


Review Feedback and Response

- The purpose of author feedback is to point out technical errors or significant misunderstandings. It is not meant to dispute the opinions of the reviewers, or to explain how criticisms can be addressed!
- Do not expect replies to your feedback in the final reviews. Rest assured that feedback identifying true flaws or misunderstandings will be taken into account in final decisions.
- Please do not provide feedback explaining how you can address the referees' concerns or criticisms. It is our assumption already that concerns will be addressed in the final version.
- Feedback should be brief and specific. Feedback is strictly limited in length to 150 words per review, no exceptions.

Paper ID	51
Paper authors	Christoph Benz Müller, Bruno Woltzenlogel Paleo
Paper title	Automating Gödel's Ontological Proof of God's Existence with Higher-order Automated Theorem Provers
Paper subtitle	
Track	()
Paper Type	Long Paper (6 pages)
Status	First Ballot
Keywords	Knowledge Representation, Reasoning, and Logic::Automated Reasoning and Theorem Proving ** Knowledge Representation, Reasoning, and Logic::Knowledge Representation (General/other) ** Multidisciplinary Topics::Philosophical and Ethical Issues
Abstract	Kurt Gödel's ontological argument for God's existence has been formalized and automated on a computer with higher-order automated theorem provers. From Gödel's premises, the computer proved: necessarily, there exists God. On the other hand, the theorem provers have also confirmed prominent criticism on Gödel's ontological argument, and they found some new results about it. The theory framework underlying this work provides offers an interesting novel perspective towards a computational theoretical philosophy.
Average overall recommendation	6.44
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Significance	Originality	Relevance	Technical quality	Presentation quality	Scholarship	Confidence	Overall recommendation
10	10	10	10	9	9	8	9

ReviewerID: 291 [Nomination for Best Paper Award]

Comments to author(s)

Minor issues:

-section 3: "some further, related problems" - please add more detail or leave this out if it's irrelevant

- first paragraph of conclusions: is your claim that philosophical arguments are "final frontier for automated reasoning" supported by any kind of complexity result or characterization of the underlying logic in which problems are formulated? I certainly hope that we can do more with ATPs than checking proofs with disputable axioms, even if that comes to existence of God.

-second paragraph of the conclusion: you should stay consistent with writing God (or god). Same goes for the references

- last paragraph of the conclusion, first line: "computational theoretical philosophy"

- reference 23: "explained"

Summary of review

The paper presents an encoding of the known Gödel's ontological proof of God's existence in higher-order logic (HOL) with the purpose to automatically check it using state-of-the-art higher-order automated provers. Towards this purpose, the authors define a base higher-order modal logic (HOML) together with a semantic-preserving encoding of HOML in HOL, much in an expected way. Thus, one can use the existing proof support of HOL for the encoding of Gödel's argument. Technically, this is achieved by representing the problem in the interchange format for higher-order provers THF0 and by performing a number of proofs on the resulting THF0 theory, including

consistency checks of the axioms and definitions. The parameters of the experiments have been allowed to vary, in the sense that different modal logics (K, KB) have been employed, the domain of individuals has been assumed fixed or varying, and different sets of axioms have been tried out for proving one and the same expected result. The results of the experiments show that the argument and the main criticisms against it can be verified using HOL automated provers.

I find the paper extremely well written and presentation clear. The main lessons

to be learned from this impressive enterprise of the authors go in two directions. On one side, the paper sets bases for a new domain of

to be learned from this impressive enterprise of the authors go in two directions. On one side, the paper sets bases for a new domain of application of automated theorem proving, namely philosophical arguments, which can now be rigorously checked for correctness by a machine. On the other side, the authors present a nice framework for obtaining proof support for a problem at hand. Once the logic underlying the problem has been properly (read, in a way that semantics is preserved) encoded in HOL, one can make use of the entire apparatus of HOL automated provers to verify the problem. This is relevant not only for philosophical or theological problems, where one can imagine that other logic than HOML is employed, but also for other domains. Given the above and the high relevance of the paper for ECAI, I recommend acceptance.

You may (but need not) reply to the review. Your reply will be visible to the PC members and area chairs that handle your paper.

In the author's opinion, this is

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Significance	Originality	Relevance	Technical quality	Presentation quality	Scholarship	Confidence	Overall recommendation
4	3	5	4	5	4	6	4

ReviewerID: 1521

Comments to author(s)

This paper replicates the Goedel's proof of God existence, using Higher Order Logic and existing solvers. I am not sure about the significance of the contribution of the paper. The proof itself is not new, it dates back to Goedel. The logic and the solvers already exist. The paper just demonstrates that existing formalisms and solvers can be used to replicate a known proof. Was this not known?

Furthermore, the authors have already published a lot of work on the same topic. They claim that this work is new, but it is not apparent to me what is the innovation in this paper with respect to their previous work.

Summary of review

Not a clear contribution.

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In the author's opinion, this is

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Significance	Originality	Relevance	Technical quality	Presentation quality	Scholarship	Confidence	Overall recommendation
6	6	6	6	5	6	4	5

ReviewerID: 1622

Comments to author(s)

This paper investigates the automation of Godel's proof for the existence of God. It examines the use of available theoretical insights and (higher-order) logic proof tools.

This paper provides some interesting insights into how you might take abstract philosophical arguments, formalise them using (higher-order) logic and then use software tools in verifying them. I have a few suggestions for improving the paper. Firstly, while the focus has been clearly on Godel's proof, it would help to have some explanations of the broader insights that were gained during this exercise and that are relevant to formalising and automating philosophical proofs like Godel's. The insights provided apply only to Gdel's proof but I'm sure there are some broader lessons that are of value. The presentation itself is quite dense and I wonder whether it is also possible to simplify it and make it clearer.

Summary of review

An interesting idea that is well worth pursuing. The paper could be improved by providing some broader insights into how philosophical reasoning can be formalised and automated. The presentation could also be improved.

You may (but need not) reply to the review. Your reply will be visible to the PC members and area chairs that handle your paper.

In the author's opinion, this is

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