

**ON THE DEVELOPMENT OF LOGIC IN BRAZIL II: INITIATIVES IN BRAZIL
RELATED TO LOGIC AND BRAZILIAN RESEARCH GROUPS DEDICATED TO LOGIC**

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Abstract

This article presents the second part of a historical overview of the development of logic in Brazil, and describes the development of contemporary logic in the country with an emphasis on its socio-institutional and interdisciplinary aspects. The first part of this historical overview appeared in the previous number of this journal, concerning the early logic studies, and the path to contemporary logic in Brazil. In an attempt to capture the various dimensions of the cultivation of logic in Brazil, we describe recognized groups for teaching and research on logic in the country, their areas of expertise, the periodicals and series of books edited by research centers devoted to logic, and the regular events organized by these centers. Both papers do not present or discuss the content of the research, or the specific results, of logicians or groups of researchers dedicated to logic in the country.

Keywords: The development of logic in Brazil, Second part, Recent initiatives, Brazilian Logic Conferences (EBLs), Latin American Symposia on Mathematical Logic (SLALMs), The Workshops on Logic, Language, Information and Computation (WoLLICs), Journals and books on logic, Brazilian research groups, Contemporary logic.

**[SOBRE O DESENVOLVIMENTO DA LÓGICA NO BRASIL II: INICIATIVAS NO BRASIL
RELACIONADAS COM A LÓGICA E GRUPOS BRASILEIROS**

DE PESQUISA DEDICADOS À LÓGICA]

Resumo

Este artigo apresenta a segunda parte de um panorama histórico do desenvolvimento da lógica no Brasil, procurando caracterizar o desenvolvimento da lógica contemporânea no país, com ênfase no aspecto histórico sócio-institucional e na interdisciplinaridade. A primeira parte deste panorama histórico foi publicada no número anterior deste periódico, com uma sucinta introdução sobre o desenvolvimento da lógica no cenário luso-brasileiro e o trabalho precursor dos primeiros autores (e grupos) brasileiros que podem ser considerados lógicos. É dado destaque especial ao eclodir da pesquisa original em lógica no Brasil. Procurando captar as várias dimensões do cultivo da lógica no Brasil, são aqui mencionados grupos reconhecidos de ensino e pesquisa em lógica no país e suas áreas de atuação, além de periódicos e coleções de livros editados pelos núcleos dedicados à lógica, e de eventos regulares organizados por esses grupos. Os dois artigos não pretendem apresentar, ou discutir, a produção e resultados específicos de pesquisa dos lógicos ou dos centros dedicados à lógica no País.

Palavras-chave: Desenvolvimento da lógica no Brasil, Segunda parte, Iniciativas recentes, Encontros Brasileiros de Lógica (EBLs), Simpósios Latinoamericanos de Lógica Matemática (SLALMs), Workshops em Lógica, Linguagem, Informação e Computação (WoLLICs), Periódicos e livros sobre lógica, Grupos brasileiros de pesquisa, Lógica contemporânea.

1. Recent initiatives in Brazil related to logic

1.1. Recent EBLs and SLALMs

The 13th EBL was held at Unicamp in 2003 in conjunction with a colloquium commemorating the 25th anniversary of CLE (Colóquio CLE 25 ANOS). This joint event took place with the usual participation of Brazilians, members of CLE, Latin Americans, and illustrious invitees of other nationalities. Special homage was paid to Oswaldo Porchat Pereira, the founder of CLE, with the launching of the book *O Filósofo e sua História: uma homenagem a Oswaldo Porchat*, volume 36 of the *Coleção CLE*, edited by Michael B. Wrigley and Plínio J. Smith.¹ The EBL was dedicated to Antonio Mário Sette, who died in 1998, the memorial lectures being delivered by Itala M. Loffredo D'Ottaviano and Xavier Caicedo. The proceedings were published in two volumes by the *Journal of the Interest Group in Pure and Applied Logics* under the title *An Event on Brazilian Logic*, edited by Walter A. Carnielli, Marcelo E. Coniglio, and Itala M. Loffredo D'Ottaviano.²

¹ See (SMITH and WRIGLEY, 2003).

² See (CARNIELLI, CONIGLIO and D'OTTAVIANO, 2004, 2005).

The 12th SLALM was realized in San José, Costa Rica, in 2003, coordinated by Jorge I. Guier Aosta. Since then, along with the support of the Association for Symbolic Logic, the SLALMs have received the financial support of the National Science Foundation (USA).

The 14th EBL was realized in Itatiaia, Rio de Janeiro, in 2006, with introductory tutorials and the expressive participation of students, Brazilian and Latin American logicians, and other invited participants. During the event, a special volume was released of the journal *Manuscrito*, edited by Walter A. Carnielli and entitled *Logic and Philosophy of the Formal Sciences – a festschrift for Itala M. Loffredo D'Ottaviano*.³

The 13th SLALM occurred in Oaxaca Mexico in 2006, coordinated by José Alfredo Amor.

The 15th EBL was again organized by the CLE. From May 11 to 17, 2008, a joint EBL/SLALM event was held for the first time: CLE 30 ANOS – 15th Brazilian Logic Conference / 14th Latin American Symposium on Mathematical Logic. The conference, organized by CLE and by the Brazilian Logic Society, received support from the Association for Symbolic Logic, which for the first time, aside from institutional support, provided financial aid to student participants.

