Introduction

:: Hykel Hosni

Abstract

The Editorial Team welcomes readers to *The Reasoner*'s new home.

Keywords

Book reviews; News; Uncertain Reasoning; History of Logic and Reasoning; Medical Reasoning and Medical Methodology; Reasoning and AI; Causal Reasoning.

Dear Reasoners, it is my pleasure to welcome you to *The Reasoner*'s new home!

The Reasoner was established in 2007 as a printable and screen-readable outlet for research ideas that were more structured than blog posts, but leaner than the usual journal paper. For the benefit of younger readers, 2007 was *before* academics spent a varying amount of their day on social media. 2007 was also the time when publishers began defending themselves against open-access, which was clearly becoming a thing.

Nearly twenty years later, the editorial niche that The Reasoner originated and developed within seems more relevant than ever. As research communities are experimenting with new ways to

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fix what's broken with scientific publishing, The Reasoner aims to catalyse multidisciplinary scholarly discussion on reasoning-related topics, while serving as a tool for community-building.

To attain this twofold objective The Reasoner now solicits both *Research Articles* and *Features*.

Research articles typically do not exceed 3000 words and report either original results, or new perspectives on the existing literature. We welcome research articles on logic, methodology of science, and history of scientific reasoning – all broadly construed to include foundations and applications to society and technology. Research Articles are peer-reviewed through a double-blind process.

In addition, The Reasoner also publishes Features that are not peer-reviewed, but subject to the decision of the editorial board. We are particularly interested in Features that appeal to a broad and multidisciplinary audience. Features do not exceed 1000 words and are reasonably self-contained.

To encourage debate, we solicit *Post-publication open reviews and comments* to previously published articles and features.

Please see our Guidelines for Authors for full editorial details, and do not hesitate to get in touch with Esther Anna Corsi, our Editorial Manager, if you have any questions on the submission procedure.

Some of our Area Editors will now give you a feel for the topics and takes we hope to find in submissions. I would like to take this opportunity to thank all of them for being part of this. But please note that The Reasoner is always work-in-progress. Please get in touch if you are interested in editing an area which you see missing!

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Finally, on behalf of the Editorial Team, I would like to thank all staff members at Milano University Press. Their commitment to the principles and best practices in Open Science made possible for The Reasoner to migrate to its new home, where we all hope it will thrive.

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Book Reviews
:: Paolo Baldi

I am very pleased to act as editor for the book reviews section in this new course of the Reasoner.

Scientific research keeps moving fast, with its products mostly presented in the format of journal articles and conference proceedings, not to speak of the much faster publication of preprints in online open access databases.

We are long past the era of the few all-encompassing "tractati" and "principia", and yet books are still indispensable and unsurpassed when it comes to the systematisation and education in the sciences.

I would thus like to invite all the readers and supporters of the Reasoner to contribute to this section, submitting reviews on books on reasoning-related topics. As we know, the analysis and modeling of reasoning is relevant to many different disciplines, and thus I would welcome texts belonging to as various fields as artificial intelligence, computer science, logic, linguistics, statistics, philosophy, cognitive science, economics, digital humanities, and even better a combination of two or more of those. More generally, I would appreciate reviews on books that appeal to both the technically-minded and the philosophical-minded readers of the Reasoner (as well as to their non-empty intersection!).

Apart from focusing on the ample range of topics touching on reasoning and the preference for interdisciplinarity, I would not put much further restrictions on the kind of books considered.

Reviews of different kinds of academic books are welcome, ranging from research monographs to textbooks, from handbooks to edited volumes on specific topics.

I would also encourage reviews of books from well-reputed authors that are intended for a general public, and yet present non-trivial scientific insights.

To name a few relatively recent publications, let me mention, for instance, *The Book of Why* by Judea Pearl and *The Road to Conscious Machines* by Michael Wooldridge. Both texts are indeed very timely in providing important conceptual tools for understanding the current AI spring, a topic naturally within the interests of the Reasoner. Furthermore, they are both presented in a accessible way, but at the same time they do not fear to dig deeper, and introduce formal and technical details, when needed.

You have a vast set of choices, and you may now have a good excuse to finally read carefully those books that have been waiting for so long on your desk. ...I am looking forward to receiving your contributions!

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News

:: Lorenzo Casini

As News Editor of The Reasoner, I'd like to welcome all of our readers to this new and exciting season, which marks the transition of The Reasoner from an online gazette to an online journal!

Certain features of The Reasoner will inevitably change through this transition — most notably, The Reasoner will devote more space to submissions of original research articles, due to the journal now being indexed and each contribution getting immediately a doi.

