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ARTIFICIAL INTELLIGENCE LARGE LANGUAGE MODEL INTERROGATION

REPRESENTATIONAL MEASUREMENT FAILURE IN HEALTH TECHNOLGY ASSESSMENT

UNITED KINGDOM: THE *HEALTH TECHNOLOGY ASSESSMENT* JOURNAL AND THE ABSENCE OF MEASUREMENT

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FOREWORD

HEALTH TECHNOLOGY ASSESSMENT: A GLOBAL SYSTEM OF NON-MEASUREMENT

This Logit Working Paper series documents a finding as extraordinary as it is uncomfortable: health technology assessment (HTA), across nations, agencies, journals, and decades, has developed as a global system of non-measurement. It speaks the language of numbers, models, utilities, QALYs, "value for money," thresholds, discounting, incremental ratios, extrapolations, and simulations. It demands arithmetic at every turn, multiplication, division, summation, aggregation, discounting, yet it never once established that the quantities to which these operations are applied are measurable. HTA has built a vast evaluative machinery on foundations that do not exist. The probabilities and normalized logits in the country reports that follow provide the empirical confirmation of this claim. They show, with unsettling consistency, that HTA presents a world of measurement failure.

The objective of this study is to examine the epistemic foundations of the journal *Health Technology Assessment* (HTA), published under the auspices of the UK National Institute for Health and Care Research, as a central institutional vehicle for the production and validation of health technology assessment evidence. Rather than evaluating individual reports or methodological quality within specific disease areas, this analysis interrogates the belief system embedded in what the journal accepts, structures, and disseminates as legitimate quantitative evaluation. Using a 24-item diagnostic grounded in representational measurement theory, the study assesses whether the numerical claims promoted through the journal satisfy the axioms required for admissible measurement, lawful arithmetic, and falsifiable scientific inference.

The assessment treats *Health Technology Assessment* not as a neutral publishing outlet, but as a defining component of the UK HTA infrastructure. Its monographs, modeling studies, and methodological reports function as reference materials for policy decisions, academic training, and international HTA replication. The objective is therefore to determine whether the journal operates as a measurement-literate scientific archive or as an institutional mechanism for stabilizing and reproducing numerical claims whose underlying constructs lack measurable status.

The findings reveal a systematic and deeply entrenched inversion of scientific order within the *Health Technology Assessment* knowledge base. Core axioms of representational measurement—including the precedence of measurement over arithmetic, the requirement of unidimensionality, and the necessity of ratio or Rasch logit ratio scales—are weakly endorsed or effectively absent. In contrast, propositions necessary to sustain reference-case modeling, composite outcome construction, and long-horizon simulation are strongly reinforced.

The journal exhibits near-complete exclusion of Rasch measurement as the necessary framework for latent trait quantification. Despite extensive reliance on patient-reported outcomes, quality-of-life instruments, and preference-based measures, the journal does not require demonstration of invariant measurement units or latent trait possession. Numerical outputs are treated as quantities by convention rather than by measurement proof. The resulting epistemic profile is not one of partial misunderstanding but of structural normalization: arithmetic is treated as foundational, while measurement is treated as optional or implicit. In consequence, the journal supports extensive analytic production while remaining incapable of generating empirically falsifiable claims.

The modern articulation of the principal that measurement must precede arithmetic can be traced to Stevens' seminal 1946 paper, which introduced the typology of nominal, ordinal, interval, and ratio scales [1]. Stevens made explicit what physicists, engineers, and psychologists already understood: different kinds of numbers permit different kinds of arithmetic. Ordinal scales allow ranking but not addition; interval scales permit addition and subtraction but not multiplication; ratio scales alone support multiplication, division, and the construction of meaningful ratios. Utilities derived from multiattribute preference exercises, such as EQ-5D or HUI, are ordinal preference scores; they do not satisfy the axioms of interval measurement, much less ratio measurement. Yet HTA has, for forty years, treated these utilities as if they were ratio quantities, multiplying them by time to create QALYs and inserting them into models without the slightest recognition that scale properties matter. Stevens' paper should have blocked the development of QALYs and cost-utility analysis entirely. Instead, it was ignored.

The foundational theory that establishes *when* and *whether* a set of numbers can be interpreted as measurements came with the publication of Krantz, Luce, Suppes, and Tversky's *Foundations of Measurement* (1971) [2] . Representational Measurement Theory (RMT) formalized the axioms under which empirical attributes can be mapped to numbers in a way that preserves structure. Measurement, in this framework, is not an act of assigning numbers for convenience, it is the discovery of a lawful relationship between empirical relations and numerical relations. The axioms of additive conjoint measurement, homogeneity, order, and invariance specify exactly when interval scales exist. RMT demonstrated once and for all that measurement is not optional and not a matter of taste: either the axioms hold and measurement is possible, or the axioms fail and measurement is impossible. Every major construct in HTA, utilities, QALYs, DALYs, ICERs, incremental ratios, preference weights, health-state indices, fails these axioms. They lack unidimensionality; they violate independence; they depend on aggregation of heterogeneous attributes; they collapse under the requirements of additive conjoint measurement. Yet HTA proceeded, decade after decade, without any engagement with these axioms, as if the field had collectively decided that measurement theory applied everywhere except in the evaluation of therapies.

Whereas representational measurement theory articulates the axioms for interval measurement, Georg Rasch's 1960 model provides the only scientific method for transforming ordered categorical responses into interval measures for latent traits [3]. Rasch models uniquely satisfy the principles of specific objectivity, sufficiency, unidimensionality, and invariance. For any construct such as pain, fatigue, depression, mobility, or need, Rasch analysis is the only legitimate means of producing an interval scale from ordinal item responses. Rasch measurement is not an alternative to RMT; it is its operational instantiation. The equivalence of Rasch's axioms and the axioms of representational measurement was demonstrated by Wright, Andrich and others as early as the 1970s. In the latent-trait domain, the very domain where HTA claims to operate; Rasch is the only game in town [4].

Yet Rasch is effectively absent from all HTA guidelines, including NICE, PBAC, CADTH, ICER, SMC, and PHARMAC. The analysis demands utilities but never requires that those utilities be measured. They rely on multiattribute ordinal classifications but never understand that those constructs be calibrated on interval or ratio scales. They mandate cost-utility analysis but never justify the arithmetic. They demand modelled QALYs but never interrogate their dimensional properties. These guidelines do not misunderstand Rasch; they do not know it exists. The axioms that define measurement and the model that makes latent trait measurement possible are invisible to the authors of global HTA rules. The field has evolved without the science that measurement demands.