This joint event was coordinated by Walter A. Carnielli, Marcelo E. Coniglio, and Itala M. Loffredo D'Ottaviano. During the preceding week, from May 7 to 9, CLE hosted the traditional Logic School, with approximately 50 participants from institutions in Brazil and the rest of Latin America, as well as European and American students. Six tutorials were held: Aristotle's underlying logic, by John Corcoran (State University of New York at Buffalo, USA); Translations between logics, by Itala M. Loffredo D'Ottaviano (CLE-Unicamp); Possible-translations semantics, by Walter A. Carnielli (CLE-Unicamp); Combining logics, by Marcelo E. Coniglio (CLE-Unicamp); Algebraic aspects of substructural logics, by Roberto Cignoli (Universidad de Buenos Aires, Argentina); and Logic and information, by Jaakko Hintikka (Boston University, USA).

The event opened on May 11 in Paraty, Rio de Janeiro, with the presence of prominent researchers from the international scientific community. Approximately 180 students and researchers from Brazil and from several Latin American countries (Argentina, Colombia, Mexico, Uruguay and Venezuela), the United States, Belgium, Holland, Italy, and Poland participated in the meeting, exceeding the numbers of all previous SLALMs. More than 80 communications were received.

Extended abstracts of the articles were published by *CLE e-Prints* (vol. 8 (6), 2008), and abstracts and a report on the event were published by the ASL in the *Bulletin of Symbolic Logic*.⁴ The proceedings of the event, edited by Walter A. Carnielli, Marcelo E. Coniglio, and Itala M. Loffredo D'Ottaviano, were published by College Publications (London) in the *Studies in Logic* series (vol. 21, 2009), under the title *The Many Sides of Logic*.⁵

³ See (CARNIELLI, 2005).

⁴ *Bulletin of Symbolic Logic*, vol. 15 (3), Sep. 2009. p. 332-376.

⁵ See (CARNIELLI, CONIGLIO and D'OTTAVIANO, 2009a).

1.2. The WoLLICs

The series of regular annual events known as the WoLLICs (Workshops on Logic, Language, Information, and Computation), now in its seventeenth edition, receives academic-scientific support from the following institutions: Interest Group in Pure and Applied Logics (IGPL); Association for Logic, Language and Information (FoLLI); Association for Symbolic Logic; European Association for Theoretical Computer Science (EATCS); Brazilian Computer Society (SBC); Brazilian Logic Society (SBL).

The WoLLICs were created, and have been organized and maintained, by Ruy de Queiroz and collaborators. Initiated in 1994, they are intended to promote interdisciplinary research in pure and applied logic, and to be a forum with the largest number of possible interactions between logicians and scientists in the areas of information and computation. At the same time, they are intended to be focused enough to allow concrete and useful interaction between the participants.

The first three WoLLICs lasted for three days each and consisted of lectures by invitees and the presentation of papers. From 1997 to 2006 the meetings were four days long, with the first day dedicated to tutorials. In 2007, the tutorials were distributed over the four days of the meeting.

WoLLICs have taken place at the following locations: Recife (Pernambuco, Brazil) in 1994 and 1995; Salvador (Bahia, Brazil) in 1996, in conjunction with the 11th EBL; Fortaleza (Ceará, Brazil) in 1997; São Paulo (Brazil) in 1998; Itatiaia (Rio de Janeiro, Brazil) in 1999, in conjunction with the 12th EBL; Natal (Rio Grande do Norte, Brazil) in 2000; Brasília (Distrito Federal, Brazil) in 2001; Rio de Janeiro in 2002; Ouro Preto (Minas Gerais, Brazil) in 2003. In 2004 the meeting was held in Fontainebleau, 60 km south of Paris, France. In 2005 it was held in Florianópolis (Santa Catarina, Brazil), and in 2006 it took place in Stanford (California, USA) at the Center for the Study of Language and Information. The 2007 meeting was held in Rio de Janeiro. Edinburgh was the headquarters for the meeting in 2008, Tokyo in 2009, and Brasília in 2010.

Future meetings will be at the following locations: Philadelphia (2011), Buenos Aires (2012), Darmstadt (2013), Santiago or Valparaíso (2014), Moscow (2015), Puebla (2016), and Utrecht (2017).

Program committees and lecturers at all of the WoLLICs have included Brazilian and foreign researchers of international reputation.⁶ The conference reports and proceedings of the WoLLICs have been published annually by well known publishers.⁷

1.3. Other important academic events

⁶ Information on past WoLLICs, including dates and lecturers, are available at: <http://www.cin.ufpe.br/~wolic/>, <http://www.cin.ufpe.br/%7Ewolic/>, <http://www.informatik.uni-trier.de/~ley/db/conf/wollic/> e <http://en.wikipedia.org/wiki/WoLLIC>.

⁷ Proceedings of the WoLLICs and special issues of scientific journals related to the WoLLICs are listed in the references at the end of this article.