Other features, however, which have contributed to the gazette's initial success, will be preserved. If it's not broken, why fix it? In particular, not only has the News Section of The Reasoner never lost the interest of our readership; in addition, we think that the continuity with which we have received spontaneous reports throughout the years witnesses the need for dissemination of the results of scientific events in the field, for which our gazette has always offered an important, if not unique, venue. In this light, we'll keep soliciting contributions of reports from organisers as well as accept spontaneous ones.

Moreover, our Editorial Team strongly believes that the dissemination task should also extend to advertising new doctoral dissertations, freshly funded scientific projects, novel scientific societies, etc. In other words, we welcome submissions that aim to give visibility to the results of young scholars, and thus pinpoint novel proposals, still unknown to the wider public, or to advertise

the future directions of academic research by giving a heads up to the community on what's going on where — which is key to foster the interactions between distant individuals or research groups that would otherwise operate in isolation.

In a world where information has never been so accessible but at the same time too vast to prune, there's a growing need for the right kind of filtering aid. We hope our News Section will be instrumental to fulfilling this need. Moreover, given that modern academia is becoming more and more specialized, there's also need for a tool that can trigger the cross-fertilisation between fields. In this respect, we hope that The Reasoner will keep helping to build bridges between academic disciplines which, albeit often institutionally separate, nonetheless share a common interest in reasoning-related topics.

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Uncertain Reasoning
:: Jürgen Landes

Our ability to make decisions based on good reasoning processes in an uncertain world have been a core part of what sets humans apart from all other known life forms. And yet, the now widely-accepted formalisation of probability theory is less than 100 years old. As Strevens put it in his book: "*our ancestors did not escape the sabertooths by thrashing them at roulette*" (Tychomancy, 2013, p. 217).

Not ever since, but especially since, Kolmogorov put forward his now-famous axioms of probability, probabilities – and models of uncertainty more widely – appear everywhere. Appearances of models of uncertain reasoning range from formal investigations in statistics, mathematics and philosophy over applications in the social sciences, physics and medicine to their didactics and history.

What then is the point of covering uncertainty and reasoning under uncertainty, which includes but is not restricted to probabilities, in *The Reasoner*? The point is precisely the vastness of the field, field**s** even!, that a) prevents the flow of ideas, b) directs and constricts one's interests to ever more-specialised niches and c) frustrates making general observations applying broadly across disciplines. *The Reasoner* aims to bring together researchers and ideas from various areas by publishing accessibly contributions that are of interest to a broad range of reasoners. Contributions in the *The Reasoner* also give readers a general sense of what is happening in a variety of areas and reduce the cost of entry when entering a new field.

When preparing a contribution to *The Reasoner* think of its readers. Wondering "how can I make my contribution fit neatly in one of the covered areas as identified by the editorial from the area editors?" or "how can I make my piece fit with the paradigm in my area?" is asking a *wrong question*. Do instead stress aspects that make your work relevant and stand out while remaining accessible to a wide range of readers. While we would all love to have our writings to be understood and treasured by everyone, but relevance for and appreciation by can only ever be achieved among a finite set of people.

Rather than telling you (at length) about my own research, which can of course be found at my website, I leave you with three of my favourite quotes:

> I only believe in statistics that I doctored myself. – (Winston S. Churchill)

> I'm not concerned about the rise of artificial intelligence; I'm worried about the decline of human intelligence. – (Unknown)

> To be uncertain is to be uncomfortable, but to be certain is to be ridiculous. – (Chinese proverb)

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Reasoning and AI
:: Felix Weitkämper

Reasoning has been a core part of artificial intelligence from the very beginning. Since its first blossoming in the 1970s, the AI Winter of the 1980s and 1990s and rapid resurgence of the field since the 2000s, the scientific study of artificial intelligence has exploded into a vast area of research, with numerous publication venues stretching from completely comprehensive (such as the prestigious IJCAI conference series or the equally renowned *Artificial Intelligence* journal published by Elsevier) to highly specialised (with journals such as *Constraints* or the *Journal on Satisfiability, Boolean Modeling and Computation* serving their respective communities).

Why then would any researcher submit a communication on artificial intelligence to the *Reasoner*? First and foremost, The Reasoner has a rather unique audience. While the vast array of traditional artificial intelligence journals have a readership of computer scientists, The Reasoner aims to be interesting and accessible to everyone with an interest in Reasoning. Indeed, philosophers make up a sizeable proportion of the Reasoner's readership and editorship.

