Logic and Philosophy Today:
Editorial Introduction

Amitabha Gupta  
Johan van Benthem

The Initiative  This special issue of the *Journal of Indian Council of Philosophical Research* (JICPR; http://www.icpr.in/journal.html), is the result of a recent initiative aimed at improving the interactions between contemporary logic and philosophy at universities and colleges in India. This initiative arose out of a chance meeting between Professors Mrinal Miri, the Editor of the JICPR, and Amitabha Gupta. During that meeting, Professor Miri expressed his desire to bring out a Special Issue of the JICPR on the interface of recent developments in Logic and Philosophy. The Journal has maximum reach throughout the country. It was thought that it would be the best instrument to disseminate knowledge of modern logic and its relationship to philosophy in order to enhance the levels of research and education of logic in India. There are already eminent and outstanding Indian logicians residing outside India. What we need now is a strong group inside India involved in advanced research and in training brilliant Indian minds, unleashing local energies in the field - as in ancient times with the Nyaya-Vaisheshika, Jaina and Buddhist schools.

Efforts have already started in India to rejuvenate advanced research and education in logic and its applications, with successful outreach into mathematics and computer science, by organizing Conferences and Winter Schools and forming a new *Association for Logic in India* (ALI; http://ali.cmi.ac.in/), overseeing a wide range of initiatives, including scientific events and various publications. The initiative to publish a Special Issue of the JICPR is in line with this, complementing these efforts by specifically targeting the field of philosophy in India and its activities and programmes relating to research, teaching and learning, by highlighting recent developments in logic and their relevance to philosophy.

The urgent need to come up with a publication that would impact a broad philosophy community in India by making modern logic accessible to it struck a sympathetic chord with Professor Johan van Benthem, a logician based at Stanford University and the University of Amsterdam, who has initiated and supported the cause of propagating logic the world over, including recently in China, and who has been associated with the recent Indian efforts from their very inception. Thus, Gupta and van Benthem were invited as Guest Editors entrusted with the ambitious task of bringing out an innovative and distinctive volume on “Logic and Philosophy
Today” of the JICPR, soliciting articles from among first-rate logicians in all continents. The volume that you are holding in your hand right now is the result of this editorial collaboration between two Dutch and Indian colleagues. But at the same time, it is much more than that, being the concrete outcome of a truly international effort. It is a pleasure to note the overwhelming response of top-ranking logicians to help enliven the interface of logic and philosophy in India by contributing a paper to this Special Issue of the JICPR. Likewise, the support of the Indian Council of Philosophical Research (ICPR) in Delhi, http://www.icpr.in/, for this enterprise has been generous and gracious all the way.

After this brief history and acknowledgment, let us now turn to matters of content. What you see here before you is a lively panorama of logic research today in a broader setting, written by a large group of distinguished authors who each open a window to their field of expertise for a general philosophical audience. Our aim in all this is to give our readers an impression of what is going on, as well as a path into the literature. Let us first say a bit more about the intellectual background as we see it.

Logic and philosophy over time  The juxtaposition of two fields in our title needs no justification. There is a millennia-old history of fruitful interactions between logic and philosophy, in both Western and Eastern traditions. But paths have diverged in recent years. During the last half-century, modern logic has been undergoing a fast expansion of themes and new interdisciplinary alliances, a rich new reality that has hardly registered in the consciousness of philosophers, even those well-disposed toward logic indeed, even those who teach it. What we have tried to do with this issue is provide the reader with a map of major thematic developments in modern logic and its current interfaces.

Logic today  Broadly speaking, modern logic was forged in the study of the foundations of mathematics, its rigour and consistency. In effect, this concern with truth and proof in mathematics was a contraction of the traditional agenda of reasoning in general domains, still found with great 19th century logicians like Bolzano or Peirce. But it led to the Golden Age of Mathematical Logic with Frege, Russell, Hilbert and Gödel, whose results are still central to the discipline as we know it today. At the same time, these new technical insights turned out to be relevant to philosophy, illuminating old issues and creating new directions, witness the work of Wittgenstein, Carnap, or Quine. What has happened after the Second World War is
both a continuation of these streams, with many new eminent names joining the pioneers, and also the rise of a wealth of new interfaces of logic with other disciplines. These include linguistics, computer science, and in recent years, also economics and psychology. Logical structures and methods have turned out to be crucial in studying natural language, computation, information flow, interaction, and above all, our cognitive abilities in general. Thus, in a sense, logic is returning to its old broad agenda once more, but with new mathematical tools.