In the late 1990s, an important world congress dedicated to paraconsistency was organized. The 1st World Congress on Paraconsistency (WCP) was held in Gent, Belgium in 1998. In 2000, the CLE Logic Group organized the 2nd WCP, held in Juquehy (São Sebastião, São Paulo) and dedicated to the seventieth birthday of Newton da Costa. The proceedings of the event, edited by Walter A. Carnielli, Marcelo E. Coniglio, and Itala M. Loffredo D'Ottaviano, were published by Marcel Dekker (New York, 2002), under the title *Paraconsistency: the logical way to the inconsistent*.⁸

The 3rd WCP was held in Toulouse, France, in 2003, and the 4th WCP in Melbourne, Australia, in 2008. The 5th WCP is to be held in Vancouver, Canada.

Another important logic event was organized by the CLE Logic Group. From August 23 to 28, 2009, CLE and the International Academy of the Philosophy of Science (AIPS) held a joint event at Unicamp in tribute to the 80th anniversary of Newton da Costa, entitled CLE/AIPS: Science, Truth and Consistency. This event was the first meeting of AIPS in Brazil (the second in South America, the first having occurred in Peru in 1989). The goal of the CLE/AIPS event, coordinated by Itala M. Loffredo D'Ottaviano and Daniele Mundici, was to unite important researchers in philosophy, logic, epistemology, and the history and philosophy of science, in order to discuss a wide variety of topics of academic interest focusing on themes related to da Costa's work, such as philosophy, philosophy of science, non-classical logic, and the history and philosophy of logic, among other topics, with a special emphasis on interdisciplinarity.

More than 100 well known members of the international scientific-philosophical community attended the event, between members of CLE and of AIPS, and the disciples, collaborators, and friends of da Costa. During the opening ceremony, the President of the Academy, Evandro Agazzi, announced that Newton da Costa had been elected an honorary member of AIPS, thus becoming the first Brazilian to receive such an honor. Also during the event, Newton da Costa received the title of Professor Emeritus of Unicamp, granted by the University Council. The proceedings of the conference will be published in three volumes, edited by Itala M. Loffredo D'Ottaviano, Daniele Mundici, and Evandro Agazzi in separate periodicals: a special volume of the journal *Studia Logica* (2011), under the title *The Legacy of Newton da Costa*;⁹ a volume of *Manuscrito – Revista Internacional de Filosofia* (2011); and two volumes of the *Principia: Revista Internacional de Epistemologia* (2011).

Another important event that was recently held in the country was Model-Based Reasoning 2009 (MBR'09). This international congress is an offshoot of research cooperation between CLE-Unicamp, the Department of Philosophy of the Università di Pavia (Italy), and the Department of Philosophy and Social Research of the Università di Siena (Italy). The event received the support of the Brazilian Logic Society, and took up several themes discussed in previous editions of the series, in particular the following: MBR'98 (Model-Based Reasoning in Scientific Discovery), MBR'01 (Model-Based Reasoning: Scientific Discovery, Technological Innovation, and Values), MBR'04 (Model-Based Reasoning in Science and Engineering: Abduction, Visualization, and Simulation),

⁸ (CARNIELLI, CONIGLIO and D'OTTAVIANO, 2002).

⁹ See (MUNDICI, D., D'OTTAVIANO, I.M.L. (eds.), 2011). *The legacy of Newton da Costa. Studia Logica*, vol. 97. Warsaw: Academy of Sciences, Institute of Philosophy and Sociology.

and MBR'06 (Model-Based Reasoning in Science and Medicine). MBR'09 was the first event of the series held in Brazil and was coordinated by Lorenzo Magnani and Walter A. Carnielli. This congress debated the logical, epistemic, and cognitive aspects of modeling practices employed in science and cognitive science, including logico-computational models of such practices. Among the lecturers invited to MBR'09, the following may be mentioned: Walter A. Carnielli (Unicamp), B. Chandrasekaran (Ohio State University, Columbus, USA), Simon Colton (Imperial College, London, UK), Jaakko Hintikka (Boston University, Boston, USA), Jairo José da Silva (Unesp, Rio Claro), Alex Kirlik (University of Illinois at Urbana-Champaign, Savoy and Urbana, USA), Lorenzo Magnani (Università di Pavia), Claudio Pizzi (Università di Siena), Paul Thagard (University of Waterloo), and John Woods (University of British Columbia, Canada).

Other important events have been held regularly in Brazil. Every two years since 1999, the Department of Philosophy at the Universidade Federal de Santa Catarina (UFSC) has held the Principia International Symposium, devoted to subjects concerning logic and philosophy of science. So far, six Principia Symposia have been conducted, organized by the Epistemology and Logic Research Group (NEL) and by the editors of *Principia – Revista Internacional de Epistemologia*. Both NEL and *Principia* exist under the auspices of UFSC. All of the Principia Symposia have been held in Florianópolis, the capital of the State of Santa Catarina.

The 1st Principia International Symposium, held from August 9 to 12, 1999, had as its main theme 'Principles in Philosophy and Science'. The 2nd Principia International Symposium was dedicated to a debate on the philosophy of Bertrand Russell, and took place from August 6 to 10, 2001. The 3rd Principia International Symposium, held from September 8 to 11, 2003, discussed themes in the philosophy of Quine. The 4th Principia International Symposium was held from August 8 to 11, 2005, and dealt with the philosophy of Donald Davidson.