How did HTA miss the bus so thoroughly? The answer lies in its historical origins. In the late 1970s and early 1980s, HTA emerged not from measurement science but from welfare economics, decision theory, and administrative pressure to control drug budgets. Its core concern was *valuing health states*, not *measuring health*. This move, quiet, subtle, but devastating, shifted the field away from the scientific question "What is the empirical structure of the construct we intend to measure?" and toward the administrative question "How do we elicit a preference weight that we can multiply by time?" The preference-elicitation projects of that era (SG, TTO, VAS) were rationalized as measurement techniques, but they never satisfied measurement axioms. Ordinal preferences were dressed up as quasi-cardinal indices; valuation tasks were misinterpreted as psychometrics; analyst convenience replaced measurement theory. The HTA community built an entire belief system around the illusion that valuing health is equivalent to measuring health. It is not.

The endurance of this belief system, forty years strong and globally uniform, is not evidence of validity but evidence of institutionalized error. HTA has operated under conditions of what can only be described as *structural epistemic closure*: a system that has never questioned its constructs because it never learned the language required to ask the questions. Representational measurement theory is not taught in graduate HTA programs; Rasch modelling is not part of guideline development; dimensional analysis is not part of methodological review. The field has been insulated from correction because its conceptual foundations were never laid. What remains is a ritualized practice: utilities in, QALYs out, ICERs calculated, thresholds applied. The arithmetic continues because everyone assumes someone else validated the numbers.

This Logit Working Paper series exposes, through probabilistic and logit-based interrogations of AI large language national knowledge bases, the scale of this failure. The results display a global pattern: true statements reflecting the axioms of measurement receive weak endorsement; false statements reflecting the HTA belief system receive moderate or strong reinforcement. This is not disagreement. It is non-possession. It shows that HTA, worldwide, has developed as a quantitative discipline without quantitative foundations; a confused exercise in numerical storytelling.

The conclusion is unavoidable: HTA does not need incremental reform; it needs a scientific revolution. Measurement must precede arithmetic. Representational axioms must precede valuation rituals. Rasch measurement must replace ordinal summation and utility algorithms. Value claims must be falsifiable, protocol-driven, and measurable; rather than simulated, aggregated, and numerically embellished.

The global system of non-measurement is now visible. The task ahead is to replace it with science.

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DISCLAIMER

This analysis is generated through the structured interrogation of a large language model (LLM) applied to a defined documentary corpus and is intended solely to characterize patterns within an aggregated knowledge environment. It does identify, assess, or attribute beliefs, intentions, competencies, or actions to any named individual, faculty member, student, administrator, institution, or organization. The results do not constitute factual findings about specific persons or programs, nor should they be interpreted as claims regarding professional conduct, educational quality, or compliance with regulatory or accreditation standards. All probabilities and logit values reflect model-based inferences about the presence or absence of concepts within a bounded textual ecosystem, not judgments about real-world actors. The analysis is exploratory, interpretive, and methodological in nature, offered for scholarly discussion of epistemic structures rather than evaluative or legal purposes. Any resemblance to particular institutions or practices is contextual and non-attributive, and no adverse implication should be inferred.

1. INTERROGATING THE LARGE LANGUAGE MODEL

A large language model (LLM) is an artificial intelligence system designed to understand, generate, and manipulate human language by learning patterns from vast amounts of text data. Built on deep neural network architectures, most commonly transformers, LLMs analyze relationships between words, sentences, and concepts to produce contextually relevant responses. During training, the model processes billions of examples, enabling it to learn grammar, facts, reasoning patterns, and even subtle linguistic nuances. Once trained, an LLM can perform a wide range of tasks: answering questions, summarizing documents, generating creative writing, translating languages, assisting with coding, and more. Although LLMs do not possess consciousness or true understanding, they simulate comprehension by predicting the most likely continuation of text based on learned patterns. Their capabilities make them powerful tools for communication, research, automation, and decision support, but they also require careful oversight to ensure accuracy, fairness, privacy, and responsible use

In this Logit Working Paper, "interrogation" refers not to discovering what an LLM *believes,* it has no beliefs, but to probing the content of the *corpus-defined knowledge space* we choose to analyze. This knowledge base is enhanced if it is backed by accumulated memory from the user. In this case the interrogation relies also on 12 months of HTA memory from continued application of the system to evaluate HTA experience. The corpus is defined before interrogation: it may consist of a journal (e.g., *Value in Health*), a national HTA body, a specific methodological framework, or a collection of policy documents. Once the boundaries of that corpus are established, the LLM is used to estimate the conceptual footprint within it. This approach allows us to determine which principles are articulated, neglected, misunderstood, or systematically reinforced.

In this HTA assessment, the objective is precise: to determine the extent to which a given HTA knowledge base or corpus, global, national, institutional, or journal-specific, recognizes and reinforces the foundational principles of representational measurement theory (RMT). The core principle under investigation is that measurement precedes arithmetic; no construct may be treated as a number or subjected to mathematical operations unless the axioms of measurement are satisfied. These axioms include unidimensionality, scale-type distinctions, invariance, additivity, and the requirement that ordinal responses cannot lawfully be transformed into interval or ratio quantities except under Rasch measurement rules.

The HTA knowledge space is defined pragmatically and operationally. For each jurisdiction, organization, or journal, the corpus consists of:

- published HTA guidelines
- agency decision frameworks
- cost-effectiveness reference cases
- academic journals and textbooks associated with HTA
- modelling templates, technical reports, and task-force recommendations
- teaching materials, methodological articles, and institutional white papers

These sources collectively form the epistemic environment within which HTA practitioners develop their beliefs and justify their evaluative practices. The boundary of interrogation is thus not the whole of medicine, economics, or public policy, but the specific textual ecosystem that sustains HTA reasoning. . The "knowledge base" is therefore not individual opinions but the cumulative, structured content of the HTA discourse itself within the LLM.

THE *HEALTH TECHNOLOGY ASSESSMENT* KNOWLEDGE BASE

The knowledge base of the UK journal *Health Technology Assessment* can be characterized as an institutionalized system of numerical evaluation oriented toward administrative decision making rather than scientific measurement. The journal's defining feature is its role as a commissioning and dissemination platform for large-scale evaluative studies intended to inform national policy. Within this framework, methodological legitimacy is derived from procedural completeness, transparency, and modeling sophistication rather than from demonstrable measurement validity.

