

- ACF_p, ACF_0 in the language of rings expanded by a single predicate for a multiplicative subgroup;
- PAC_p -fields, in an appropriate language expanded by arbitrarily many predicates for additive subgroups.

From an independence relation \perp^T in T , we define independence relations in TS and identify which properties of \perp^T are transferred to those new independence relations in TS , and under which conditions. This allows us to exhibit hypotheses under which the expansion from T to TS preserves $NSOP_1$, simplicity, or stability. In particular, under some technical hypothesis on T , we may draw the following picture (the left column implies the right column):

Configuration $T_0 \subseteq T$	Generic expansion TS
$T_0 = T$	Preserves stability
$T_0 \subseteq T$	Preserves $NSOP_1$
$T_0 = \emptyset$	Preserves simplicity

In particular, this construction produces new examples of $NSOP_1$ not simple theories, and we study in depth a particular example: the expansion of an algebraically closed field of positive characteristic by a generic additive subgroup. We give a full description of imaginaries, forking, and Kim-forking in this example.

The second part studies expansions of the group of integers by p -adic valuations. We prove quantifier elimination in a natural language and compute the dp-rank of these expansions: it equals the number of independent p -adic valuations considered. Thus, the expansion of the integers by one p -adic valuation is a new dp-minimal expansion of the group of integers. Finally, we prove that the latter expansion does not admit intermediate structures: any definable set in the expansion is either definable in the group structure or is able to “reconstruct” the valuation using only the group operation.

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BRUNO JACINTO, *Necessitism, Contingentism, and Theory Equivalence*, University of St Andrews, St Andrews, Scotland, UK (SASP PhD Programme), 2016. Supervised by Stephen Read and Gabriel Uzquiano. MSC: 03B16, 03B45. Keywords: necessitism-contingentism debate, theory equivalence, higher-order modal logic.

Abstract

Necessitism, Contingentism, and Theory Equivalence is a dissertation on issues in higher-order modal metaphysics. Consider a modal higher-order language with identity in which the universal quantifier is interpreted as expressing (unrestricted) universal quantification and the necessity operator is interpreted as expressing metaphysical necessity. The main question addressed in the dissertation concerns the correct theory formulated in this language. A different question that also takes centre stage in the dissertation is what it takes for theories to be equivalent.

The whole dissertation consists of an extended argument in defence of the (joint) truth of two seemingly inconsistent higher-order modal theories, specifically:

1. *Plantingan Moderate Contingentism*, a theory based on Plantinga’s [1] modal metaphysics that is committed to, among other things, the contingent being of some individuals and the necessary being of all possible higher-order entities;
2. *Williamsonian Thorough Necessitism*, a theory advocated by Williamson [3] which is committed to, among other things, the necessary being of every possible individual as well as of every possible higher-order entity.

Part of the case for these theories' joint truth relies on defences of the following metaphysical theses: (i) *Thorough Serious Actualism*, the thesis that no things could have been related while being nothing, and (ii) *Higher-Order Necessitism*, the thesis that necessarily, every higher-order entity is necessarily something. It is shown that *Thorough Serious Actualism* and *Higher-Order Necessitism* are both implicit commitments of very weak logical theories. The defence of *Higher-Order Necessitism* constitutes a powerful challenge to Stalnaker's [2] *Thorough Contingentism*, a theory committed to, among other things, the view that there could have been some individuals as well as some entities of any higher-order that could have been nothing.

In the dissertation it is argued that *Plantingan Moderate Contingentism* and *Williamsonian Thorough Necessitism* are in fact equivalent, even if they appear to be jointly inconsistent. The case for this claim relies on the *Synonymy account*, a novel account of theory equivalence developed and defended in the dissertation. According to this account, theories are equivalent just in case they have the same commitments and conception of logical space.

By way of defending the *Synonymy account's* adequacy, the account is applied to the debate between noneists, proponents of the view that some things do not exist, and Quineans, proponents of the view that to exist just is to be some thing. The *Synonymy account* is shown to afford a more nuanced and better understanding of that debate by revealing that what noneists and Quineans are really disagreeing about is what expressive resources are available to appropriately describe the world.

By coupling a metatheoretical result with tools from the philosophy of language, it is argued that *Plantingan Moderate Contingentism* and *Williamsonian Thorough Necessitism* are synonymous theories, and so, by the lights of the *Synonymy account*, equivalent. Given the defence of their extant commitments made in the dissertation, it is concluded that *Plantingan Moderate Contingentism* and *Williamsonian Thorough Necessitism* are both correct. A corollary of this result is that the dispute between Plantingans and Williamsons is, in an important sense, merely verbal. For if two theories are equivalent, then they "require the same of the world for their truth."

Thus, the results of the dissertation reveal that if one speaks as a Plantingan while advocating *Plantingan Moderate Contingentism*, or as a Williamsonian while advocating *Williamsonian Thorough Necessitism*, then one will not go wrong. Notwithstanding, one will still go wrong if one speaks as a Plantingan while advocating *Williamsonian Thorough Necessitism*, or as a Williamsonian while advocating *Plantingan Moderate Contingentism*.

On the basis of a conception of the individual constants and predicates of second-order modal languages as *strongly Millian*, i.e., as having *actually* existing entities as their semantic values, in the appendix are presented second-order modal logics consistent with Stalnaker's *Thorough Contingentism*. Furthermore, it is shown there that these logics are strong enough for applications of higher-order modal logic in mathematics, a result that constitutes a reply to an argument to the contrary by Williamson [3]. Finally, these logics are proven to be complete relative to particular "thoroughly contingentist" classes of models.

[1] A. PLANTINGA, *The Nature of Necessity*, Oxford University Press, Oxford, 1974.

[2] R. STALNAKER, *Mere Possibilities: Metaphysical Foundations of Modal Semantics*, Princeton University Press, Princeton, 2012.

[3] T. WILLIAMSON, *Modal Logic as Metaphysics*, Oxford University Press, Oxford, 2013.

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