The fifth edition of the Principia International Symposium addressed the philosophy of Bas van Fraassen and celebrated ten years of existence of the journal *Principia*. It took place between August 6 and 9, 2007. Among the key speakers at this event were Bas C. Van Fraassen (Princeton University, USA), Harvey Brown (University of Oxford, England), Michel Ghins (Université Catholique de Louvain, Belgium), Michel Paty (Université Paris Diderot, France, and USP), Hugh Lacey (Swarthmore College, Pennsylvania, USA), Steven French (University of Leeds, United Kingdom), Wilson Mendonça (Universidade Federal do Rio de Janeiro), Newton C. A. da Costa (UFSC), and João Paulo Gomes Monteiro (Universidade Nova de Lisboa, Portugal, and USP). The event was organized by Luiz Henrique Dutra (editor of *Principia*, UFSC), acting as President, César Mortari (assistant editor of the *Principia*, UFSC), acting as Secretary, and Otávio Bueno (University of Miami, USA) and Sara Albieri (USP). The Scientific Commission of this edition of the event was constituted by Michel Ghins as President, Alberto Cupani (UFSC) as Secretary, Hugh Lacey (Swarthmore College, Pennsylvania, USA), Harvey Brown, and Gustavo Andrés Caponi (UFSC).

The 6th Principia International Symposium was dedicated to the work of Charles Darwin and his impact on philosophy and science. This event was held from August 3 to 6,

2010, and was organized by Gustavo Caponi (UFSC), President, César Mortari (UFSC), Secretary, and Alberto Cupani (UFSC).

Since 1996, the Department of Philosophy at the Universidade Federal de Santa Maria (UFSM), Rio Grande do Sul, has annually held the Conesul Colloquium – Philosophy of the Formal Sciences. The events have been coordinated by Abel Lassale Casanova and Frank Thomas Sautter. The 14th Conesul Colloquium, entitled Quantification and Generality, was held in November 2009 and was dedicated to Oswaldo Chateaubriand in honor of his seventieth birthday.¹⁰

The Department of Philosophy at the Pontifícia Universidade Católica do Rio de Janeiro (PUC-RJ) has realized several events on proof theory in recent years, with the participation of foreign invitees.

Another recent initiative that should be highlighted are the studies developed in Brazil, and in collaboration with groups in other countries, in the area of universal logic, which pretends to be a general theory of all possible logics. To this end, universal logic uses abstract tools such as the theory of categories, translations between logics, combinations of logics, and other methods. The aim of this area of research is to find the most general properties shared by all logics, or by specific classes of logics. To realize this project, Jean-Yves Béziau (Universidade Federal do Rio de Janeiro, UFRJ) and Alexandre Costa Leite (Universidade de Brasília, UnB) have organized three world congresses: the 1st World Congress and Logic School on Universal Logic (UNILOG'05) was held in 2005 in Montreux, Switzerland; the 2nd World Congress and Logic School on Universal Logic (UNILOG'07) was held in 2007 in Xian, China; and the 3rd World Congress and School on Universal Logic (UNILOG'10) was held in Lisbon, Portugal, in 2010.¹¹

1.4. Journals on logic and analytic philosophy

In addition to the periodicals and collections of books published by CLE that have already been mentioned, a number of other periodicals are edited by Brazilian research groups in areas related to logic.

The journal *Principia: Revista Internacional de Epistemologia* publishes writings on contemporary epistemology, philosophy of science, and related areas, in Portuguese, Spanish, English and French. *Principia* publishes not only articles, but also notes, book reviews, and debates and critical studies about recent works. Occasionally, special issues devoted to specific topics are produced. The journal appears quarterly, with numbers appearing in April, August, and December. It has been published in traditional format since 1997, and nine volumes had been produced by 2005. In 2005, the journal also began to be published in digital form (online and CD-ROM), and since then its publication in paper form has been irregular. At this writing, *Principia* has so far reached the mark of 14 volumes. From its inception, Luiz Henrique de Araújo Dutra has been the editor-in-chief of

¹⁰ Volume 22 (1999) of *Manuscrito – Revista Internacional de Filosofia*, edited by Michael B. Wrigley, was dedicated to Oswaldo Chateaubriand in commemoration of his 60th birthday. See (WRIGLEY, 1999).

¹¹ For more information, see <http://www.uni-log.org>.

the journal, with the collaboration of associate editors Cezar Augusto Mortari and Alexandre Meyer Luz. *Principia* is indexed in *The Philosopher's Index*.

The three most recent volumes (2009 and 2010), under the responsibility of Décio Krause, are dedicated to Newton da Costa in commemoration of his 80th birthday, with articles by his disciples and collaborators as well as by invited authors from Brazil and several other countries.

Among the periodicals edited by Brazilian research groups in areas related to logic, the following should also be mentioned: the journal *O Que Nos Faz Pensar*, the publication *Cognitio: Revista de Filosofia*, and *Revista Brasileira de Filosofia*.

The periodical *O Que Nos Faz Pensar* is published under the auspices of the Department of Philosophy of PUC-RJ. Started in 1989, it has dedicated several issues to logic and the philosophy of logic. It has constituted an important space for interchange and dialogue in the scholarly community in logic in Rio de Janeiro and in Brazil as a whole, given that it has distinguished itself as one of the most important academic publications in the country in the area of philosophy. Up to the present time, 24 issues have been published in this historic series. Professors Danilo Marcondes de Souza Filho and Déborah Danowski share the editing tasks, and Kátia Muricy is associate editor. Articles published in *O Que Nos Faz Pensar* are indexed in *The Philosopher's Index*.

