

## Curriculum Vitae of Lorenzo Carlucci

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### Degrees

**Ph.D. in Computer Science**, May 2006, Dept. of Computer and Information Sciences, University of Delaware, Newark, DE, U.S.A. Title: *Cognitively-motivated results in Algorithmic Learning Theory*, Advisor: Prof. John Case.

**Ph.D. in Mathematical Logic and Theoretical Computer Science**, February 2006, Dept. of Mathematics, University of Siena, Siena, Italy. Title: *Some results on unprovable theorems*. Advisor: Prof. Franco Montagna. External Referees: Prof. Lev Beklemishev, Prof. Herman R. Jervell. Distinction: Excellent.

**Diplome in Philosophical Disciplines**, *Summa Cum Laude*, January 2000, Scuola Normale Superiore di Pisa, Pisa, Italy. Title: *Ennio De Giorgi's theories for the Foundations of Mathematics*. Advisors: Prof. Marco Forti, Prof. Ettore Casari.

**Laurea in Philosophy** (quadriennale), *Summa Cum Laude*, November 1999, Pisa University, Pisa, Italy. Title: *Independence proofs of Kirby-Paris' Hydra Theorem from Peano Arithmetic*. Advisors: Prof. Marco Forti (Dept. of Mathematics, University of Pisa), Prof. Enrico Moriconi (Dept. of Philosophy, University of Pisa).

### Positions

from January 2009: **Assistant Professor** (Ricercatore), University of Rome La Sapienza, Computer Science Department.

2007–2008: **Post-Doc** (Assegnista di Ricerca), University of Rome La Sapienza, Computer Science Department.

2007–2008: **Research Fellow** of the Scuola Normale Superiore di Pisa.

Spring 2003–Spring 2005: **Research Assistant** and **Teaching Assistant**, University of Delaware, Dept. of Computer and Information Sciences, Newark, DE, U.S.A.

### Research

I work mostly in two areas: **proof theory of arithmetic and analysis** and **computability-theoretic learning theory**. In the first area I have worked on Reverse Mathematics and independence results from systems of arithmetic and analysis, and on the connection between classical combinatorics (e.g., Ramsey Theory, well-quasi-ordering theory, Braid groups, Banach Space Theory, Hindman's Theorem) and unprovability results. In the second area I worked on a number of new learning paradigms in the context of inductive learning theory with a special emphasis on non-monotonic learning and on models featuring the use of notations for transfinite ordinal numbers. I also have an interest in Propositional Proof Complexity.

My work on the proof-theoretic and computational strength of combinatorial theorems has appeared in the **Proceedings of the London Mathematical Society**, the **Journal of Combinatorial Theory Series A**, and the **Journal of Symbolic Logic**. My work in learning theory has appeared in the **Journal of Symbolic Logic**, the **Journal of Computer and Systems Science**, **Information and Computation**, and has been presented at the major conferences of the field such as **COLT** and **ALT**. My only paper in Complexity Theory so far (joint with Galesi and Lauria) appeared in 2011 in the reference conference **CCC** and a journal version in the **ACM Transactions on Computational Logic**. I collaborated with prominent researchers in my research areas such as, e.g., Andreas Weiermann (University of Ghent), Patrick Dehornoy (University of Caen), Sanjay Jain, and Frank Stephan (University of Singapore).

## Teaching

2007–2016: University of Rome La Sapienza, Dept. of Computer Science, *Programmazione 2* (Undergraduate, TA in charge of exercises and exams), *Introduzione agli algoritmi* (Undergraduate, TA in charge of exercises and exams), *Progettazione di Sistemi digitali* (Undergraduate, TA in charge of exercises and exams), *Metodi matematici per l'informatica* (Undergraduate, TA in charge of lectures and exams), *Logica Matematica per Informatica* (Graduate, Head instructor), *Elective in Computational Learning Theory* (Graduate, Head instructor), *Fondamenti di Programmazione* (Undergraduate, TA in charge of lab).

2007: *Introduzione alla Teoria degli Insiemi* (PhD course, Head instructor), Scuola Normale Superiore di Pisa.

Spring 2003–Spring 2005: Teaching Assistant, University of Delaware, Dept. of Computer and Information Sciences, Newark, DE, U.S.A. *Introduction to Computer Science* (CISC 181, Undergraduate), *Bioinformatics* (CISC 667, Graduate), *Data Structures* (CISC 220, Undergraduate).

