External Examiner's Report on the Dissertation of Petr Švarný
"Observing time: Inferences in static universes"
Submitted in 2019 at the Department of Logic

I. Brief summary of the dissertation

The dissertation investigates two conceptually difficult questions both of which are interesting and relevant to the philosophy of modern physics, namely "What does time look like for observers living in a static universe?" and "Whether observers can tell that they live in a Block Univese?". Among other in the static models of Branching Spacetime, Branching Continuations and Barbour's Platonia, it is shown that observers cannot tell in general that they are living in a Block Universe because a generalized flow of time can be defined for them in all the three cases in certain models.

II. Brief overall evaluation of the dissertation

The doctoral candidate demonstrates that he has absorbed and has acquired a deep understanding of the literature of temporal logic and related areas. He is able to ask and answer scientific questions, introduce new concepts, formalize theories and prove new theorems about them. The exposition of the thesis is clear, logical and well-structured even though at some places, especially in some of the proofs, it could have been more detailed.

The work clearly meets the standard customarily required of a doctoral dissertation. I recommend the dissertation for a public defense.

III. Detailed evaluation of the dissertation and its individual aspects

1. Structure of the argument

The dissertation, apart from a few typos and minor didactic glitches, is well-readable and clearly structured. The arguments are clear and correct.

By minor didactic glitches, I mean things like some easy-to-guess notations are not introduced. For example, the domain L of valuation V on page 29 is not introduced. I think it would have been better to indulge the reader and introduce even these kind of well-known notations.

Another minor glitch that may confuse the reader at first is that the set of all possible point-events sometimes denoted by OW and sometimes by W. For example. in Definition 16 both notation is used. which actually helps the reader to learn that these two notations indicate the same thing, but it would have been better using only one of them throughout the dissertation.

I think it would have been better stating as a theorem the existence of generalized flow of time in certain models of Branching Continuations and Barbour's Platonia instead of just mentioning it in the ending paragraphs of

the corresponding sections. Similarly, I think it would have been better to explicitly introduce the counter example at the end of Chapter 3.1, maybe using a general construction if there is such, cf. my question (1) below, instead of just quickly explaining why such an example exists.

2. Formal aspects of the dissertation

In general, the author is coherent in the use of abbreviations and notations. The syntax of bibliographical references is used correctly. The language of the dissertation is grammatically correct and free of linguistic infelicities. The dissertation is visually well-presented. Typographically and graphically well-formatted.

3. Use of sources and/or material

The author works transparently with secondary sources and the relevant sources made use of. The primary sources are used properly.

4. Personal contribution to the subject

The dissertation contains original contributions to the field and advances our knowledge and understanding about the flow of time in static universes. The main contributions are introducing observers and related concepts required to introduce the notion of generalized flow of time in Branching Space-times and then showing the existence of models of Branching Spacetimes in which there is a generalized flow of time. Although it requires much more work and technicalities, the same result is achieved in case Branching Continuations. Finally to show the existence of generalized flow of time in case of Barbour's Platonia, the candidate introduces a whole new theory of Barbourian Branching Configurations together with its own temporal logic.

+1. Some minor editorial points

On p.25 line 7: "abbreviati" should be "abbreviation".

At footnote 7: "past" should be "**Past**".

At the bottom of p.29: writing "interval set $INT(\mathbf{ITL})$ of **ITL**" would make the sentence easier to be read.

At the bottom of p.29: "$V : L \rightarrow INT(\mathbf{ITL})$" should be written instead of "$V : L \rightarrow INT(\mathbf{ITL}) \times INT(\mathbf{ITL})$".

On p.29 in the definition of semantics a couple of occurrences of letter "u" is in text mode instead of math mode.

In the middle of p.31: "he is in a Block universe" should be "she is in a Block universe".

Abbreviation **TL** used on p.36 is not introduced and not listed on p.67.

In Definition 11 and Lemma 12 (and possibly in other places) references use the numbering of the preprint version of (Placek. 2011) which differ from the numbering in the appeared version.

In the proof of Lemma 15, "2. of Def 2." should be referred instead of "Def 34".

In Definition 16. isn't item 2. follows from item 1.? I think a "for all history h" is missing from the definition of non-trivial setting of now-points.

In 1. of Definition 20. there is a superfluous comma after e_n.

In 2. of Definition 46. a prime is missing from one of the e-s.

IV. Questions for the author

(1) Is it true that for every Branching Spacetime there is a semantics such that a generalized flow of time can be defined and there is another semantics such that no generalized flow of time can be defined in the case of this other semantics?

(2) Is it possible, in case of appropriately chosen semantics, that for certain observers a kind of generalized flow of time can be defined while there is no such flow of time for some other observers in the same model?

V. Conclusion

I recommend the submitted dissertation with the tentative grade of pass.

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