Qeios

Peer Review

Review of: "Six Birds Foundations II: Admissibility, Meta-Theory, and the Exact-Six Program"

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SUMMARY DECISION: Major Revision Required

The manuscript makes a mathematically substantive claim - that typed closure roles are exactly six within a precisely bounded domain - and assembles a coherent formal apparatus to support it. The core idea is original, the definitions are generally careful, and the scoped approach to the exact-six theorem is a legitimate contribution. However, the manuscript has critical weaknesses that prevent acceptance at this stage: several key definitions are forward-referenced without clear signposting, the admissibility regime remains under-specified in sections prior to its formal treatment, proof quality is variable (some arguments are merely declared rather than demonstrated), the provenance of theorem-chain artifacts is unexplained, and four key terms introduced in this work have no prior literature grounding. These issues are addressable in revision.

CRITICAL ISSUES

Critical Issue 1: Five Statuses Forward-Referenced Without Adequate Signposting

Location: Sections 1-6.1, residual classification scheme

The residual classification scheme assigns labels including five named statuses. Definition 4.18 explicitly states that "the five statuses [are] later formalized in Section 7," which is a legitimate forward reference by design. However, the manuscript does not make this dependency visible to the reader at the point of use. Readers encountering the five-status scheme in Sections 1-6.1 have no indication that they are working with names whose formal content will only be delivered later, and no notation flags this. In a manuscript whose central contribution is formal precision, an unmarked forward dependency at this scale is a significant readability and rigor concern.

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Required action: Add explicit forward-reference markers at every use of the five statuses before Section 7. A standard approach is a footnote at first use: "Formal definitions are given in Section 7; these names are used provisionally here." The forward-reference structure is acceptable; the absence of signposting is not.

Critical Issue 2: Admissibility Regime Under-Specified in Sections 1-6

Location: Sections 2-5, admissibility discussions

The admissibility regime (honest bookkeeping, level trichotomy: behavioral/verification/structural-categorical) is invoked throughout Sections 2-5 before it is formally specified. Unlike the five-status forward reference, this is not acknowledged as a forward dependency. Readers are expected to work with admissibility conditions whose content they do not yet have. The level trichotomy in particular - behavioral, verification, structural-categorical - is applied to specific definitions without the reader being able to verify the application.

Required action: Either (a) move the formal admissibility specification to precede first use, or (b) provide a clearly labeled preliminary section that gives operational content for all three levels before they are applied.

Critical Issue 3: Threats in Sections 1-6.1 Are Not Formally Defined

Location: Threat enumeration, Sections 1-6.1

The manuscript enumerates threats to closure role typing in Sections 1-6.1. These threats are named and discussed, but their formal definitions do not appear in the sections where they are used. A reader cannot verify that a given construction constitutes a "threat" in the manuscript's sense without either inferring from context or searching later sections.

Required action: Provide formal definitions of the threat types at or before first use, or add explicit cross-references with section numbers at every first use of each threat name.

MAJOR ISSUES

Major Issue 1: Proof Quality in Section 3 is Below Formal Standards

Location: Section 3, propositions

Several propositions in Section 3 are stated in a declarative or policy-like register rather than proven. Statements of the form "this construction preserves typing" or "no collapse occurs" are asserted without the chain of inference that would make them proofs. This pattern recurs across at least three separate propositions in Section 3.

Required action: Each proposition must either (a) be accompanied by a formal proof, (b) be reduced to a lemma citing a prior result that does the work, or (c) be reclassified as a definition or assumption if it is, in fact, a stipulated property.

Major Issue 2: The Typed Non-Collapse Argument is Asserted, Not Demonstrated

Location: Typed non-collapse section

The typed non-collapse result is stated and appealed to in the main theorem chain without an explicit proof of sufficient granularity. The argument given amounts to an appeal to the typed structure plus an assertion that the structure is fine-grained enough. This is not a proof of non-collapse; it is a restatement of the claim.

Required action: Provide an explicit proof of typed non-collapse. At minimum, exhibit two role types that the scheme separates and show that the typing conditions are not simultaneously satisfiable. If the result follows from prior work, cite it with a precise statement of the applicable result.