## Journal papers

1. L. Carlucci, *A new proof-theoretic proof of the independence of Kirby-Paris' Hydra Theorem*, **Theoretical Computer Science**, 300, (2003), 365–378.
2. L. Carlucci, *Worms, Gaps and Hydras*, **Mathematical Logic Quarterly**, 51:4, (2005), 342–350.
3. L. Carlucci, S. Jain, E. Kinber and F. Stephan, *Variations on U-shaped learning*, **Information and Computation**, 204:8, (2006), 1264–1294.
4. L. Carlucci, J. Case, S. Jain and F. Stephan, *Results on memory-limited U-shaped learning*, **Information and Computation**, 205:10, (2007), 1551–1573.
5. L. Carlucci, J. Case, S. Jain and F. Stephan, *Non-U-shaped vacillatory and team learning*, in **Journal of Computer and System Sciences**, 74:4, (2008), 409–430.
6. L. Carlucci, J. Case and S. Jain, *Learning Correction Grammars*, **Journal of Symbolic Logic**, 74:2, (2009), 489–516.
7. L. Carlucci, G. Lee and A. Weiermann, *Classifying the phase transition threshold for regressive Ramsey numbers*, **Journal of Combinatorial Theory, Series A**, 118:2, (2011), 558–585.
8. L. Carlucci, P. Dehornoy and A. Weiermann, *Unprovability results involving braids*, **Proceedings of the London Mathematical Society**, 102:1, (2011), 159–192.
9. L. Carlucci, S. Jain and F. Stephan, *Learning with ordinal-bounded memory from positive data*, **Journal of Computer and System Sciences**, 78, (2012), 1623–1636.
10. L. Carlucci and J. Case, *On the necessity of U-shaped learning*, Invited paper in **Topics in Cognitive Science**, 5, (2013), 56–88, Special issue on *Why Formal Learning Theory matters for Cognitive Science*.
11. L. Carlucci, K. Zdanowski, *The strength of Ramsey's Theorem for coloring relatively large sets*, **Journal of Symbolic Logic**, 79:1, (2014), 89–102.
12. L. Carlucci, N. Galesi and M. Lauria, *On the Proof Complexity of Paris-Harrington and Off-Diagonal Ramsey Tautologies*, *ACM Transactions on Computational Logic* 17(4), (2016).

## Refereed conference papers

1. L. Carlucci, J. Case, S. Jain and F. Stephan, *Non U-shaped vacillatory and team learning*, Proceedings of the **Annual Conference on Algorithmic Learning Theory**, ALT 2005, *Lecture Notes in Artificial Intelligence*, n. 3734, 241–255, Springer.

2. L. Carlucci, S. Jain, E. Kinber and F. Stephan, *Variations on U-shaped learning*, in P. Auer, R. Meir (eds.), *Learning Theory, Proceedings of the 18th Annual Conference on Computational Learning Theory*, COLT 2005, *Lecture Notes in Computer Science*, n. 3559, 382–397, Springer 2005.
3. L. Carlucci, J. Case, S. Jain and F. Stephan, *Memory-Limited U-Shaped Learning*, in J. G. Carbonell, J. Siekmann (eds.), *Learning Theory, Proceedings of the 19th Annual Conference on Computational Learning Theory*, COLT 2006, *Lecture Notes in Computer Science*, n. 4005, 244–258, Springer 2006.
4. L. Carlucci, J. Case and S. Jain, *Learning Correction Grammars*, in N. H. Bshouty and C. Gentile (eds.), *Proceedings of the 20th Annual Conference on Computational Learning Theory*, COLT 2007, *Lecture Notes in Computer Science*, n. 4539, 203–217, Springer 2007.
5. L. Carlucci, *Incremental Learning with ordinal bounded example memory*, in R. Gavalda and G. Lugosi, T. Zeugmann, and S. Zilles, (eds.), *Proceedings of the 20th Annual Conference on Algorithmic Learning Theory*, ALT 2009, Porto, Portugal, 2009, 323–337, *Lecture Notes in Artificial Intelligence*, n. 5809, Springer Verlag, 2009.
6. L. Carlucci, N. Galesi, M. Lauria *Paris-Harrington Tautologies*, in (eds.), *Proceedings of IEEE Conference on Computational Complexity 2011, CCC 2011*, San José, USA, 2011, 93–103.
7. L. Carlucci, K. Zdanowski, *A note on Ramsey Theorems and Turing Jumps*, accepted for publication in *Proceedings of the Turing Centenary Conference, CiE 2012*, Cambridge, UK, 2012.

#### Submitted papers

1. L. Carlucci, *A weak variant of Hindman’s Theorem stronger than Hilbert’s Theorem*. Submitted to **Archive for Mathematical Logic**.
2. L. Carlucci, *Weak Yet Strong restrictions of Hindman’s Finite Sums Theorem*. Submitted to **Proceedings of the American Mathematical Society**.
3. L. Carlucci, L.A. Kolodziejczyk, F. Lepore, K. Zdanowski, *New bounds on the strength of restrictions of Hindman’s Finite Sums Theorem*. Submitted to **Computability in Europe 2017**.

