Axiomatic Potentialism

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Overview

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- Still deeper roots in mathematics in general.

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- Here we will be focused on axiomatic potentialism, and on relations between potentialist axiom systems and their first order counterparts.

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Instantiation requires assumption of existence.

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Proof: use mirroring.

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This is essentially what Button calls ‘near-synonymy’.

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- M proves the universal possibility of forcing.
- e.g., it proves it is possible for the continuum to exist and have a cardinality at least as great as any $\aleph$ number whose existence is provable in ZFC.

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By comprehension,

$$\Diamond\exists x\Psi(x, z) \wedge \exists X\forall y[Xy \leftrightarrow y \in z]$$

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But then the rigidity/extensionality imply $w = z$ after all, so we have a contradiction.

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Amounts to 'restricting' ourselves to parameters that exist at the world of evaluation.

Relative Consistency

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Key Point

It turns out that M exhibits roughly the same relation to second order arithmetic together with the $\mathbf{\Pi}^1_1$ -*Perfect Set Property* as L did to ZFC.

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- The Γ-PSP implies no formula in Γ defines a well-order of the reals.
- Γ-definable sets are thus 'regular' or 'well behaved'.

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- Our translation will be doubly parameterized, once by a real and once by a transitive set. (These are the 'worlds' in the sense of the interp)
- Our interpretation for $\Diamond_\uparrow$ will involve holding r fixed and climbing transitive sets in $L[r]$;
- while our interpretation for $\Diamond_\leftarrow$ will involve allowing new reals to be added but not extending the height of the transitive set parameter.

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M $\vdash \varphi$ implies T $\vdash \forall r, T \in L[r][t(\varphi)(X, r)]$

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Since (all sets are countable)$^{\Diamond}$, the result follows.

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The exact details of $\Diamond_{\leftarrow}$ are incidental anyway; if we formulate the theory with just $\Diamond$ and $\Diamond_{\uparrow}$, we will get near synonymy.

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- What happens if we strengthen the regularity properties?
- You get more large cardinals in inner models.
- In the modal theory, this corresponds to the $\Diamond_{\uparrow}$-possibility of large cardinals.

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- But I am not convinced that there are decisive reasons for taking one of these, rather than the other, to hold only in inner models.
- This corresponds, as we have effectively seen in this talk, to not thinking there are decisive reasons to favor pure height over height-and-width potentialism.

Thanks!