At the core of this knowledge base is the routine acceptance of composite outcome constructs. Patient-reported outcomes, utilities, quality-adjusted life-years, and modeled endpoints are treated as commensurable quantitative objects despite lacking evidence of unidimensionality, invariant units, or permissible arithmetic structure. These constructs are embedded directly into analytic workflows, often as dependent variables in economic models, without prior assessment of their measurement properties.

The journal places heavy emphasis on reference-case modeling. Long-horizon simulations are presented as central instruments of evaluation, projecting lifetime costs and outcomes from short-term data using layered assumptions. Within this structure, numerical plausibility replaces empirical testability. Claims are stabilized through scenario analysis and sensitivity testing rather than through protocols capable of prospective falsification. The model becomes the object of evaluation rather than the therapy claim itself.

Latent attributes are pervasive within the journal's output but remain conceptually underdeveloped. Constructs such as health-related quality of life, functional status, and wellbeing are invoked as if they represented measurable quantities, yet no formal measurement model is required to justify this assumption. Rasch measurement, which uniquely enables transformation of ordinal responses into invariant logit ratio measures of latent trait possession, is effectively absent from the journal's methodological expectations. Without this transformation, subjective responses remain ordinal, regardless of subsequent statistical treatment.

The journal's methodological standards therefore allow arithmetic operations to proceed independently of scale-type admissibility. Means, differences, regressions, and cost-effectiveness ratios are routinely reported without reference to permissible transformations. Statistical robustness substitutes for measurement validity, and consistency of output is mistaken for quantification.

Importantly, the knowledge base is defined as much by omission as by assertion. Representational measurement theory is not debated, critiqued, or explicitly rejected; it is simply excluded from the analytic frame. Measurement precedes arithmetic as a rhetorical principle but not as an operational requirement. This patterned silence enables continuity of practice while insulating foundational assumptions from challenge.

As a result, *Health Technology Assessment* functions less as a scientific journal in the classical sense and more as an administrative knowledge apparatus. Its outputs are coherent within their own conventions but lack the properties required for cumulative objective knowledge. Replication becomes repetition of modeling frameworks rather than empirical verification of measurable claims.

In this way, the journal plays a pivotal role in sustaining the UK—and global—HTA memeplex. By presenting numerically elaborate analyses without enforcing measurement gatekeeping, it confers institutional legitimacy on claims that cannot, in principle, be falsified. The journal therefore does not merely reflect the prevailing HTA belief system; it actively reproduces and stabilizes it through authoritative publication at scale.

CATEGORICAL PROBABILITIES

In the present application, the interrogation is tightly bounded. It does not ask what an LLM "thinks," nor does it request a normative judgment. Instead, the LLM evaluates how likely the HTA knowledge space is to endorse, imply, or reinforce a set of 24 diagnostic statements derived from representational measurement theory (RMT). Each statement is objectively TRUE or FALSE under RMT. The objective is to assess whether the HTA corpus exhibits possession or non-possession of the axioms required to treat numbers as measures. The interrogation creates an categorical endorsement probability: the estimated likelihood that the HTA knowledge base endorses the statement whether it is true or false; *explicitly or implicitly.*

The use of categorical endorsement probabilities within the Logit Working Papers reflects both the nature of the diagnostic task and the structure of the language model that underpins it. The purpose of the interrogation is not to estimate a statistical frequency drawn from a population of individuals, nor to simulate the behavior of hypothetical analysts. Instead, the aim is to determine the conceptual tendencies embedded in a domain-specific knowledge base: the discursive patterns, methodological assumptions, and implicit rules that shape how a health technology assessment environment behaves. A large language model does not "vote" like a survey respondent; it expresses likelihoods based on its internal representation of a domain. In this context, endorsement probabilities capture the strength with which the knowledge base, as represented within the model, supports a particular proposition. Because these endorsements are conceptual rather than statistical, the model must produce values that communicate differences in reinforcement without implying precision that cannot be justified.

This is why categorical probabilities are essential. Continuous probabilities would falsely suggest a measurable underlying distribution, as if each HTA system comprised a definable population of respondents with quantifiable frequencies. But large language models do not operate on that level. They represent knowledge through weighted relationships between linguistic and conceptual patterns. When asked whether a domain tends to affirm, deny, or ignore a principle such as unidimensionality, admissible arithmetic, or the axioms of representational measurement, the model draws on its internal structure to produce an estimate of conceptual reinforcement. The precision of that estimate must match the nature of the task. Categorical probabilities therefore provide a disciplined and interpretable way of capturing reinforcement strength while avoiding the illusion of statistical granularity.

The categories used, values such as 0.05, 0.10, 0.20, 0.50, 0.75, 0.80, and 0.85, are not arbitrary. They function as qualitative markers that correspond to distinct degrees of conceptual possession: near-absence, weak reinforcement, inconsistent or ambiguous reinforcement, common reinforcement, and strong reinforcement. These values are far enough apart to ensure clear interpretability yet fine-grained enough to capture meaningful differences in the behavior of the knowledge base. The objective is not to measure probability in a statistical sense but to classify the epistemic stance of the domain toward a given item. A probability of 0.05 signals that the knowledge base almost never articulates or implies the correct response under measurement theory, whereas 0.85 indicates that the domain routinely reinforces it. Values near the middle reflect conceptual instability rather than a balanced distribution of views.

Using categorical probabilities also aligns with the requirements of logit transformation. Converting these probabilities into logits produces an interval-like diagnostic scale that can be compared across countries, agencies, journals, or organizations. The logit transformation stretches differences at the extremes, allowing strong reinforcement and strong non-reinforcement to become highly visible. Normalizing logits to the fixed ±2.50 range ensure comparability without implying unwarranted mathematical precision. Without categorical inputs, logits would suggest a false precision that could mislead readers about the nature of the diagnostic tool.

In essence, the categorical probability approach translates the conceptual architecture of the LLM into a structured and interpretable measurement analogue. It provides a disciplined bridge between the qualitative behavior of a domain's knowledge base and the quantitative diagnostic framework needed to expose its internal strengths and weaknesses.