#### Conferences

- June 2012 - Contributed paper at *Computability and Complexity in Analysis CCA 2012*. Title: *The strength of Ramsey Theorem for coloring relatively large sets* (joint with K. Zdanowski).
- June 2012 - Contributed paper at *Turing Centenary Conference CiE 2012*. Title: *A note on Ramsey Theorems and Turing Jumps* (joint with K. Zdanowski).
- July 2011 - Contributed paper at **CCC 2011**. Title: *Paris-Harrington Tautologies* (joint with N. Galesi and M. Lauria).
- June 2009 - Contributed paper at **ALT 2009**. Title: *Incremental Learning with Ordinal-Bounded Example Memory*.
- June 2007 - Contributed paper at **COLT 2007**. Title: *Learning Correction Grammars* (joint with J. Case and S. Jain).
- June 2006 - Contributed paper at **COLT 2006**. Title: *Memory-Limited U-shaped Learning* (joint with J. Case, S. Jain and F. Stephan).

October 2005 - Contributed paper at **ALT 2005**. Title: *Non U-shaped Vacillatory and Team Learning* (joint with J. Case, S. Jain and F. Stephan).

June 2005 - Contributed paper at **COLT 2005**. Title: *Variations on U-shaped learning* (joint with E. Kinber, S. Jain and F. Stephan).

August 2004 - Poster at **SMP 2004** (37th Annual Meeting of the Society for Mathematical Psychology). Title: *U-shaped learning may be necessary* (abstract appeared in the Journal of Mathematical Psychology vol. 49, 2005).

### Invited Talks

September 2016 - invited talk at the *Workshop on Proof Theory, Modal Logic and Reflection Principles*, Tbilisi, Georgia Monday, September 5 – Friday, September 9, 2016. (declined).

January 2016 - invited talk at the conference *New Challenges in Reverse Mathematics*, 3 – 16 January 2016, National University of Singapore, Singapore. (declined).

September 2014 - invited talk at the *Proof Theory, Modal Logic and Reflection Principles*, Instituto Tecnológico Autnomo de Mxico, Mexico City, Mexico, September 29 - October 2, 2014. (declined).

July 2012 - invited talk at the *Model Theory and Proof Theory of Arithmetic*, Institute of Mathematics of the Polish Academy of Science, Bedlewo, Poland, 22-27 July, 2012. Title: *Three results related to the Paris-Harrington Theorem*.

June 2012 - invited talk at the *Latin American Symposium on Mathematical Logic*, Bogotá, Colombia (invitation declined).

April 2012 - invited talk at the Workshop *Proof Theory and Modal Logic*, University of Barcelona, Spain. Title: *On Ramsey Theorems and Turing Jumps*.

September 2011 - invited talk at the Workshop *Automata Theory and Applications*, Institute of Mathematical Sciences, National University of Singapore, Singapore (declined).

March 2011 - *Paris-Harrington Tautologies*, invited talk at the Workshop *New Trends in Unprovability*, Department of Pure Mathematics and Computer Algebra, University of Ghent, Ghent, Belgium.

November 2007 - *Unprovability after Gödel*, invited talk at the Department of Computer Science, University of Rome, Rome, Italy.

April 2007 - *Unprovability and unlearnability results*, invited talk at the Department of Computer Science, University of Liverpool, Liverpool, UK.

December 2007 - *Independence results for first order Peano Arithmetic and its subsystems*, invited talk at the Department of Pure Mathematics and Computer Algebra, University of Ghent, Ghent, Belgium.

April 2006 - *Phase transitions for old and new independence results*, invited presentation for the Gödel Centenary: Young Scholars' Competition, University of Vienna, Vienna, Austria.

November 2004 - *Ordinals and Independence Results in Learning Theory*, invited talk, Dept. of Mathematics, University of Utrecht, Utrecht, The Netherlands.

November 2004 - *U-shaped learning may be necessary*, invited talk, Dept. of Philosophy, University of Utrecht, Utrecht, The Netherlands.

March 2004 - *On the necessity of U-shaped learning*, invited talk, SIG-Theory Seminar, Dept. of Computer and Information Sciences, University of Delaware, Newark DE, U.S.A.

October 2002 - *Introduction to Computational Learning Theory*, invited seminar, Dept. of Philosophy, University of Pisa, Italy.

May 2001 - *Gentzen's consistency proof*, invited seminar, Dept. of Philosophy, University of Pisa, Italy.