In my own research, I have oftentimes made use of both general ideas and concrete techniques and results developed in mathematical and philosophical logic to tackle issues in artificial intelligence that have resisted approaches more typical of computer scientists working in the field, and I feel that there is still very much to be gained from bringing over approaches that are salient to the

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topic, but new to the respective field. I therefore hope that this cross-fertilisation between groups of researchers that often work on very similar topics from different angles, but with almost no institutionalised point of contact, will prove fruitful to everyone operating in the space of reasoning and artificial intelligence.

As a way of suggesting the many opportunities that arise for a dedicated space for reasoning in artificial intelligence, let us just briefly recall the wide usage that reasoning has found in contemporary artificial intelligence systems.

Firstly, there are the classical subfields of artificial intelligence that have crucially relied on reasoning techniques ever since they emerged. This encompasses assisted and automated theorem proving in all its variations. While arguably the mechanisation of mathematical reasoning was already the focal point Hilbert's ultimately doomed program of founding mathematics on a provably consistent and complete set of axioms, and Gödel's subsequent proof of its impossibility, positive progress on this semi-decidable task accelerated with Robinson's discovery of resolution theorem-proving in the 1960s. Since then, automated theorem proving led to the distinct discipline of logic programming, and its extension to various higher-order and non-classical logics of acute philosophical interest have captured the interest even of the general public, such as Benzmüller's work on Gödel's and Leibniz's argument for the existence of god, captured in modal logic.

Reasoning is also a crucial component of query answering systems. The close relationship between the predicate calculus and the relational algebra underlying the relational database model motivated plenty of work in finite model theory, and led to very fruitful investigations of the interplay between logic programming and databases. Even though they ultimately have very different

priorities, the joint roots of the fields of databases and artificial intelligence in reasoning can be very illuminating for a mutual transfer of results and techniques, as is happening now with probabilistic databases and statistical relational artificial intelligence.

Another traditional application area of logic in is automated planning and scheduling, which established itself very early on as a key part of artificial intelligence. Just to pick out one particular aspect, the vibrant field of epistemic planning, which takes explicit account of the knowledge of the agents involved in a situation, relies heavily on the advancement made in reasoning in epistemic logic.

Beyond those classical fields of symbolic artificial intelligence, which are almost unthinkable without formal reasoning, logic also interplays very well with the notions of learning and uncertainty that have dominated discourse on artificial intelligence since over the last 20 years.

The most direct combination of logical reasoning and learning is learning explicit logical connections from data. This has been studied in great depth by the field of inductive logic programming, which aims at learning logic programs that describe relationships in provided data. From its beginnings in the 1980s, there rapidly emerged both sophisticated theory and practical tools, some of which such as the learning systems FOIL and Aleph are still in use as research benchmarks today. After a brief lull in interest in the early 2000s, recent work in meta-interpretative learning has led to renewed interest in inductive logic programming approaches, particularly for classic program induction tasks from a small number of input-output pairs.

Combining logical rules with probabilities leads to statistical relational artificial intelligence, which developed since the 1990s from

roots in probabilistic logic programming and in template graphical models. There are now a wide range of formalisms and a unifying theory rooted in logical reasoning, supporting both probabilistic reasoning and structured machine learning (probabilistic inductive logic programming).

Of course, in addition to probabilities, research on reasoning has brought forth a range of other, qualitative approaches to incorporating uncertainty in logical frameworks such as belief functions or approaches based on fuzzy logic. A very promising, more recent application area of reasoning is neuro-symbolic artificial intelligence, which combines a symbolic reasoning layer with a subsymbolic component. This could directly enhance the reasoning capabilities of connectionist systems, or be used for a division of labour between a subsymbolic system responsible for low-level perception tasks and a reasoning layer responsible for higher tasks like planning or event recognition.

Hopefully, this very brief and woefully incomplete overview suffices to show the enduring relevance of reasoning in artificial intelligence. However, arguably the greatest potential for reasoning approaches in the current climate is the huge potential of reasoning for human-oriented, explainable artificial intelligence. The necessity to move beyond inscrutable black boxes to engage with human users on their own terms, in a language they can understand and with the certainty that this indeed captures the behaviour of the artificial agent, is becoming clearer with every new use case that artificial intelligence takes on. This opens up another application of reasoning: beyond applying reasoning *within* artificially intelligent systems, we can and should reason *about* artificial intelligent systems. Formal logic is uniquely placed to contribute to humanity's search for powerful, but safe and human-oriented artificial intelligence systems. However, for this challenge in par-

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ticular, many disciplines have something to contribute, from computer science to cognitive science and philosophy. Hence, I am very excited to serve as the area editor for a journal that has the potential to bring all those communities together in a regular, but less formal setting, and look forward to your contributions, disseminating timely ideas from reasoning in artificial intelligence throughout the communities involved in reasoning research.