The publication *Cognitio: Revista de Filosofia* is dedicated to the themes of pragmatism and analytic philosophy, and the journal has given a privileged space to contemporary logic. It has been published semi-annually since 2000, having reached at present a total of 10 volumes. The journal is prepared by the Center for the Study of Pragmatism and the Graduate Studies Program in Philosophy, both part of the Pontifícia Universidade Católica de São Paulo. It is edited Ivo Assad Ibri, with Edelcio Gonçalves de Souza as deputy editor. The journal is listed in the following indexes: *The Philosopher's Index*; *Citas Latinoamericanas en Ciencias Sociales y Humanidades* (CLASE); *International Philosophical Bibliography*.

The *Revista Brasileira de Filosofia*, founded in 1951 and directed for many years by Miguel Reale (1910-2006), is the official publication of the Brazilian Institute of Philosophy (IBF). This periodical has maintained remarkable regularity, constituting a privileged academic venue devoted to debate in all fields of philosophical research. Since its founding, the journal's editors have devoted considerable space to research in logic – its history and philosophy – and to analytic philosophy and the philosophy of science. Works by the most important names in logic and epistemology in the country have appeared in its pages. Given its longevity, the journal reached the figure of 200 quarterly issues in 2000, representing 49 years of fruitful work. Since the death of its founder, the journal's editor has been Tercio Sampaio Ferraz Jr., and the associate editors have been Juliano Souza de Albuquerque Maranhão and Marcelo E. Coniglio, the latter being responsible for the logic section. Number 233, volume 58, was published in 2010, with significant contributions from researchers in the fields of logic, analytic philosophy, and epistemology. Since 2009, the journal has been published by Editora Revista dos Tribunais, which belongs to the Thomson Reuters group. *Revista Brasileira de Filosofia* is one of the most enduring publications specializing in philosophy in Brazil.

With the development of research on universal logic and the maturing of this field of research, the journal *Logica Universalis* was created in 2007, with Jean-Yves Béziau as editor. This academic journal, which appears annually, is dedicated to publishing works related to universal aspects of logic. Among the topics covered are the study of tools and techniques for the analysis of logics in general, classes of logics, the scope of validity and the domain of application of fundamental theorems and of characterization, as well as historical and philosophical aspects involved in the general concepts of logic.¹² Another publication related to research in universal logic, also edited by Jean-Yves Béziau, is the monograph series *Studies in Universal Logic*, which has as its objective the publication of texts on the general approach to logical concepts.

Several books by Brazilian authors about basic and advanced topics in logic have been published in recent years, both by Brazilian publishers and by international publishers such as Springer Verlag and Oxford University Press, among others. Some of these authors may be noted: Newton da Costa (one book co-authored with J.-Y. Béziau and O. Bueno, another co-authored with Steven French), Francisco Miraglia Neto (one book co-authored with E. G. K. Lopez-Escobar, another with M. Dickmann); Matias Francisco Dias (one translation, and one book co-authored with Leonardo Weber), Itala M. Loffredo D'Ottaviano (a book co-authored with E. G. K. Lopez-Escobar, and two co-authored with R. Cignoli and D. Mundici); Jairo J. da Silva; José Carlos Cifuentes Vasquez; César Mortari; Oswaldo Chateaubriand (two volumes); Ruy de Queiroz (two translations of books into Portuguese); Walter A. Carnielli (two books co-authored with R. L. Epstein, two co-authored with C. Pizzi, one co-authored with M. E. Coniglio, C. Sernadas, P. Gouveia, and D. Gabbay); Marcelo E. Coniglio (book co-authored with W. A. Carnielli, C. Sernadas, P. Gouveia, and D. Gabbay); Décio Krause (book co-authored with S. French).

2. Brazilian research groups dedicated to logic

At present there are research groups and centers dedicated to logic at several Brazilian universities and institutions. We will make a brief survey of this scene and its personages, certain that the report presented here it will not do justice to all those who dedicate themselves with tenacity and zeal to the cultivation of the logic in the country. At USP, as expected, there is the continuous and recognized work of Oswaldo Porchat Pereira, Luis Enrique Lopes dos Santos, Newton da Costa, and Andrea Loparić, at the Faculty of Philosophy, Letters and Human Sciences (FFLCH), and of Edison Farah, Jacob Zimbarg Sobrinho and Francisco Miraglia Neto at the Institute of Mathematics and Statistics (IME). These professors have trained innumerable researchers. In addition, also present today at USP are Marcelo Finger, Renata Wassermann, Hugo Luís Mariano, Flávio Correa, and others.

At Unicamp, logic has been assiduously cultivated since the 1960s by various researchers. With the arrival of Newton da Costa and Ayda Arruda at the Department of

¹² See <http://www.springer.com/birkhauser/mathematics/journal/11787>

Mathematics in 1968, two groups of logic researchers came into being: the logic group of the Department of Mathematics of the Institute of Mathematics, Statistics and Computer Science consisted of da Costa and Arruda, as well as Antonio Mário Sette, Luiz Paulo de Alcântara, Itala M. Loffredo D'Ottaviano, Marta Sagastume de Galego, Roberto Cignoli, and Walter Carnielli; the logic and philosophy of science group at the Department of Philosophy of the Institute of Philosophy and Human Sciences (IFCH) included Oswaldo Porchat Pereira, Luis Henrique Lopes dos Santos, Andrés Raggio, Carlos Alberto Lungarzo, Jose Alexandre Guerzoni, Andrea Loparić, Luiz Carlos P. D. Pereira, Elias Humberto Alves, Zeljko Loparić, Michel Ghins, Steven French, Michael Wrigley, and Harvey Brown. In 1993, the logicians at IMECC moved to the Department of Philosophy at IFCH. In 1998, this group was joined by Marcelo Esteban Coniglio.