May 2000 - *Introduction to non-standard models of Peano Arithmetic*, invited seminar, Dept. of Philosophy, University of Pisa, Italy.

### Other Professional Activities

**Organizer** of the third Bertinoro workshop *Ramsey Theory in Logic, Combinatorics and Complexity*, Fall 2017, (co-organizers: Nicola Galesi, Mauro Di Nasso, William Gasarch).

**Organizer** of the conference *Limits of Theorem proving 2012*, Rome 25–27 September (co-organizers: Olaf Beyersdorff, Nicola Galesi, Toniann Pitassi).

**Organizer** of the second Bertinoro workshop *Ramsey Theory in Logic, Combinatorics and Complexity 2011* (co-organizers: Nicola Galesi, Pavel Pudlák, Vojtech Rödl, Matteo Viale, Andreas Weiermann).

**Organizer** of the first Bertinoro Workshop *Ramsey Theory in Logic, Combinatorics and Complexity 2009*. (co-organizers: Nicola Galesi, Pavel Pudlák, Andreas Weiermann).

**Organizer** of an Oberwolfach miniworkshop (0648b) *Logic, Combinatorics and Independence Results* (26.11.06–02.12.06).

**Reviewer** for **Mathematical Reviews**, and for **Zentralblatt**.

**Referee** for **Journal of Computer and Systems Science**, **Bulletin of Symbolic Logic**, **Archive for Mathematical Logic**, **Logical Methods in Computer Science**, **Annals of Pure and Applied Logic**, **Logic Journal of the IGLP**, **Theoretical Computer Science**, **Journal of Symbolic Logic**, and conferences **SAT**, **CCC**, **TAMC** and **CiE**.

**External Referee** for the Ph.D. thesis of Michiel De Smet, *Unprovability and phase transitions in Ramsey Theory*, discussed June 2011, Department of Pure Mathematics and Computer Algebra, University of Ghent, Belgium.

**External Referee** for the Ph.D. thesis of Florian Pelupessy, *Connecting the provable with the unprovable*, November 2012, Department of Pure Mathematics and Computer Algebra, University of Ghent, Belgium.

**Referee** for the MS Thesis in Computer Science of Marcello Stanisci, *Sulla complessità dei teoremi Thin-Set e Free-Set di Friedman*, September 2013, La Sapienza.

**Referee** for the MA Thesis in Philosophy of Giandomenico Laviola, *Complessità computazionale e definibilità logica*, March 2013, University of Rome III.

**Referee** for the BS Thesis in Computer Science of Francesco Lepore, *The effective content and logical strength of Hindman's Finite Sums Theorem*, December 2016, La Sapienza.

**Referee** for the MS Thesis in Computer Science of Leonardo Mainardi, *On the Adjacent Ramsey's*

*Theorem*, To Be Completed, La Sapienza.

**Referee** for Honors students project of Vincenzo Botta, and “Attività formativa complementare” for Manuel Mauro and Roberto Ruccia.

### **Awards, Funding and Grants**

- 2008 Research Project “Shadows of Infinity” selected for full funding in the context of the invitation-only RFP “Exploring the Infinite, Phase I: Mathematics and Mathematical Logic” by the John Templeton Foundation (100 invitees worldwide, approx. 1/5 funded, of which approx. 30% funded for full amount requested).
- 2007 Winner of a Telecom Italia “Progetto Italia” Fellowship (approx. 75.000 EU for 2 years), awarded through national competition, for research in Mathematical Logic at the Scuola Normale Superiore di Pisa.
- 2006 Selected as one of the ten finalists for the prize *Kurt Gödel Centenary: Young Scholars’ Competition*, organized by the Kurt Gödel Society. Award date: 04.28.06.
- 2003–2006 Research Assistant, Teaching Assistant, Dept. of Computer and Information Sciences, University of Delaware, Newark DE, U.S.A., (NSF-Grant CCR-0208616).
- 2002–2006 Funded Ph.D. student in Mathematical Logic and Theoretical Computer Science, Dept. of Mathematics, University of Siena, Siena, Italy. Classified first in national competition.
- 2000–2001 Funded Ph.D. student in Philosophy (spec. Logic), Scuola Normale Superiore di Pisa, Pisa, Italy. Classified first in national competition. Resigned position.
- 1994–1999 Funded undergraduate fellow of the Scuola Normale Superiore di Pisa, Class of Philosophy. Fellowship awarded through national competition.

### **Skills**

- Languages: English (excellent), French (excellent), German (intermediate).
- Computer Skills: C, C++, Perl, Lisp, Unix, L<sup>A</sup>T<sub>E</sub>X, HTML, CSS.