**Migrations**

This broad contemporary role of logic also presents philosophy with new interfaces. It would be hard to write the intellectual history of major themes in logic and philosophy in the last century without tracing their striking further intellectual migrations back and forth across academia. Here is one such saga out of many. It was philosophers who started the study of counterfactual conditionals in their analysis of natural laws; logicians then developed these ideas into conditional logics beyond what mathematical logic provides, and this topic then turned out to be crucial to understanding non-monotonic consequence relations for practical default reasoning in artificial intelligence, while finally, the later logic systems are now being applied in areas as far apart (to the superficial observer) as legal argumentation, the linguistic semantics of normality, brain research with neural nets, and recently, even the study of traditional Indian logic. Van Benthems paper ‘Logic in Philosophy’ [H. B. Jacquette, ed., 2007, *Handbook of the Philosophy of Logic*, Elsevier, Amsterdam, pp. 65–99] discusses many further examples of this interplay between logic, philosophy and other disciplines, with key logical themes such as knowledge and information coming to reach from practical philosophy to game theory and the social sciences, or dynamic theories of meaning that bridge philosophy, linguistics and computer science.

**Logic in India**

While the above trends make sense for logic and philosophy generally, there is a special interest in bringing these developments to attention in India. It may not be evident *a priori* why people in diverse cultures, with distinct pursuits, disparate convictions, divergent customs and a veritable feast of viewpoints would develop what Amartya Sen called argumentative traditions and ingeniously nurture them. But they have. And while there are scholarly debates about just what characterized the old Indian study of logic, it is clear that inspired by a robust and vibrant tradition of *naturalism*, India made its mark in the world history of logic, with fa-
mous names such as Akapda Gautama, Vasubandhu, Nagarjuna, and Siddhasena Divkara, representing a wealth of schools, in particular, Nyaya, Buddhist Logic, Navya Nyaya, and Jainist logic.

When modern Western logic came to India, scholars first took the Frege-Russell stance, interpreting and reformulating traditional Indian logic to fit that mould, even when the linguistic realities of Sanskrit needed to be twisted occasionally. Whether biased or not, these studies did provide the first significant links, and thereby started a potential conversation across traditions. A later generation of distinguished scholars, influenced more by Quine, then produced much more sensitive analyses of Indian logical thought, widening the contacts. This volume contains a paper by Prabal Sen and Amita Chatterjee, illustrating this by reviewing Navya-Nyaya Logic and explaining its difficult ideas and terminology in an accessible fashion, using first order language in the tradition of Sibajiban Bhattacharyya, Daniel Ingalls, Bimal Krishna Matilal, Frits Staal, and in particular, Jonardon Ganeri. In recent years, we see a third wave of studies, many of them bringing the broader logic perspectives outlined in the above to bear on understanding Indian logic. This makes sense, because now that the agenda of Western Logic itself is in flux, its openness to ideas from other traditions tends to increase. These newer perspectives on interpreting Indian texts in logic include case-based reasoning developed by Jonardon Ganeri, paraconsistent logic by Graham Priest, non-monotonic logic by Claus Oetke, dialogical logic by Shahid Rahman, or modern situational logics of information flow, games, and social software by Sarah Uckelman. Our collection includes a paper adding yet one more perspective; Fabien Schang surveys two Indian dialectical traditions and shows how the ancient Indian logicians successfully buttressed the dialectic tradition. We see in all these phases of contacts historically important stages in increasing mutual understanding between traditions, and we hope that this issue will encourage such studies even further.

Contents of this issue In designing this issue, we have chosen a number of broad areas that allowed us to sample major developments, some extending proven classical lines, others opening new ones. Even so, this publication is not a textbook, but an invitation. Each chapter consists of a description of an area, with some special highlights, and pointers to further literature. If an author has succeeded in getting you interested, you will then know where to look further.
In Part 1, *History of Logic*, Wilfrid Hodges and Stephen Read give a masterly survey of Western logic, including its subsequent ramifications in Arabic logic. Fabien Schang then samples the Indian tradition through the theme of dialectical logics, while Prabal Sen and Amita Chatterjee introduce its major flowering in Navya-Nyaya Logic. Fenrong Liu and Wujing Yang then conclude with a brief history of a perhaps less-known tradition, that of Chinese logic since Antiquity.


