

# CGP

## Convergent Grammar Principle

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## 1 0. Orientation and Scope

The **Convergent Grammar Principle (CGP)** is a **meta-level criterion** for evaluating the expressive adequacy of formal grammars under variation of representation. It addresses a specific problem: how to distinguish grammars whose expressive capacity is robust to representational change from those whose apparent adequacy is an artifact of particular encodings.

CGP does not define a grammar, calculus, or ontology. It does not introduce primitives, rules of transformation, or semantic interpretation. Its role is diagnostic rather than constructive: it provides a way to assess whether a proposed grammar maintains expressive sufficiency across multiple, non-equivalent representations of the same underlying structure.

Accordingly, CGP should not be read as a theory of meaning, truth, or reality. It does not claim that a convergent grammar is correct, true, or necessary. It specifies only a structural condition that a grammar may or may not satisfy.

The scope of CGP is deliberately narrow. It applies only where multiple representations of a structure are available and where expressive adequacy is a concern. Outside that context, CGP is silent.

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## 2 1. Posture, Dependency, and Replaceability

CGP occupies a **lateral position** within the corpus. It is neither upstream nor downstream of ontology, grammar, or calculus. Instead, it functions as an optional evaluative lens that may be applied to formal systems without conferring authority upon them.

CGP presupposes the existence of grammars to which it may be applied, but it does not justify or validate those grammars. A grammar that satisfies CGP is not thereby endorsed as correct or complete. A grammar that fails CGP is not thereby refuted. CGP establishes a criterion of expressive robustness, nothing more.

Dependency does not flow upward from CGP. Ontological claims do not rely on CGP. Formal grammars do not derive their validity from CGP. Calculi defined over grammars are not grounded by CGP. Any use of the principle is optional and context-dependent.

CGP itself is **replaceable**. Other meta-criteria may be proposed that assess different aspects of grammatical adequacy, such as efficiency, simplicity, or interpretive transparency. CGP claims no exclusivity and no foundational status.

This posture has important consequences:

- Convergence under CGP is a structural property, not a mark of truth.
- Failure to converge does not imply semantic inadequacy.
- Application of CGP does not privilege any particular grammar by definition.

With posture and dependency fixed, the sections that follow state the problem CGP addresses and articulate the principle itself, without extending beyond this evaluative role.

### 3 2. Problem Statement: Representation Variance

Formal grammars are typically developed and evaluated within a specific representational context. Symbols, encodings, and structural conventions are chosen to make certain relations explicit and tractable. While such choices are often necessary, they introduce a persistent problem: **apparent expressive adequacy may be an artifact of representation rather than a property of the grammar itself.**

Representation variance arises when multiple, non-equivalent representations can be constructed for the same underlying structure. A grammar that appears sufficient under one representation may fail to express the same structure when the representation changes, even though no ontological or semantic content has been altered.

This problem is not primarily semantic. It does not depend on interpretation, meaning, or truth conditions. It is structural. Different representations may distribute relational information differently, encode hierarchy or symmetry in distinct ways, or rely on implicit assumptions that are not preserved under transformation.

As a result, grammars may exhibit **representation sensitivity**: their expressive success depends on specific encodings, coordinate choices, or symbolic conveniences. Such sensitivity can remain hidden as long as the grammar is tested only within a narrow representational regime.

The difficulty is compounded by the fact that representational choices often feel neutral or natural to their designers. A grammar may appear robust simply because it has not been subjected to sufficiently divergent representations. In these cases, expressive failure is misdiagnosed as an implementation issue, a modeling error, or a limitation of application, rather than as a limitation of the grammar.

The problem CGP addresses can therefore be stated as follows:

How can one distinguish grammars whose expressive adequacy is **invariant under representational change** from those whose adequacy depends on particular encodings?

Without a criterion to address this question, grammars risk being overestimated in scope, silently embedding assumptions tied to representation rather than structure.

The Convergent Grammar Principle is introduced to provide such a criterion. It does not eliminate representation variance, nor does it prescribe preferred encodings. Instead, it offers a way to test whether a grammar's expressive capacity converges across multiple, structurally distinct representations of the same underlying relations.

The next section states the principle itself.

### 4 3. Statement of the Convergent Grammar Principle

The **Convergent Grammar Principle (CGP)** can be stated as follows:

A formal grammar is *convergent* if its expressive adequacy is preserved across multiple, structurally distinct representations of the same underlying relations.

Convergence, in this sense, does not require identical encodings, symbols, or constructions. It requires that, when representational choices vary in non-trivial ways, the grammar remains capable of expressing the relevant relational structure without loss, distortion, or reliance on representation-specific assumptions.