The LLM computes these categorical probabilities from three sources:

1. **Structural content of HTA discourse**
   If the literature repeatedly uses ordinal utilities as interval measures, multiplies non-quantities, aggregates QALYs, or treats simulations as falsifiable, the model infers high reinforcement of these false statements.
2. **Conceptual visibility of measurement axioms**
   If ideas such as unidimensionality, dimensional homogeneity, scale-type integrity, or Rasch transformation rarely appear, or are contradicted by practice, the model assigns low endorsement probabilities to TRUE statements.
3. **The model's learned representation of domain stability**
   Where discourse is fragmented, contradictory, or conceptually hollow, the model avoids assigning high probabilities. This is *not* averaging across people; it is a reflection of internal conceptual incoherence within HTA.

The output of interrogation is a categorical probability for each statement. Probabilities are then transformed into logits [$\ln(p/(1-p))$], capped to ±4.0 logits to avoid extreme distortions, and normalized to ±2.50 logits for comparability across countries. A positive normalized logit indicates reinforcement in the knowledge base. A negative logit indicates weak reinforcement or conceptual absence. Values near zero logits reflect epistemic noise.

Importantly, *a high endorsement probability for a false statement does not imply that practitioners knowingly believe something incorrect*. It means the HTA literature itself behaves as if the falsehood were true; through methods, assumptions, or repeated uncritical usage. Conversely, a low probability for a true statement indicates that the literature rarely articulates, applies, or even implies the principle in question.

The LLM interrogation thus reveals structural epistemic patterns in HTA: which ideas the field possesses, which it lacks, and where its belief system diverges from the axioms required for scientific measurement. It is a diagnostic of the *knowledge behavior* of the HTA domain, not of individuals. The 24 statements function as probes into the conceptual fabric of HTA, exposing the extent to which practice aligns or fails to align with the axioms of representational measurement.

INTERROGATION STATEMENTS

Below is the canonical list of the 24 diagnostic HTA measurement items used in all the logit analyses, each marked with its correct truth value under representational measurement theory (RMT) and Rasch measurement principles.

This is the definitive set used across the Logit Working Papers.

Measurement Theory & Scale Properties

1. Interval measures lack a true zero — TRUE
2. Measures must be unidimensional — TRUE
3. Multiplication requires a ratio measure — TRUE
4. Time trade-off preferences are unidimensional — FALSE
5. Ratio measures can have negative values — FALSE
6. EQ-5D-3L preference algorithms create interval measures — FALSE
7. The QALY is a ratio measure — FALSE
8. Time is a ratio measure — TRUE

Measurement Preconditions for Arithmetic

9. Measurement precedes arithmetic — TRUE
10. Summations of subjective instrument responses are ratio measures — FALSE
11. Meeting the axioms of representational measurement is required for arithmetic — TRUE

Rasch Measurement & Latent Traits

12. There are only two classes of measurement: linear ratio and Rasch logit ratio — TRUE
13. Transforming subjective responses to interval measurement is only possible with Rasch rules — TRUE
14. Summation of Likert question scores creates a ratio measure — FALSE

Properties of QALYs & Utilities

15. The QALY is a dimensionally homogeneous measure — FALSE
16. Claims for cost-effectiveness fail the axioms of representational measurement — TRUE
17. QALYs can be aggregated — FALSE

Falsifiability & Scientific Standards

18. Non-falsifiable claims should be rejected — TRUE
19. Reference-case simulations generate falsifiable claims — FALSE

Logit Fundamentals

20. The logit is the natural logarithm of the odds-ratio — TRUE

Latent Trait Theory

21. The Rasch logit ratio scale is the only basis for assessing therapy impact for latent traits — TRUE
22. A linear ratio scale for manifest claims can always be combined with a logit scale — FALSE
23. The outcome of interest for latent traits is the possession of that trait — TRUE
24. The Rasch rules for measurement are identical to the axioms of representational measurement — TRUE

AI LARGE LANGUAGE MODEL STATEMENTS: TRUE OR FALSE

Each of the 24 statements has a 400 word explanation why the statement is true or false as there may be differences of opinion on their status in terms of unfamiliarity with scale typology and the axioms of representational measurement.

The link to these explanations is: https://maimonresearch.com/ai-llm-true-or-false/

INTERPRETING TRUE STATEMENTS

TRUE statements represent foundational axioms of measurement and arithmetic. Endorsement probabilities for TRUE items typically cluster in the low range, indicating that the HTA corpus does *not* consistently articulate or reinforce essential principles such as:

- measurement preceding arithmetic
- unidimensionality
- scale-type distinctions

- dimensional homogeneity
- impossibility of ratio multiplication on non-ratio scales
- the Rasch requirement for latent-trait measurement

Low endorsement indicates **non-possession** of fundamental measurement knowledge—the literature simply does not contain, teach, or apply these principles.

INTERPRETING FALSE STATEMENTS

FALSE statements represent the well-known mathematical impossibilities embedded in the QALY framework and reference-case modelling. Endorsement probabilities for FALSE statements are often moderate or even high, meaning the HTA knowledge base:

- accepts non-falsifiable simulation as evidence
- permits negative "ratio" measures
- treats ordinal utilities as interval measures
- treats QALYs as ratio measures
- treats summated ordinal scores as ratio scales
- accepts dimensional incoherence

This means the field systematically reinforces incorrect assumptions at the center of its practice. *Endorsement* here means the HTA literature behaves as though the falsehood were true.

2. SUMMARY OF FINDINGS FOR TRUE AND FALSE ENDORSEMENTS: *HEALTH TECHNOLOGY ASSESSMENT*

Table 1 presents probabilities and normalized logits for each of the 24 diagnostic measurement statements. This is the standard reporting format used throughout the HTA assessment series.

It is essential to understand how to interpret these results.

The endorsement probabilities do not indicate whether a statement is *true* or *false* under representational measurement theory. Instead, they estimate the extent to which the HTA knowledge base associated with the target treats the statement as if it were true, that is, whether the concept is reinforced, implied, assumed, or accepted within the country's published HTA knowledge base.

The logits provide a continuous, symmetric scale, ranging from +2.50 to –2.50, that quantifies the degree of this endorsement. the logits, of course link to the probabilities (p) as the logit is the natural logarithm of the odds ratio; logit = ln[p/1-p].