At the Universidade Estadual Paulista (Unesp), which has campuses throughout São Paulo State, other research groups may be mentioned. In the Department of Philosophy, now located at the Marília campus, the work initiated by professor Elias Humberto Alves is continued by Ricardo Pereira Tassinari and Hércules de Araújo Feitosa; at the Mathematics Department, by Maria Cláudia Cabrini Gracio. In the Department of Mathematics of the Rio Claro campus, logic has benefited from the efforts of Mário Tourasse Teixeira, Eurides Alves de Oliveira, Irineu Bicudo and Jairo Jose da Silva. At the Pontifícia Universidade Católica de São Paulo, Lafayette de Moraes and Edélcio Gonçalves de Souza, also disciples of da Costa, may be mentioned.

At the Universidade Paulista (UNIP, São Paulo), Jair Minoro Abe and his collaborators, also disciples of da Costa, are active.

In the city of Rio de Janeiro, logic has been cultivated by a community of scholars. At the Pontifícia Universidade Católica do Rio de Janeiro (PUC-RJ), Oswaldo Chateaubriand has made important contributions, working in philosophy of logic, philosophy of the mathematics, and philosophy of the language, with an interest in various subjects such as ontology, the nature of the logic, theory of the descriptions, theory of the truth, and authors in such as Frege, Russell, Tarski, Quine, and Goodman, and others. Also associated with PUC-RJ are Armando Haebeler (deceased), George Svetlchny, Edward Hermann Hauesler, and Luis Carlos P. D. Pereira, these last two especially dedicated to the theory of the proof and natural deduction. At the Universidade Federal do Rio de Janeiro are Gerson Zaverucha, Mário Benevides, Sheila Veloso and Paulo Augusto Silva Veloso, working in the areas of computer science, especially in finite automata, regular languages, networks of automata, decomposition of automata, and families of languages. At the same university we must note the work of Francisco Dória, who, in collaboration with Newton da Costa, has achieved significant results in the foundations of physics and of mathematics, especially with their contribution to the celebrated problem in theoretical computation, $P \stackrel{?}{=} NP$.

Logic has flourished in other regions of the country as well. At the Universidade Federal do Ceará (UFCE), Ana Teresa de Castro Martins is active, having experience in the area of computer science with an emphasis on logic and the theory of the computation. Her work is dedicated to classical and non-classical logics, proof theory, theory of finite models and descriptive complexity, and logics for the formalization and automatization of reasoning. Another researcher at this center is Tarcísio Pequeno, who also is dedicated to

computer science, especially to formal specification, non-classical logics, analytical methods, tableau methods, automatic proof, and formal specification. Jean-Yves Béziau, also a disciple of da Costa, specializing in the study of universal logic, taught at UFCE, having recently assumed as docent at the Philosophy Department of UFRJ.

At the Universidade Federal de Pernambuco (UFPE) Ruy de Queiroz is active. He was co-founder, in 1990, with Dov Gabbay, of the Interest Group in Pure and Applied Logic, that has served as “clearing house” for logicians of all around the world. He is currently co-editor-in-chief of the *Logic Journal of the IGPL* (Oxford University Press) and member of the editorial board of the *International Directory of Logicians*. As already mentioned, Queiroz founded in 1994, and has since then maintained, the WoLLIC annual meetings. He works mainly in subjects related to the theory of proof and computation, mathematical logic, model theory, and the foundations of computer security, having participated in the advisory group of the Prize Committee of the “Rolf Schock Prize in Logic and Philosophy”, awarded by the Royal Swedish Academy of Sciences, editions 2008 and 2009.

At the Universidade Federal da Paraíba (UFPB), Matias Francisco Dias, Ana Leda Araújo, and Giovanni de Queiroz are all active.

Also in the northeast region of the country, a very promising research group in logic has been established. At the Master’s Program in Philosophy at the Universidade Federal do Rio Grande do Norte (UFRN), the following scholars of the Group on Logic, Knowledge and Ethics are active: Maria da Paz Nunes de Medeiros, researcher in proof theory, translations, and linear logic; Daniel Durante Pereira Alves, a scholar in logic and philosophy of science, working mainly with proof theory, philosophical logic, and philosophy of science and technology; as well as José Eduardo de Almeida Moura and Ângela Maria Paiva Cruz; we also mention João Marcos and the Group for Logic, Language, Information, Theory and Applications (LoLITA), at the Computer Science Department of UFRN.

In the southern region of Brazil, the Universidade Federal de Santa Catarina (UFSC) has for some time aggregated researchers interested in the various branches of logic. Among them are Cezar Mortari, dedicated to modal logic and the semantics of possible worlds; Décio Krause, interested in philosophy and the ontology of quantum mechanics, inductive logic, paraconsistent logics, as well as in researching subjects such as truth in physics, the objectivity of physical theories, the logical analysis of physical theories; Antonio Coelho, specializing in set theory and the foundations of mathematics. From 2003 on, the Santa Catarina group has benefited from the contributions of Newton da Costa, who resides in the city of Florianópolis and is nowadays invited Collaborator Professor of the UFSC, where the University is located.