A grammar that satisfies CGP exhibits **representation-invariant sufficiency**. Its ability to express structure does not depend on privileged coordinate systems, canonical encodings, or implicit representational conveniences. A grammar that fails CGP may appear adequate within a narrow representational regime while lacking general expressive robustness.

CGP is a **necessary but not sufficient** condition for grammatical adequacy in contexts where representational variance is relevant. Satisfaction of the principle does not establish correctness, truth, or semantic validity. It indicates only that expressive success is not contingent on a particular representation.

Convergence is assessed relative to a family of representations. A grammar is not convergent or non-convergent in isolation, but only with respect to the range and diversity of representations against which it is tested.

CGP makes no claim about which representations are preferred, natural, or correct. It does not prescribe representational choices or eliminate representational diversity. It functions solely as a criterion for detecting when expressive adequacy collapses under representational change.

Failure to satisfy CGP does not imply that a grammar is unusable or incorrect. Many grammars are intentionally representation-specific and function effectively within their intended scope. CGP applies only where representation-invariant expressibility is a design goal.

The principle therefore establishes a limited diagnostic distinction:

- **Convergent grammars** maintain expressive adequacy across representational variation.
- **Non-convergent grammars** depend on specific encodings for expressive success.

No further evaluative weight is implied.

The following section specifies how convergence and divergence are identified and constrained, without extending the principle beyond this diagnostic role.

### 5 4. Convergence and Divergence Criteria

This section specifies the **criteria by which convergence or divergence is identified** under the Convergent Grammar Principle. These criteria are structural and comparative. They do not

evaluate truth, correctness, or utility, and they do not privilege particular representations.

The goal is not to prescribe a testing methodology, but to clarify what it means, in principle, for a grammar's expressive adequacy to persist or collapse under representational variation.

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### 5.1 4.1 Families of Representations

Convergence is assessed relative to a **family of representations**.

A family consists of multiple representations that:

- Encode the same underlying relational structure
- Differ in non-trivial structural ways (e.g., coordinate choice, decomposition, orientation, or encoding strategy)
- Do not merely rename symbols or apply superficial syntactic variation

CGP does not specify how such families are generated. The criterion applies once representational diversity is present.

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### 5.2 4.2 Criterion for Convergence

A grammar is **convergent** with respect to a given family of representations if, for each representation in the family, the grammar can express the relevant relational structure without:

- Loss of structural information
- Introduction of representation-specific auxiliary assumptions
- Reliance on implicit conventions not preserved across representations

Convergence requires that expressive adequacy be maintained without tailoring the grammar to each representation.

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### 5.3 4.3 Criterion for Divergence

A grammar **diverges** with respect to a family of representations if its expressive adequacy depends on specific representational features.

Indicators of divergence include:

- Failure to express relations present in some representations
- Requirement of ad hoc extensions or reinterpretations
- Breakdown of structural correspondence under representational change

Divergence may be partial or total. A grammar may converge for some families of representations and diverge for others.

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## 5.4 4.4 Local and Global Convergence

Convergence may be **local or global**.

- Local convergence occurs when a grammar remains adequate for certain substructures or relational classes across representations.
- Global convergence occurs when adequacy is preserved across the full structural scope under consideration.

CGP does not privilege global convergence. The distinction exists to prevent overgeneralization from limited success.

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## 5.5 4.5 Non-Binary Outcomes

Convergence under CGP is not inherently binary.

A grammar may:

- Converge strongly across a wide family of representations
- Converge weakly across a narrow family
- Exhibit mixed behavior depending on structural features

CGP supports graded assessment without ranking grammars or assigning value judgments.

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## 5.6 4.6 No Methodological Prescription

CGP does not mandate how convergence testing must be performed.

It does not require empirical sampling, exhaustive enumeration, or algorithmic verification. The principle specifies *what counts* as convergence or divergence, not *how* such determinations must be made in practice.

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## 5.7 4.7 Summary

Under CGP:

- Convergence is assessed relative to families of representations
- Adequacy must persist without representation-specific scaffolding
- Divergence indicates representation dependence, not failure
- Outcomes may be local, global, or graded

These criteria complete the formal statement of CGP. The following sections clarify the scope and limits of the principle and its relationship to grammars and calculi.

## 6 5. Scope and Limits of CGP

This section explicitly delineates the **scope and limits** of the Convergent Grammar Principle. These limits are essential to preventing CGP from being misread as a foundational criterion, a theory of correctness, or a substitute for semantic or ontological evaluation.

CGP is intentionally narrow. Its strength lies in what it refuses to address.

