and rescue game on a cycle (submitted)

Bui, T. and Lidbetter, T. New results for the continuous patrolling game (in preparation)

INVITED TALKS

- Tutorial on Search Games at 19th International Symposium on Dynamic Games and Applications, Porto, July 2022
- *A Polyhedral Approach to some Max-Min Problems*, 19th International Symposium on Dynamic Games and Applications, Porto, July 2022
- *Continuous Patrolling Games*, 7th Workshop on Stochastic Methods in Game Theory, Erice, Italy, May 2022
- *A general framework for approximating min sum ordering problems*, International Symposium on Artificial Intelligence and Mathematics (ISAIM), January 2022 (online)
- *Continuous Patrolling Games*, Graph Searching in Canada (GRASCan) Workshop, August 2021 (online)
- *Continuous Patrolling Games*, Department of Management seminar, Bar-Ilan University, Israel, June 2021 (online)
- *A Polyhedral Approach to some Max-Min Problems*, Seminar on Combinatorics, Games and Optimisation, London School of Economics, UK, May 2021 (online)
- *A Polyhedral Approach to some Max-Min Problems*, Operational Research seminar, Sorbonne University, France, March 2021 (online)
- *Search and patrolling on networks*, invited talk at meeting of Rutgers Business School Board of Advisers meeting, Newark, NJ, December 2019
- *A search games on a hypergraph with booby traps*, Department of Mathematics and School of Management, TU Munich, October 2019

- *On submodular search and machine scheduling*, Department of Mathematics and School of Management, TU Munich, October 2019
- *When is depth-first search optimal?*, Operations Research Seminar Series, Naval Postgraduate School, Monterey, CA, USA, May 2019
- *Finite search games with multiple targets*, HEC Montreal, Canada, November 2018
- *Search theory and machine scheduling*, Operations Research Seminar Series, Naval Postgraduate School, Monterey, CA, USA, July 2018
- *Burning spiders, forests and more: graph burning as a model of social contagion*, Seminar on Combinatorics, Games and Optimisation, London School of Economics, UK, June 2018
- *Games of hide-and-seek with balls in boxes*, Rutgers Discrete Mathematics Seminar, Rutgers University, NJ, USA, April 2018
- *Search theory and machine scheduling*, ORMS Seminar, Warwick Business School, UK, November 2017
- *Submodular search and machine scheduling*, CSE Seminar, New York University, NY, USA, September 2017
- *Using a best response oracle to solve search games*, Operations Research Seminar Series, Naval Postgraduate School, Monterey, CA, USA, May 2017
- *Using a best response oracle to solve search games on graphs*, Graph Search Theory and Applications, Anogia, Crete, Greece, April 2017
- *Mining coal or finding terrorists: the expanding search paradigm*, Paris Game Theory Seminar, France, March 2017
- *Mining coal or finding terrorists: the expanding search paradigm*, Rutgers Industrial Engineering Department Seminar Series, New Brunswick, NJ, January 2017
- *Searching for many hidden objects*, Department of Management Science and Information Systems, Rutgers Business School, New Jersey, USA, March 2016
- *Searching for many hidden objects*, Department of Operations Research, Naval Postgraduate College, Monterey, California, USA, March 2016
- *Searching for many hidden objects*, Department of Industrial and Systems Engineering, University of Southern California, Los Angeles, USA, February 2016
- *The expanding search ratio of a graph*, 7th Workshop on Graph Search, Theory and Applications, Montreal, Canada, October 2015
- *Search games with submodular payoff functions*, Mathematical Sciences Seminar, Birkbeck, University of London, October 2015
- *The expanding search ratio of a graph*, 27th European Conference on Operational Research, University of Strathclyde, July 2015
- *Search games with submodular payoff functions*, Workshop on Search Games and Rendezvous, The Shard, London, July 2015
- *Optimal search for a small (or well hidden) object*, Department of Mathematics, Technical University of Delft, Netherlands, February 2015
- *Optimal search for a small (or well hidden) object*, International Conference on Applied Mathematical Optimization and Modeling, University of Warwick, UK, April 2014
- *Expanding search on a network*, 6th Workshop on Graph Searching, Theory and Applications, Institut d'Etudes Scientifiques de Cartèse, Corsica, France, April 2014
- *A caching game with continuous hiding material and continuous search effort*, Workshop on Game Theory and Computational Complexity, University of Strathclyde, UK, March 2014
- *Optimal search for a small (or well hidden) object*, Management Science Seminar, London School of Economics, UK, October 2013