An important initiative at UFSC was the establishment of the Epistemology and Logic Research Group (NEL) in 1996, which has as its purpose to make known and encourage research in the fields of the epistemology and logic, functioning as a link between the several groups working in these fields at UFSC and other institutions. Currently, NEL includes the Knowledge and Language Research Group and the Logic and Foundations of Science Research Group.

At other federal universities, mention should be made of the work of researchers such as Jose Carlos Cifuentes Vasquez, of the Universidade Federal do Paraná (UFPR); Frank Thomas Sautter and Abel Lasalle Casavale, of the Universidade Federal de Santa Maria (UFSM), Rio Grande Do Sul; Márcio Chaves Tannus and Carlos González of the Universidade Federal de Uberlândia (UFU), Minas Gerais; Nelson Gomes and Alexander Costa Leite, of the Universidade de Brasília (UnB); Wagner Sanz of the Universidade Federal de Goiás (UFG); and Roque da Costa Caiero and Juliana Bueno-Soler of the Universidade Federal do ABC (UFABC), São Paulo.

Recently, in August of 2008, under the auspices of the Faculdade de São Bento, the Center for Legal Logic and Theories of the Argument was established. The Center, headquartered in the historic Monastery of São Bento in the city of São Paulo, offers courses and studies in legal logic and theories of the argument, with the objective of refining and providing a basis for legal discourse. Among its faculty are Newton da Costa, Nelson Gonçalves Gomes (UnB), Tércio Sampaio Ferraz Jr. (USP, PUC-SP), Elias Humberto Alves and Antonio Eduardo Consalvo (Faculdade São Bento), Juliano Souza de Albuquerque Maranhão (USP), Edécio Gonçalves de Souza and Lafayete de Moraes (PUC-SP), and Itala M. Loffredo D'Ottaviano and Marcelo E. Coniglio (Unicamp). With this initiative, the undergraduate course in philosophy of the Monastery of São Bento has renewed its place as a pioneering philosophy program in Brazil. It was the first university-level philosophy course in the country, as the result of an agreement made in 1906 with the University of Louvain, which recognized the studies done in the Monastery's course and awarded diplomas to its students.

The Group for Theoretical and Applied Logic of CLE/IFCH-Unicamp, which beginning in 2011 included the participation of the researcher Fábio Maia Bertato, has dedicated itself in recent years, aside from research in non-classical logics and algebraic logic, to the study of the relation of logical consequence, the relations between logical systems in general through the analysis of translations and combinations between logics, abstract semantics for contemporary logics, and quantum logic.¹³

Beyond the financial support of Brazilian universities, the activities of Brazilian groups of logicians are supported and financed by institutions in the various states of the country. The constant support of the São Paulo Research Foundation, known in Brazil as the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), deserves special mention. Among the other numerous other Brazilian and foreign institutions that support logic-related activities in Brazil are the following: Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq, Brazil), Coordenadoria de Aperfeiçoamento de Pessoal de Nível Superior (CAPES, Brazil), Financiadora de Estudos e Projetos (FINEP, Brazil), the British Council (England), Conseil National des Recherches Scientifiques (CNRS, France), Consiglio Nazionale delle Ricerche (CNR, Italy), Alexander von Humboldt Stiftung (Germany), Fullbright Commission (USA), Association for Symbolic Logic (USA) and the National Science Foundation (USA).

¹³ See (CARNIELLI and D'OTTAVIANO, 1997); (FEITOSA, 1998); (DA SILVA, D'OTTAVIANO and SETTE, 1999); (FEITOSA and D'OTTAVIANO, 2001); (D'OTTAVIANO and FEITOSA, 2001, 2007); (CARNIELLI, CONIGLIO, GABBAY, GOUVEIA and SERNADAS, 2008); CARNIELLI, CONIGLIO and D'OTTAVIANO, 2009b).

3. Final Considerations

A new generation of logicians with international recognition is giving continuity to the pioneering work of Tourasse Teixeira, da Costa, and Arruda.

Since 1964, the logics of da Costa have been widely studied and many scholars from diverse countries have contributed to the development of paraconsistent logic in general. Da Costa, his disciples, and his collaborators, in Brazil and in other countries such as United States, Argentina, Chile, England, France, Italy, Australia, Germany, and Japan, have introduced many paraconsistent systems and have obtained results relevant to the semantics and decidability of such calculi, as well as contributing to a general theory of valuations, associated algebraic structures, theories of paraconsistent sets, higher order logics, model theory, differential paraconsistent calculi, and recent applications to computer science, engineering, medicine, and technology. Also worthy of mention is the introduction by Carnielli, Coniglio, and Marcos of the class of formally inconsistent logics, a general class of paraconsistent logics that contains several of the paraconsistent logics studied in the literature and that has as a subclass the hierarchy of da Costa's propositional calculi C_n , $1 \leq n \leq \omega$.¹⁴

The development of paraconsistent logic has given birth to important philosophical questions, opened up diverse areas of research, and propitiated the solution of problems relevant to the foundations of science.