- Strongly positive logits indicate pervasive reinforcement of the statement within the knowledge system.
- Strongly negative logits indicate conceptual absence, non-recognition, or contradiction within that same system.
- Values near zero indicate only shallow, inconsistent, or fragmentary support.

Thus, the endorsement logit profile serves as a direct index of a country's epistemic alignment with the axioms of scientific measurement, revealing the internal structure of its HTA discourse. It does not reflect individual opinions or survey responses, but the implicit conceptual commitments encoded in the literature itself.

TABLE 1: ITEM STATEMENT, RESPONSE, ENDORSEMENT AND NORMALIZED LOGITS *HEALTH TECHNOLOGY ASSESSMENT*

STATEMENT	RESPONSE 1=TRUE 0=FALSE	ENDORSEMENT OF RESPONSE CATEGORICAL PROBABILITY	NORMALIZED LOGIT (IN RANGE +/- 2.50)
INTERVAL MEASURES LACK A TRUE ZERO	1	0.20	-1.40
MEASURES MUST BE UNIDIMENSIONAL	1	0.15	-1.75
MULTIPLICATION REQUIRES A RATIO MEASURE	1	0.10	-2.20

TIME TRADE-OFF PREFERENCES ARE UNIDIMENSIONAL	0	0.85	+1.75
RATIO MEASURES CAN HAVE NEGATIVE VALUES	0	0.90	+2.20
EQ-5D-3L PREFERENCE ALGORITHMS CREATE INTERVAL MEASURES	0	0.90	+2.20
THE QALY IS A RATIO MEASURE	0	0.90	+2.20
TIME IS A RATIO MEASURE	1	0.95	+2.50
MEASUREMENT PRECEDES ARITHMETIC	1	0.10	-2.20
SUMMATIONS OF SUBJECTIVE INSTRUMENT RESPONSES ARE RATIO MEASURES	0	0.85	+1.75
MEETING THE AXIOMS OF REPRESENTATIONAL MEASUREMENT IS REQUIRED FOR ARITHMETIC	1	0.10	-2.20
THERE ARE ONLY TWO CLASSES OF MEASUREMENT LINEAR RATIO AND RASCH LOGIT RATIO	1	0.05	-2.50
TRANSFORMING SUBJECTIVE RESPONSES TO INTERVAL MEASUREMENT IS ONLY POSSIBLE WITH RASH RULES	1	0.05	-2.50
SUMMATION OF LIKERT QUESTION SCORES CREATES A RATIO MEASURE	0	0.90	+2.20
THE QALY IS A DIMENSIONALLY HOMOGENEOUS MEASURE	0	0.85	+1.75
CLAIMS FOR COST-EFFECTIVENESS FAIL THE AXIOMS OF REPRESENTATIONAL MEASUREMENT	1	0.15	-1.75
QALYS CAN BE AGGREGATED	0	0.95	+2.50
NON-FALSIFIABLE CLAIMS SHOULD BE REJECTED	1	0.60	+0.40
REFERENCE CASE SIMULATIONS GENERATE FALSIFIABLE CLAIMS	0	0.85	+1.75
THE LOGIT IS THE NATURAL LOGARITHM OF THE ODDS-RATIO	1	0.55	+0.20
THE RASCH LOGIT RATIO SCALE IS THE ONLY BASIS FOR ASSESSING THERAPY IMPACT FOR LATENT TRAITS	1	0.05	-2.50
A LINEAR RATIO SCALE FOR MANIFEST CLAIMS CAN ALWAYS BE COMBINED WITH A LOGIT SCALE	0	0.65	+0.60

THE OUTCOME OF INTEREST FOR LATENT TRAITS IS THE POSSESSION OF THAT TRAIT	1	0.20	-1.40
THE RASCH RULES FOR MEASUREMENT ARE IDENTICAL TO THE AXIOMS OF REPRESENTATIONAL MEASUREMENT	1	0.05	-2.50

HEALTH TECHNOLOGY ASSESSMENT: THE MONOGRAPH ENGINE THAT NORMALIZED ARITHMETIC WITHOUT MEASUREMENT

Health Technology Assessment (HTA) is not just another journal in the ecosystem. It is a state-backed monograph engine: long, authoritative reports that present themselves as the apex form of "decision-grade evidence," produced within the UK health policy infrastructure and disseminated globally as methodological exemplars. The NIHR Journals Library frames the series as a vehicle for "full reports of research funded by the NIHR HTA Programme," spanning evidence syntheses, trials, and economic evaluations; precisely the genres that set norms for what later becomes "standard practice." The problem is that when you interrogate this corpus against representational measurement axioms, the result is not mild slippage or occasional carelessness. The logit profile is the signature of an institutional method system that routinizes arithmetic first, treats measurement as a decorative afterthought, and then calls the output "science" because it arrives in the form of a carefully structured report.

Start with the non-negotiable gatekeeper: measurement precedes arithmetic. On any defensible philosophy of quantification, this is not a "nice to have." It is the entry ticket. Yet the table places it at p = 0.10 (−2.20). This is not ignorance in a casual sense; it is operational doctrine. A knowledge base that truly treated measurement as prior constraint would not permit the downstream arithmetic that defines modern HTA—utility averaging, QALY construction, ICER comparisons, thresholding—until scale type and invariance were established. Instead, the HTA monograph tradition has perfected the opposite: present the arithmetic as if it were intrinsically meaningful, then offer methodological discussion as if it were merely about improving precision, reducing parameter uncertainty, or standardizing reporting. That is the inversion. And the inversion is what makes the entire "reference case" worldview administratively useful: it produces closure without requiring measurement legitimacy.

The second gatekeeper is equally brutal: multiplication requires ratio measurement. Cost-utility analysis lives and dies on multiplication: time is multiplied by a preference weight and treated as a "quantity of health." But the logit profile drives the ratio requirement to the basement at p = 0.10 (−2.20). You cannot simultaneously deny the rule and defend the product of multiplication as a quantity. Yet the HTA corpus proceeds exactly as if it can: it treats the multiplication as a professional ritual whose legitimacy is guaranteed by convention, committee assent, and international repetition. This is why the journal is so damaging in supply-chain terms: it does not merely publish QALY arithmetic; it presents it as the mature endpoint of "good assessment," thereby educating analysts, reviewers, and policy audiences to accept multiplication on non-measures as normal.