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### 6.1 5.1 No Ontological Authority

**Limit:** CGP makes no ontological claims.

The principle does not assert that convergent grammars describe reality, capture necessary structure, or correspond to existence. Ontological commitments, if any, arise entirely outside CGP and cannot be inferred from convergence or divergence.

A grammar's convergence under CGP neither supports nor undermines any ontological position.

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### 6.2 5.2 No Semantic Evaluation

**Limit:** CGP does not evaluate meaning or truth.

Convergence does not imply that a grammar expresses correct meanings, accurate interpretations, or valid propositions. Likewise, divergence does not imply semantic failure.

CGP is blind to interpretation. It assesses only structural expressibility under representational variation.

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### 6.3 5.3 No Empirical or Practical Validation

**Limit:** CGP does not validate grammars empirically or practically.

A convergent grammar is not thereby effective, useful, efficient, or applicable in any particular domain. Practical success or failure of a grammar has no bearing on its status under CGP.

Conversely, a grammar may be practically successful while remaining representation-dependent.

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## **6.4 5.4 No Universality or Sufficiency Claims**

**Limit:** CGP does not establish universality or sufficiency.

Satisfaction of CGP is not sufficient for grammatical adequacy in general. Other criteria—formal, semantic, pragmatic, or domain-specific—may be equally or more relevant depending on context.

CGP is one criterion among many, not a gatekeeper.

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## **6.5 5.5 Dependence on Representational Diversity**

**Limit:** CGP applies only where representational variance is meaningful.

In contexts where a grammar is intentionally representation-specific, or where no alternative representations are available or relevant, CGP may have little or no applicability.

Failure to satisfy CGP in such contexts does not constitute a deficiency.

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## **6.6 5.6 No Prescribed Methodology**

**Limit:** CGP does not prescribe methods of assessment.

The principle does not mandate how representations are generated, how adequacy is tested, or how divergence is diagnosed. These methodological choices are external to CGP and may vary by context.

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## **6.7 5.7 Summary**

The limits of CGP can be summarized as follows:

- It carries no ontological authority
- It evaluates no semantics or truth
- It provides no empirical or practical validation
- It establishes no universality or sufficiency
- It applies only where representational variance is relevant
- It prescribes no assessment methodology

By enforcing these limits, CGP remains a diagnostic tool rather than a foundation. The sections that follow situate CGP relative to grammars and calculi and illustrate its application without extending its scope.

## 7 6. Relationship to Grammar and Calculus

This section clarifies how the Convergent Grammar Principle (CGP) relates to **formal grammars** and **calculi** without conferring authority, validation, or privilege. CGP operates at a meta-level and remains optional and lateral to both.

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### 7.1 6.1 Relationship to Grammar

CGP may be applied to a formal grammar to assess whether the grammar's **expressive adequacy** persists across representational variation.

When applied to a grammar, CGP:

- Evaluates representation-invariant sufficiency only
- Does not assess correctness, truth, or meaning
- Does not modify or constrain the grammar
- Does not establish necessity or universality

A grammar that converges under CGP is not thereby endorsed. A grammar that diverges under CGP is not thereby disqualified. CGP provides a diagnostic distinction regarding representation dependence, nothing more.

CGP does not require that grammars be designed to satisfy it. Many grammars are intentionally representation-specific and remain appropriate within their intended scope.

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### 7.2 6.2 Relationship to Calculus

CGP may also be applied, where relevant, to calculi defined over grammars.

In this context, CGP assesses whether a calculus's **admissible transformations** preserve expressive adequacy across representational variation of the underlying grammar structures. The principle does not evaluate transformation preference, efficiency, or semantic interpretation.

As with grammars, convergence or divergence under CGP does not validate or refute a calculus. It identifies whether the calculus's operation depends on representational artifacts.

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### 7.3 6.3 No Privileging of Specific Systems

Application of CGP to any particular grammar or calculus does not privilege that system within the corpus or beyond it.

CGP applies equally to:

- Established grammars

- Experimental formalisms
- Domain-specific calculi
- Alternative or competing systems

No system derives authority from satisfying CGP by definition.

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#### **7.4 6.4 Independence from Design Intent**

CGP does not assume that grammars or calculi are intended to be representation-invariant.

Design goals such as simplicity, efficiency, interpretability, or domain fit may legitimately take precedence over convergence. CGP merely provides information about representation sensitivity when that information is relevant.

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#### **7.5 6.5 Summary**

CGP relates to grammars and calculi as follows:

- It evaluates representation-invariant sufficiency, not validity
- It applies optionally and laterally
- It privileges no system by construction
- It respects diverse design goals

With this relationship clarified, the remaining sections illustrate CGP's use and restate its replaceable, non-foundational role without extending its scope.