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Medical Reasoning and Medical Methodology: :: Sarah Wieten

I am excited to join The Reasoner as the new subject editor in Medical Reasoning and Medical Methodology, I would like to re-invite papers related to reasoning, inference and scientific method as it pertains to medicine to submit here.

By way of introduction, my formal training is in philosophy of medicine, a relatively young discipline which is some ways takes it cues from philosophy of science. I have also worked as a clinical ethicist in a hospital, developing and applying work in bioethics to real time cases, and in a meta-research center, producing research on the institutions and methods that produce the contemporary science (particularly the health science) literature. These different positions throw different light on the area of medical reasoning, and I look forward to reading work related to all.

It is my hope that these works might come from a wide variety of disciplines (philosophy, medicine, public health, meta-research, economics, history, medical anthropology, sociology, psychology) and address a wide range of audiences (academic, practitioner, patient, public). Interdisciplinary work is very welcome.

However, of particular interest to me as an editor will be supporting work which pushes philosophy of medicine and work on medical reasoning in a somewhat new direction-towards integration with thinking in social and political philosophy. While work on the individual diagnostic encounter and shared decision making

about medical intervention remains important, investigations of the roles played by the social and political in medical reasoning, not just at the individual, but also at the population level, are extremely welcome.

Recent changes at The Reasoner mean that is this publication is indexed in DOAJ, WoS and Scopus and that each article has a doi, making the work more durable and accessible online. The Reasoner retains magazine-style interviews and features but is also an exciting option for placing academic work of interdisciplinary interest. Publishing in The Reasoner is **open access and free of charge, unlike much of the current academic publishing system.**

I would also like to close by pointing to a section after my own heart – The Reasoner Speculates. If you have an argument, correction, complaint, or question related to the goals of The Reasoner, but for whatever reason this is not a good fit for a traditional full-length article, consider it for The Reasoner Speculates. You can see more information about The Reasoner Speculates and other types of submission here.

I look forward to receiving your work in medical reasoning.

Sarah Wieten

University of Durham

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Causal Reasoning
:: Jon Williamson

Causal reasoning has become a hugely important area of interdisciplinary research and we very much welcome submissions on any aspect of causal reasoning.

There are important descriptive questions about causal reasoning that would be of interest to readers of *The Reasoner*. For example, how do we infer causal relationships? How do we use causal relationships? How does causal cognition develop in childhood? The Oxford Handbook of Causal Reasoning provides a valuable introductory resource on topics related to causal cognition in humans. Descriptive work on causal enquiry in the sciences, medicine and law is also of key importance. Case studies of causal inferences in these fields can be very illuminating, for example, as Gillies (2019) demonstrates.

There are also important normative questions about causal reasoning. For example, how should we establish causal relationships? How should we evaluate causal claims? Can we automate causal discovery?

Normative approaches to causal reasoning can broadly be divided into three camps. Some theories make strong theoretical assumptions but offer methods that guarantee success in cases where those assumptions are satisfied. For example, Donald Rubin's potential outcomes framework and Judea Pearl's graphical causal modelling framework have both led to very fruitful streams of theoretical results.

A second group of theories make strong philosophical assump-

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tions about the nature of causality and use these metaphysical presuppositions to motivate theories of causal enquiry. For example, probabilistic theories of causality can be used to motivate certain statistical approaches to causal inference, while agency or interventionist theories of causality steer one towards specific kinds of causal models, and dispositional or mechanistic theories are sometimes used to motivate methods such as process tracing. According to Andersen et al. (2019), such approaches are prone to 'philosophical bias', but may nevertheless be productive.

A third strategy is to try to avoid strong assumptions—both theoretical and metaphysical—in the hope of developing accounts of causal enquiry that are more general and less controversial, but nevertheless informative. The evidence-based evaluation movement can be thought of as situated in this camp, though it has by no means avoided controversy. Evidential Pluralism is an alternative approach in this camp that attempts to overcome some of the shortcomings of orthodox evidence-based methods.

What is clear is that while research on causal reasoning is enormously productive, the central questions are far from settled. Moreover, there is a great deal that each discipline can learn from others: some approaches dominate in certain fields for largely sociological reasons and there is value to be had in learning of good practice in other fields. *The Reasoner* is a perfect forum for this sort of cross-disciplinary engagement. Please submit features on research on causal reasoning that has caught your attention, or on your own research projects or research events in this area.

Jon Williamson

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