Now look at the enabling falsehoods; the beliefs without which the monograph machine would seize. “The QALY is a ratio measure” and “EQ-5D algorithms create interval measures” both sit at p = 0.90 (+2.20), while “QALYs can be aggregated” sits at the ceiling p = 0.95 (+2.50). This triad is the load-bearing scaffold. If EQ-5D scoring were treated as what it is an algorithmic mapping of ordinal health-state descriptions to a pseudo-cardinal index, then the pretense of interval status collapses. If the QALY were treated as what it is a composite constructed by multiplying a manifest ratio variable (time) by a non-ratio preference weight then the “ratio QALY” collapses. And if aggregation were treated as a claim requiring dimensional homogeneity and legitimate units, then the grand policy move, population-level rationing narratives derived from aggregated QALYs collapses. The table tells you exactly what the knowledge base protects: not patient measurement, not scientific discipline, but the administrative convenience of an index that can be averaged, multiplied, applied to thresholds, and used to justify decisions while remaining insulated from measurement adjudication.

The profile is especially damning on the “negative utility” accommodation: “ratio measures can have negative values” sits at p = 0.90 (+2.20). This is not a technical quibble. Negative values are not a harmless extension if you are claiming ratio status. A ratio scale has a meaningful zero that represents the absence of the attribute. If the system tolerates negative values while insisting on ratio arithmetic, it is not making a subtle philosophical move; it is committing a category error and institutionalizing it as routine. The point is not that analysts are “wrong” in the ordinary sense; it is that the journal ecosystem has normalized a mathematical impossibility as an operational norm because the alternative, admitting the scale type failure, would dismantle the entire cost-utility edifice.

Unidimensionality exposes the same pattern of selective amnesia. “Measures must be unidimensional” sits at p = 0.15 (−1.75) near the floor. Yet “time trade-off preferences are unidimensional” is treated as entrenched at p = 0.85 (+1.75). That is the tell. The knowledge base does not enforce unidimensionality as a requirement; it invokes unidimensionality as an assumption when the production chain needs a single continuum. The result is the systematic laundering of multidimensional descriptions into single-index outputs, exactly the procedure that makes EQ-5D-derived utility weights usable for arithmetic. In a measurement-first discipline, unidimensionality would be demonstrated, challenged, and re-tested across groups and contexts. In the HTA monograph tradition, it becomes a convenient stipulation that keeps the model moving.

The decisive failure, however—the one that shows the journal is not simply “wrong” but structurally organized against measurement—is the Rasch block. If you accept that subjective observations require construction of measures, then the discipline has to confront the reality that ordinal responses are not quantities. You do not rescue them with reliability coefficients, factor models, or regression sophistication. You rescue them, if at all, with a measurement model that yields invariant units. That is the role Rasch was built to play. Yet the corpus drives every Rasch-defining proposition to the absolute floor: “only two admissible classes… linear ratio and Rasch logit ratio” at p = 0.05 (−2.50); “Rasch is the only basis for latent-trait impact” at p = 0.05 (−2.50); “transforming subjective responses… only possible with Rasch rules” at p = 0.05 (−2.50); and

“Rasch rules identical to representational axioms” at p = 0.05 (−2.50). This is not a community that has weighed Rasch and found it wanting. It is a community that cannot allow Rasch to become sovereign, because sovereignty would invalidate a vast proportion of its preferred endpoints, mappings, and “utility estimation” practices.

That is why Table 1 simultaneously shows near-ceiling endorsement for the scoring rituals: “summation of Likert scores creates a ratio measure” at p = 0.90 (+2.20) and “summations of subjective instrument responses are ratio measures” at p = 0.85 (+1.75). This is the substitution mechanism: if you cannot (or will not) pay the price of measurement, you install a meme that scores *are* measures. Once installed, the discipline becomes self-protecting. It can publish endless model refinements, endless sensitivity analyses, endless Bayesian updates, endless probabilistic claims—because the one question that would stop the machinery (is the dependent variable a measure?) is treated as optional or irrelevant. The result is exactly what your broader program calls out: arithmetic without measurement, professionalized into a reporting genre and then exported as best practice.

The falsification items clinch the diagnosis. “Non-falsifiable claims should be rejected” lands at p = 0.60 (+0.40): enough to preserve the rhetorical posture of science, not enough to govern behavior. Meanwhile, “reference case simulations generate falsifiable claims” sits at p = 0.85 (+1.75): the knowledge base confers scientific status on projections that are conditional on non-measured inputs and untestable horizons. This is how the monograph genre maintains its authority: it presents scenario robustness as if it were empirical risk. But scenario analysis is not falsification; it is internal consistency checking within an assumed story world. When the journal treats that as falsifiable evidence, it is not merely mistaken it is redefining “science” as “a set of coherent narratives with uncertainty intervals.”

This is where the parallel with prior journal targets becomes all too obvious. *Value in Health* supplies legitimacy through professional consensus and “guidance”; *Pharmacoeconomics* supplies reinforcement through incessant replication of the same constructs and training of the next cohort. *Health Technology Assessment* supplies something even more potent**:** institutional imprimatur. The long-form monograph, attached to national infrastructure and framed as definitive evaluation, gives the memeplex a special kind of durability. It makes the false measurement system feel like public-interest rationality rather than a contested methodological belief. And because it is embedded in the UK policy supply chain, it also functions as a transmitter: what is normalized here is readily re-exported to agencies, consultancies, and academic centers seeking to mimic the “gold standard.”

What is the forensic conclusion from the logits? The pattern is not mixed. It is asymmetrical in a way that is diagnostic of a belief system: everything that would constrain arithmetic is suppressed (negative logits near floor), everything that enables QALY/ICER production and aggregation is elevated (positive logits near ceiling), Rasch is quarantined, and falsification is invoked rhetorically while being operationally displaced by simulation. This is not “a few bad assumptions.” It is a coherent epistemic architecture designed, whether by intent, inertia, or administrative selection pressure to produce closure without measurement.