- *A search game model of the speed-acuity trade-off*, Conference on Mathematical Models of Ecology and Evolution, University of York, UK, August 2013
- *Optimal search for a small (or well hidden) object*, European Conference on Operational Research, Rome, Italy, July 2013
- *Search games with multiple hidden objects*, Karlsruher Institut für Technologie, Operations Research Colloquium, Germany, January 2013
- *A game theoretic approach to geographic profiling*. OR Society Criminal Justice Special Interest Group seminar, London, UK, June 2012
- *Searching for multiple hidden objects*. Optimization and Incentives Seminar, Statistical Laboratory, University of Cambridge, UK, June 2012
- *Expanding search for one or more hiders*. Workshop on Search and Rendezvous, Lorentz Centre, Netherlands, May 2012
- *Expanding search for an immobile hider on a network*, Department of Mathematics Lunchtime Seminar, London School of Economics, UK, October 2011
- *A search game model of terrorist attack*, Knowledge Sharing Seminar, Home Office, UK, September 2011

OTHER TALKS

- *Continuous patrolling games*, INFORMS conference on security, Arlington, VA, August 2022
- *A Polyhedral Approach to some Max-Min Problems*, INFORMS annual meeting, Anaheim, CA, October 2021
- *A Polyhedral Approach to some Max-Min Problems*, 31st European Conference on Operational Research, July 2021
- *Search and Rescue in the Face of Uncertain Threats*, INFORMS annual meeting, November 2020 (online)
- *A search game on a hypergraph with booby traps*, LSE-Warwick Workshop on Search Games, London, UK, June 2019
- *On submodular search and machine scheduling*, MAPSP (Workshop on Models and Algorithms for Planning and Scheduling Problems), Netherlands, June 2019
- *On submodular search and machine scheduling*, 5th Rutgers Applied Probability Conference, Newark NJ, November 2018
- *On submodular search and machine scheduling*, INFORMS annual meeting, Phoenix, AZ, November 2018
- *Bounds on the burning numbers of spiders and path-forests*, 9th Workshop on Graph Searching: Theory and Applications, Berlin, Germany, September 2018
- *Dynamic search for balls hidden in boxes*, 18th Symposium on Dynamic Games and Applications, Grenoble, France, July 2018
- *Searching for multiple objects in multiple locations*, Workshop on Search Games and Rendezvous, London, UK, July 2017
- *The expanding search ratio of a graph*, INFORMS annual meeting, Nashville, TN, November 2016
- *The expanding search ratio of a graph*, 27th International Conference on Game Theory, Stony Brook, NY, July 2016
- *Search games with a submodular payoff function*, Discrete Mathematics and Game Theory Seminar, London School of Economics, London, UK, November 2015
- *Optimal search for a small (or well hidden) object*, 8th International Conference on Game Theory for Management, St Petersburg, Russia, June 2014

TEACHING

University of Virginia

- 2022-23
 - *Game Theoretic Methods for Strategic Decision Making* (joint undergraduate and graduate course)

Rutgers Business School

- 2021-22
 - *Game Theoretic Methods for Strategic Decision Making* (graduate course)
 - *Linear Programming* (graduate course)
- 2020-21
 - *Introduction to Probability* (graduate course)
 - *Introduction to Probability and Applications* (DBA course)
 - *Introduction to Business Research Methods* (undergraduate class)
- 2019-20
 - *Stochastic calculus for finance* (graduate course)
- 2018-19
 - *Introduction to Probability* (graduate course)
 - *Linear Programming* (graduate course)
 - *Game Theory* (graduate course)
- 2017-18
 - *Introduction to Probability* (graduate course)
 - *Introduction to Business Research Methods* (undergraduate course)
- 2016-17
 - *Game Theory* (new graduate course)
 - *Introduction to Probability* (graduate Course)
 - *Introduction to Business Research Methods* (undergraduate course)

London School of Economics

- 2015-16
 - Course leader, lecturer, seminar/class teacher for postgraduate/3rd year undergrad. course, MA402/MA301, *Game Theory*
 - Course leader, lecturer, seminar teacher for postgrad course, MA419, *Search Games*
 - Course leader, lecturer and class teacher for 3rd year undergrad. course, MA316, *Graph Theory*
- 2014-15
 - Course leader, lecturer and class teacher for 3rd year undergrad. course, MG313, *Practical Optimisation Modelling*
 - Course leader, lecturer and seminar teacher for postgrad. course, OR428, *Model Building in Mathematical Programming*.