Part 3, *Logics of Processes and Computation*, charts the thriving interface of logic and computer science (arguably the locus of the bulk of logic research today), with chapters on temporal and dynamic logic by Frank Wolter and Michael Wooldridge, logic and categories by Samson Abramsky, and logic and automata theory by Ramaswamy Ramanujam.

Part 4, *Logics of Information and Agency*, broadens the theme of computation to communication, agency, and logical structures in social organization. Eric Pacuit describes logics of informational attitudes and informative actions, Richard Booth and Tommie Meyer survey modern logics of belief change (the engine of learning and adaptation), and Rohit Parikh, the originator of the well-known program of Social Software employing logic to understand (and improve) social procedures, ends with a key piece on knowledge, games and society.

While many of the earlier pieces are of great relevance to philosophers interested in logical analysis, Part 5, *Logic and Its Interfaces with Philosophy*, tells a more explicit story of contacts between logic and philosophy today. Out of a large set of possible topics, we have selected a representative sample from philosophy of language (Isidora Stojanovic), formal epistemology (Jeffrey Helzner and Vincent Hendricks), logic and philosophy of science (Bas van Fraassen), logic and ethics (Sven Ove Hansson), quantified modal logic (Horacio Arló-Costa), logic and philosophy of mathematics (Hannes Leitgeb), and logic and metaphysics (Edward Zalta).
We continue this exploration, in line with what we said about migrations earlier, with a number of congenial further interfaces in Part 6, Logic and Other Disciplines. Its chapters cover logic and quantum physics (Sonja Smets), logic and probability (Kenny Easwaran), logic and argumentation theory (Dov Gabbay), logic and cognitive science (Alistair Isaac and Jakub Szymanik), decision and game theory (Olivier Roy), and many-valued and fuzzy logics (Petr Hajek).

Taken together, the articles in our issue paint a very broad picture of our field. But pictures arise as much from omitting as applying brush strokes. We could have included many more topics, and we may, in later extensions of this issues. But for now, the material presented here should be enough to open anyone’s eyes to the power, sweep and beauty of logic today.

**Conclusion**  This volume does not stand in a vacuum. Indian logicians today are active in university departments of mathematics, computer science, and philosophy and they have been remarkably active in recent years in joining the international community. Organizational efforts began with a series of successful Conferences (2005 and 2007) and Winter Schools (2006) held at IIT Bombay on Logic and its Relationship with other Disciplines that are documented in two forthcoming books: *Proof, Computation, and Agency: Logic at the Crossroads Vol. 1*, Amitabha Gupta, Rohit Parikh and Johan van Benthem, eds., and *Games, Norms, and Reasons: Logic at the Crossroads Vol. 2*, Johan van Benthem, Eric Pacuit and Amitabha Gupta, eds., both published by Springer Verlag.

Our present initiative hopes to strengthen this process by drawing in more of the Indian philosophical community than was done so far, both through the papers in our volume and an associated meeting in a Conference *Week on Logic* to be held at the University of Delhi from January 5–11, 2011. We plan to bring together our authors with teachers, research scholars and students from Departments of Philosophy in the country as well as participants of ALI Winter School.

But let content have the final say. The various contributions in this issue paint a rich picture of logic today, in a way that we hope will be of interest to philosophers. It has amazed us to see how easy it was to collect a distinguished galaxy of both senior and junior logicians from all over the world, willing to share their ideas and insights with a broader audience. The articles collected here may not all be ‘easy reads’, but if you make the effort,
they will show you something that is rare: both the broader vision of today’s researchers on their broader areas, and their enthusiasm about specific themes. Indeed, the editors themselves have learnt a lot of new things about logic today, beyond what they imagined. Of course, not all our authors will agree on what modern logic is exactly, or where it is heading. We stated our own view in the above, but that was just an ‘editorial license’: taken together, it is the papers in this volume that tell the real story of the field today. But no matter how one construes the march of history, we are certain that, once these contacts have been made, Indian logicians will come to be noticed more and more at the world-wide stage, adding original insights in philosophy, mathematics, language, computation, and even the social sciences. And we would not be surprised at all if some of this innovation would come about by drawing upon India’s own rich logical tradition.

Amitabha Gupta and Johan van Benthem
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