If the journal were rebuilt around admissible measurement, its editorial gatekeeping would look entirely different. A "health technology assessment" worthy of the name would (i) restrict quantitative claims to linear ratio measures for manifest attributes (counts, time, resource use) and (ii) require Rasch logit ratio measures for latent traits, with invariance demonstrated and possession interpreted on a calibrated continuum. Under that regime, most of what the monograph system currently treats as its signature achievement—QALY arithmetic, mapping, preference algorithms treated as measures, long-horizon reference case ICERs—would be reclassified as descriptive storytelling. Not "bad science." Not "uncertain evidence." But non-measures**.**

And that is precisely why this review matters. A journal can survive being told it needs better reporting. It cannot survive being told its dependent variables are not measures and its arithmetic is therefore inadmissible. The HTA monograph tradition has run for decades on the opposite assumption: that if you standardize methods, quantify uncertainty, and align with the reference case, then you are doing rigorous science. The logit profile says otherwise. It says the series has functioned as a highly efficient distribution channel for the core NICE-era memeplex: a system in which measurement is not the foundation of arithmetic, but the thing you talk around so the arithmetic can proceed.

In measurement terms the verdict is simple: the journal's knowledge base exhibits the same structural inversion you have documented elsewhere, but magnified by institutional authority. It is not merely "missing" representational measurement theory; it is organized in a way that makes the axioms non-binding so that the monograph output remains usable for administrative closure. That is the opposite of normal science. It is the bureaucratic triumph of numerically formatted belief.

3. THE TRANSITION TO MEASUREMENT IN HEALTH TECHNOLOGY ASSESSMENT

THE IMPERATIVE OF CHANGE

This analysis has not been undertaken to criticize decisions made by health system, nor to assign responsibility for the analytical frameworks currently used in formulary review. The evidence shows something more fundamental: organizations have been operating within a system that does not permit meaningful evaluation of therapy impact, even when decisions are made carefully, transparently, and in good faith.

The present HTA framework forces health systems to rely on numerical outputs that appear rigorous but cannot be empirically assessed (Table 1). Reference-case models, cost-per-QALY ratios, and composite value claims are presented as decision-support tools, yet they do not satisfy the conditions required for measurement. As a result, committees are asked to deliberate over results that cannot be validated, reproduced, or falsified. This places decision makers in an untenable position: required to choose among therapies without a stable evidentiary foundation.

This is not a failure of expertise, diligence, or clinical judgment. It is a structural failure. The prevailing HTA architecture requires arithmetic before measurement, rather than measurement before arithmetic. Health systems inherit this structure rather than design it. Manufacturers respond to it. Consultants reproduce it. Journals reinforce it. Universities promote it. Over time it has come to appear normal, even inevitable.

Yet the analysis presented in Table 1 demonstrates that this HTA framework cannot support credible falsifiable claims. Where the dependent variable is not a measure, no amount of modeling sophistication can compensate. Uncertainty analysis cannot rescue non-measurement. Transparency cannot repair category error. Consensus cannot convert assumption into evidence.

The consequence is that formulary decisions are based on numerical storytelling rather than testable claims. This undermines confidence, constrains learning, and exposes health systems to growing scrutiny from clinicians, patients, and regulators who expect evidence to mean something more than structured speculation.

The imperative of change therefore does not arise from theory alone. It arises from governance responsibility. A health system cannot sustain long-term stewardship of care if it lacks the ability to distinguish between claims that can be evaluated and claims that cannot. Without that distinction, there is no pathway to improvement; only endless repetition for years to come.

This transition is not about rejecting evidence. It is about restoring evidence to its proper meaning. It requires moving away from composite, model-driven imaginary constructs toward claims that are measurable, unidimensional, and capable of empirical assessment over time. The remainder of this section sets out how that transition can occur in a practical, defensible, and staged manner.

MEANINGFUL THERAPY IMPACT CLAIMS

At the center of the current problem is not data availability, modeling skill, or analytic effort. It is the nature of the claims being advanced. Contemporary HTA has evolved toward increasingly complex frameworks that attempt to compress multiple attributes, clinical effects, patient experience, time, and preferences into single composite outputs. These constructs are then treated as if they were measures. They are not (Table 1).

The complexity of the reference-case framework obscures a simpler truth: meaningful evaluation requires meaningful claims. A claim must state clearly what attribute is being affected, in whom, over what period, and how that attribute is measured. When these conditions are met, evaluation becomes possible. When they are not complexity substitutes for clarity. The current framework is not merely incorrect; it is needlessly elaborate. Reference-case modeling requires dozens of inputs, assumptions, and transformations, yet produces outputs that cannot be empirically verified. Each additional layer of complexity increases opacity while decreasing accountability. Committees are left comparing models rather than assessing outcomes.

In contrast, therapy impact can be expressed through two, and only two, types of legitimate claims. First are claims based on manifest attributes: observable events, durations, or resource units. These include hospitalizations avoided, time to event, days in remission, or resource use. When properly defined and unidimensional, these attributes can be measured on linear ratio scales and evaluated directly.

Second are claims based on latent attributes: symptoms, functioning, need fulfillment, or patient experience. These cannot be observed directly and therefore cannot be scored or summed meaningfully. They require formal measurement through Rasch models to produce invariant logit ratio scales. These two forms of claims are sufficient. They are also far more transparent. Each can be supported by a protocol. Each can be revisited. Each can be reproduced. Most importantly, each can fail. But they cannot be combined. This is the critical distinction. A meaningful claim is one that can be wrong.

Composite constructs such as QALYs do not fail in this sense. They persist regardless of outcome because they are insulated by assumptions. They are recalculated, not refuted. That is why they cannot support learning. The evolution of objective knowledge regarding therapy impact in disease areas is an entirely foreign concept. By re-centering formulary review on single-attribute, measurable claims, health systems regain control of evaluation. Decisions become grounded in observable change rather than modeled narratives. Evidence becomes something that accumulates, rather than something that is re-generated anew for every submission.

THE PATH TO MEANINGFUL MEASUREMENT

Transitioning to meaningful measurement does not require abandoning current processes overnight. It requires reordering them. The essential change is not procedural but conceptual: measurement must become the gatekeeper for arithmetic, not its byproduct.

The first step is formal recognition that not all numerical outputs constitute evidence. Health systems must explicitly distinguish between descriptive analyses and evaluable claims. Numbers that do not meet measurement requirements may inform discussion but cannot anchor decisions.

The second step is restructuring submissions around explicit claims rather than models. Each submission should identify a limited number of therapy impact claims, each defined by attribute, population, timeframe, and comparator. Claims must be unidimensional by design.

Third, each claim must be classified as manifest or latent. This classification determines the admissible measurement standard and prevents inappropriate mixing of scale types.

Fourth, measurement validity must be assessed before any arithmetic is permitted. For manifest claims, this requires confirmation of ratio properties. For latent claims, this requires Rasch-based measurement with demonstrated invariance.