- 2013-14
 - Class teacher for 3rd year undergrad. course, OR301, *Model Building in Operational Research*
 - Seminar teacher for postgrad. course, OR428 *Model Building in Mathematical Programming*
- 2011-13
 - Class teacher for third year undergraduate course, MA300/301 *Game Theory*
 - Class teacher for first year undergraduate course, MA103 *Introduction to Abstract Mathematics*

University of Cambridge

- 2005-2007 – Taught mathematics to first year undergraduates in small groups of 2 or 3, graded student assignments

SERVICE

Doctoral candidates supervised:

- Christy Bui, Rutgers Business School (Fall 2020 – present)
- Yifan Xie, Rutgers Business School (Fall 2018 – Spring 2020)

On doctoral thesis committees for:

- Bryan Smith (ESE Department, University of Virginia)
- Denghui Zhang (MSIS Department, Rutgers Business School)
- Felix Happach (Department of Mathematics and School of Management, Technical University of Munich)
- Tavish Tejas (Accounting Department, Rutgers Business School)
- Farid Razzak (MSIS Department, Rutgers Business School)
- Peter Mursic (MSIS Department, Rutgers Business School)
- Yanchi Liu (MSIS Department, Rutgers Business School)
- Junming Liu (MSIS Department, Rutgers Business School)
- Pedro Gerum (ISE Department, Rutgers University, New Brunswick)
- Abdolmajid Yolmeh (ISE Department, Rutgers University, New Brunswick)

MSIS seminar organizer, September 2016-present, except Fall 2019 (jointly, with Mert Gurbuzbalaban).

Gave a presentation on my research at the RBS Board of Advisers meeting, Newark, NJ, December 2019

Representative for MSIS department for:

- MBA and graduate programs virtual open house, Rutgers Business School, April 19th 2020
- MBA and graduate programs open house, Rutgers Business School, Newark, September 24th 2018
- Admitted Student Day, Rutgers Business School, Newark, April 22nd 2017
- MBA and graduate programs open house, Rutgers Business School, Newark, April 8th 2016

Represented RBS in meeting for AACSB accreditation (March 2019)

Other professional experience

- July 2022 – Session organizer of “Search and Patrolling Games” at International Symposium on Dynamic Games and Applications 2022, Porto, Portugal
- January 2022 – Session organizer of “Sequencing, Sequential Decision Making and Scheduling”, International Symposium on Artificial Intelligence and Mathematics (ISAIM) 2022 (online)
- November 2020 – Session organizer of “Search Games” session in INFORMS annual meeting
- June 2019 – Organizer for workshop on Search Games and Rendezvous, London School of Economics, UK
- November 2018 – Program Committee member for 5th Rutgers Applied Probability Conference
- July 2017 – Organizer for workshop on Search Games and Rendezvous, Warwick Business School, The Shard, London, UK
- June 2016 – Organizer for workshop on Search Games: Theory and Algorithms, Lorentz Center, Netherlands
- July 2015 – Organizer for Workshop on Search Games and Rendezvous, Warwick Business School, The Shard, London, UK
- December 2014 – Programme committee member for IMA Conference on Game Theory and its applications, St Anne’s College, University of Oxford, UK
- April 2014 - Session organiser for International Conference on Applied Mathematical Optimization and Modeling, Warwick Business School, UK
- August 2013 - Session organiser for Mathematical Models of Ecology and Evolution Conference, University of York, UK
- 2016 – Examiner for University of London
- 2012-2016 – Assistant examiner for University of London
- 2016-date – Member of INFORMS

Referee for:

Algorithmica, Mathematics of Operations Research, Operations Research, INFORMS Journal on Computing, Discrete Applied Mathematics, Multiple Criteria Decision Making, SIAM Journal on Optimization, Journal of Combinatorial Optimization, Dynamic Games and Applications, Conference on Web and Internet Economics (WINE), Conference on Learning Theory (COLT), Theoretical Computer Science, Annual ACM Symposium on Theory of Computing (STOC), Transactions on Algorithms, Bulletin of the Malaysian Mathematical Sciences Society, Mathematical Methods in the Applied Sciences, International Game Theory Review, Annals of Operations Research, Networks, Theory and Decision, Naval Research Logistics, Probability in the Engineering and Informational Sciences, IIE Transactions, OR Spectrum, European Journal of Operations Research, International Journal of Game Theory, The Australasian Journal of Combinatorics