Diverse applications of paraconsistent logic have been developed, as in theories of semantically closed languages, ethics, doxastics, epistemic and deontic logics, probability theory, the foundations of quantum mechanics, artificial intelligence, cognitive science, the foundations of infinitesimal calculus, and the foundations of science and their philosophical analysis.¹⁵

Another important contribution of da Costa, proposed in the 1980s in the field of epistemology, was his theory of pragmatic probability, introduced in collaboration with Rolando Chuaqui, and the theory of pragmatic truth, introduced in collaboration with Chuaqui and Irene Mikenberg.¹⁶ One of the relevant concepts formally and rigorously introduced by da Costa is his concept of quasi-truth, a pragmatic notion of truth that generalizes Tarski's definition of correspondence truth: quasi-truth can be formulated through a generalization of standard model theory and is related to what da Costa calls abstract Galois theory. The concept of quasi-truth can be considered as the concept of truth inherent in the empirical sciences, in particular in physical theories; it was later shown that the logic of quasi-truth is paraconsistent.¹⁷

The importance of da Costa's work has made him one of the most cited Brazilian scientists. Specialized academic events have been dedicated to the discussion and debate of

¹⁴ See (CARNIELLI, CONIGLIO and MARCOS, 2007).

¹⁵ See (ARRUDA, 1980) and (D'OTTAVIANO, 1990). See also (DA COSTA, KRAUSE and BUENO, 2007).

¹⁶ See (MILKENBERG, DA COSTA and CHUAQUI, 1986) and (DA COSTA, 1986).

¹⁷ See (D'OTTAVIANO and HIFUME, 2004).

his work in Brazil, Belgium, Poland, the United States, Canada, Denmark, and Italy, making possible the emergence of an internationally recognized 'Brazilian School' of logic.

For von Wright, according to personal correspondence with da Costa, paraconsistent logic was the most important creation in logic during the second half of 20th century, having expanded the paradigms of logic.

Some important events relative to paraconsistent logic deserve mention here. As already noted, the term 'paraconsistent' logic was coined by the Peruvian philosopher Francisco Miró-Quesada in 1976, during the 3rd SLALM at Unicamp. In 1984, volume 43 (numbers 1, 2 and 3) of the periodical *Studia Logica* was entirely dedicated to paraconsistent logic;¹⁸ in 1989, Philosophia Verlag published the first encyclopedic book on paraconsistency, *Paraconsistent Logic: essays on the inconsistent*, edited by Routley, Priest, and Norman;¹⁹ in 1990, 'paraconsistent logic' appeared for the first time in the Subject Classification of *Mathematical Reviews* and the *Zentralblatt für Mathematik*; in 1994, the 1st World Congress on Paraconsistency took place in Ghent, Belgium; in 2000, volume 125, number 12, of *Synthese*, was also dedicated to Newton da Costa (*Festschrift in Honour of Newton da Costa*).²⁰

In 1993, as an indication of the public recognition of his work, the Moinho Santista Prize (currently the Bunge Foundation Prize), the most important prize awarded to intellectuals and scientists in Brazil, offered annually for intellectual activity in a given area of knowledge, was granted in the area of Mathematical Logic to Newton da Costa. In 1993 the Moinho Santista Jovem Prize, granted to young recent PhDs, was given to Cosme Damião D. B. Massi, who received his PhD from Unicamp and was at the time professor at Universidade Estadual Paulista in Marília. Among others prizes and titles should be mentioned the Nicolaus Copernicus Medal of Scientific Merit awarded to da Costa in 1998 by the Nicolaus Copernicus University of Toruń, Poland.

Brazilian logicians have worked in areas such as mathematics, relativity theory, and quantum mechanics, and the foundations of mathematics, logic, and physics, with an emphasis on philosophical topics; also model theory, proof theory, and category theory; algebraic logic; computability theory; philosophy of logic; especially, in non-classical logics, paraconsistent logic, many-valued logic, intuitionist logic, modal logic, quantum logic; and universal logic.

The diverse groups of researchers in the country, in general, have established and dedicated themselves to graduate programs in logic and related areas, maintaining intense academic interchange with other groups and research institutions in diverse countries, particularly in Latin America and Europe.

The founding role of the first generation of Brazilian logicians may be seen in the activity of the students they have trained, who presently occupy academic positions in the above mentioned Brazilian institutions, as well as in universities in Argentina, Colombia, Mexico, Switzerland, Germany, France, the United States, and Italy, and other countries.

¹⁸ See (*Studia Logica*, 1984a, 1984b).

¹⁹ See (PRIEST, ROUTLEY and NORMAN, 1989).

²⁰ See (*Synthese*, 2000).

The term ‘contemporary logic’ has been adopted by the Group for Theoretical and Applied Logic at CLE-Unicamp in extension of the term ‘non-classical logic’, because current research in formal logic, including computer science, falls under the scope of ‘non-classical’. As D’Ottaviano, Carnielli, and Alves affirm in *The Centre for Logic in Campinas and the development of logic in Brazil*:

*Contemporary logic, thus, seems to be a more appropriate descriptive name for this area which has received the attention of such a great number of researchers and has proved to be not only of practical interest but also subject of philosophical attention.*²¹

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²¹ See (D’OTTAVIANO, CARNIELLI and ALVES, 1996).

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