Major Issue 3: Appendix A - API Provenance of Theorem-Chain Artifacts

Location: Appendix A

Appendix A references the "API provenance of theorem-chain artifacts" without explaining what this phrase means. In the context of a formal mathematics paper, "API provenance" has no standard meaning. If this refers to machine-checked proof artifacts, the verification environment should be named (Lean, Coq, Agda, Isabelle, or other), the version recorded, and the artifact repository linked. As written, Appendix A creates an unresolved transparency question that weakens the manuscript's formal claims.

Required action: Either (a) fully document the provenance: verification system, version, commit, or DOI, (b) remove the phrase if it adds no formal content, or (c) replace it with a clear description of what was mechanically verified versus manually proven.

Major Issue 4: Selected-Lift Atlas Construction Requires More Rigorous Justification

Location: Selected-lift atlas section

The selected-lift atlas is used to support the main classification results, but the justification is insufficient. The manuscript shows that the construction is possible for specific instances but does not demonstrate that it extends to all cases required by the theorem.

Required action: Prove completeness of the selected-lift atlas for the FATCD domain, or enumerate all required atlas entries with verification that each satisfies the selection conditions.

MINOR ISSUES

Minor Issue 1: W1-W6 Labels Introduced Without Formal Definition

Location: Informal role descriptions, Section 2

The labels W1 through W6 appear in the informal role descriptions before they are given formal content. Unlike the five-status forward reference, no forward pointer is given for the W-labels.

Required action: Add forward references to the section where W1-W6 receive formal definitions, or move those definitions earlier.

Minor Issue 2: Table 1 Placement Disrupts Reading Flow

Location: Table 1

Table 1 appears mid-paragraph in a way that interrupts the reading flow.

Required action: Move Table 1 to a float position with a caption. Add a cross-reference sentence in the preceding paragraph.

Minor Issue 3: Placeholder Language in Proof Sketches

Location: Multiple proof sketches

Several proof sketches contain language of the form "one can verify" or "it follows straightforwardly" at steps that are not straightforward in the context of closure calculus typing.

Required action: Replace every instance of "one can verify," "it is easy to see," and "straightforwardly follows" with the actual argument, or with a precise citation to a lemma that does the work.

Minor Issue 4: Section 4 Propositions Conflate Definitions with Results

Location: Section 4

Some statements labeled "Proposition" in Section 4 appear to be definitions or boundary conditions rather than derived results. Propositions that cannot be falsified given the preceding definitions are not results.

Required action: Audit Section 4 propositions. Re-label as definitions or assumptions any statement that is stipulated rather than derived.

Minor Issue 5: Thermodynamic Terminology Without Motivation

Location: Sections using "affinity" and "detailed balance"

The terms "affinity" and "detailed balance" are established technical terms in statistical physics used here in a non-thermodynamic context. The manuscript does not explain the analogy or motivate why thermodynamic framing is appropriate for closure role typing.

Required action: Either motivate the thermodynamic framing explicitly, or replace it with terminology from type theory or category theory that does not carry thermodynamic connotations.

Minor Issue 6: Nonclaim Lists in Remark 2.9 and Proposition 3.12 Overlap but Differ

Location: Remark 2.9, Proposition 3.12

The nonclaim lists in Remark 2.9 and Proposition 3.12 cover substantially overlapping content, but Proposition 3.12 adds at least two items not present in Remark 2.9 and modifies at least two others. The difference is not explained.

Required action: Add a sentence explaining the relationship between the two lists and why they differ where they do.

Minor Issue 7: Four Key Terms Have No Prior Literature Grounding

Location: Terminology introduction, throughout

The terms "typed closure role," "scoped exact-six," "FATCD," and "selected-lift atlas" do not appear in any identifiable prior literature. The manuscript does not clearly identify which terms are novel coinages versus established terms being applied in a new context.

Required action: In the introduction or a terminology section, explicitly distinguish terms imported from prior work (with citations) from terms introduced by this paper.

RECOMMENDATION

Major revision. The core mathematical claim is original and worth pursuing. The formal apparatus is more developed than most manuscripts at this stage of a new formal system. The issues identified are not fatal, but they are substantive: forward-reference signposting, admissibility pre-specification, proof quality in Section 3, the non-collapse argument, Appendix A transparency, the atlas completeness gap, and the coined-term attribution all require attention before the manuscript is ready for publication. A revised manuscript addressing the critical and major issues listed above should be re-reviewed.

Declarations

Potential competing interests: No potential competing interests to declare.