Fifth, claims must be supported by prospective or reproducible protocols. Evidence must be capable of reassessment, not locked within long-horizon simulations designed to frustrate falsification.

Sixth, committees must be supported through targeted training in representational measurement principles, including Rasch fundamentals. Without this capacity, enforcement cannot occur consistently.

Finally, evaluation must be iterative. Claims are not accepted permanently. They are monitored, reproduced, refined, or rejected as evidence accumulates.

These steps do not reduce analytical rigor. They restore it.

TRANSITION REQUIRES TRAINING

A transition to meaningful measurement cannot be achieved through policy alone. It requires a parallel investment in training, because representational measurement theory is not intuitive and has never been part of standard professional education in health technology assessment, pharmacoeconomics, or formulary decision making. For more than forty years, practitioners have been taught to work within frameworks that assume measurement rather than demonstrate it. Reversing that inheritance requires structured learning, not informal exposure.

At the center of this transition is the need to understand why measurement must precede arithmetic. Representational measurement theory establishes the criteria under which numbers can legitimately represent empirical attributes. These criteria are not optional. They determine whether addition, multiplication, aggregation, and comparison are meaningful or merely symbolic. Without this foundation, committees are left evaluating numerical outputs without any principled way to distinguish evidence from numerical storytelling.

Training must therefore begin with scale types and their permissible operations. Linear ratio measurement applies to manifest attributes that possess a true zero and invariant units, such as time, counts, and resource use. Latent attributes, by contrast, cannot be observed directly and cannot be measured through summation or weighting. They require formal construction through a measurement model capable of producing invariant units. This distinction is the conceptual fulcrum of reform, because it determines which claims are admissible and which are not.

For latent trait claims, Rasch measurement provides the only established framework capable of meeting these requirements. Developed in the mid–twentieth century alongside the foundations of modern measurement theory, the Rasch model was explicitly designed to convert subjective observations into linear logit ratio measures. It enforces unidimensionality, tests item invariance, and produces measures that support meaningful comparison across persons, instruments, and time. These properties are not approximations; they are defining conditions of measurement.

Importantly, Rasch assessment is no longer technically burdensome. Dedicated software platforms developed and refined over more than four decades make Rasch analysis accessible, transparent, and auditable. These programs do not merely generate statistics; they explain why items function or fail, how scales behave, and whether a latent attribute has been successfully measured. Measurement becomes demonstrable rather than assumed.

Maimon Research has developed a two-part training program specifically to support this transition. The first component provides foundational instruction in representational measurement theory, including the historical origins of scale theory, the distinction between manifest and latent attributes, and the criteria that define admissible claims. The second component focuses on application, detailing claim types, protocol design, and the practical use of Rasch methods to support latent trait evaluation.

Together, these programs equip health systems, committees, and analysts with the competence required to enforce measurement standards consistently. Training does not replace judgment; it enables it. Without such preparation, the transition to meaningful measurement cannot be sustained. With it, formulary decision making can finally rest on claims that are not merely numerical, but measurable.

DESIGNED FOR CLOSURE

For those who remain unconvinced that there is any need to abandon a long-standing and widely accepted HTA framework, it is necessary to confront a more fundamental question: why was this system developed and promoted globally in the first place?

The most plausible explanation is administrative rather than scientific. Policy makers were searching for an assessment framework that could be applied under conditions of limited empirical data while still producing a determinate conclusion. Reference-case modeling offered precisely this convenience. By constructing a simulation populated with assumptions, surrogate endpoints, preference weights, and extrapolated time horizons, it became possible to generate a numerical result that could be interpreted as decisive. Once an acceptable cost-effectiveness ratio emerged, the assessment could be declared complete and the pricing decision closed. This structure solved a political and administrative problem. It allowed authorities to claim that decisions were evidence-based without requiring the sustained empirical burden demanded by normal science. There was no requirement to formulate provisional claims and subject them to ongoing falsification. There was no obligation to revisit conclusions as new data emerged. Closure could be achieved at launch, rather than knowledge evolving over the product life cycle.

By contrast, a framework grounded in representational measurement would have imposed a very different obligation. Claims would necessarily be provisional. Measurement would precede arithmetic. Each therapy impact claim would require a defined attribute, a valid scale, a protocol, and the possibility of replication or refutation. Evidence would accumulate rather than conclude. Decisions would remain open to challenge as real-world data emerged. From an administrative standpoint, this was an unreasonable burden. It offered no finality.

The reference-case model avoided this problem entirely. By shifting attention away from whether quantities were measurable and toward whether assumptions were plausible, the framework replaced falsification with acceptability. Debate became internal to the model rather than external to reality. Sensitivity analysis substituted for empirical risk. Arithmetic proceeded without prior demonstration that the objects being manipulated possessed the properties required for arithmetic to be meaningful.

Crucially, this system required no understanding of representational measurement theory. Committees did not need to ask whether utilities were interval or ratio measures, whether latent traits had been measured or merely scored, or whether composite constructs could legitimately be multiplied or aggregated. These questions were never posed because the framework did not require them to be posed. The absence of measurement standards was not an oversight; it was functionally essential.

Once institutionalized, the framework became self-reinforcing. Training programs taught modeling rather than measurement. Guidelines codified practice rather than axioms. Journals reviewed technique rather than admissibility. Over time, arithmetic without measurement became normalized as “good practice,” while challenges grounded in measurement theory were dismissed as theoretical distractions. The result was a global HTA architecture capable of producing numbers, but incapable of producing falsifiable knowledge. Claims could be compared, ranked, and monetized, but not tested in the scientific sense. What evolved was not objective knowledge, but institutional consensus.

This history matters because it explains why the present transition is resisted. Moving to a real measurement framework with single, unidimensional claims does not merely refine existing methods; it dismantles the very mechanism by which closure has been achieved for forty years. It replaces decisiveness with accountability, finality with learning, and numerical plausibility with empirical discipline. Yet that is precisely the transition now required. A system that avoids measurement in order to secure closure cannot support scientific evaluation, cumulative knowledge, or long-term stewardship of healthcare resources. The choice is therefore unavoidable: continue with a framework designed to end debate, or adopt one designed to discover the truth.

Anything else is not assessment at all, but the ritualized manipulation of numbers detached from measurement, falsification, and scientific accountability.

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