

Generative Cognition

M. Bello

Abstract

Human cognition rests on deep structural invariants. A universal and biologically fixed capacity cannot be realized in a system that varies in fundamental ways across populations or individuals. This paper formalizes the constraint that universal faculties presuppose cognitive invariants.

1. Introduction

Humans vary in behavior and experience, but exhibit deep cognitive constraints that are biologically-structured.

A capacity that is universal, fixed, and biologically-structured must be realized in a system that is also universal, fixed, and biologically-structured.

This is necessary mathematically and biologically.

2. Invariance Argument

Invariance under a mapping:

If a function produces the same output across different inputs, then the system is only responding to what those inputs share.

Let

- $C = \text{cognition}$
- $F = \text{the language faculty}$
- $A = \text{abstract linguistic invariants}$

Let

- $f(C) = F$
- $g(F) = A$

If A is invariant across humans,

and g maps F to A ,
and F is invariant across humans,
and f maps C to F ,
then:

If the output is invariant, the operator must be invariant.

Formally,
if $f(C_1) = f(C_2) = f(C_3) = F_{\text{universal}}$,
then the features of C_1, C_2, C_3 that f is sensitive to must be identical.
So $C_1 \equiv C_2 \equiv C_3$ under f :
 C_1, C_2 , and C_3 under f lie in the same equivalence class defined by f .
Non-universal C cannot produce universal F .

So, the universals in A emerge out of universals in F which emerge out of universals in C .

If abstract linguistic universals exist, they must be grounded in invariants of cognition.

If many different inputs go through a system and always yield the same type of output,
then the system is only sensitive to the structural features that are shared across the inputs.

This logic defines the relationship:

Out of invariant cognition emerges the universal structure of the language faculty, out of which the universals found across human languages emerge.

3. Conclusion

The invariance of linguistic universals leads to the conclusion that other cognitive structures must themselves be invariant. This generative, invariant subset of cognition — invariant cognition — provides the structural foundation for the human language faculty and its universals.

4. Supporting Mathematics

4.1 Invariance Theory (central)

4.2 Equivalence Class Theory

4.3 Function Sensitivity / Kernel Analysis

5. Relevant Terms for Clarity

Natural Grammar — The innate constraints and principles that form the boundaries of what a human language can be.

Language Faculty — The shared biological system that lets children acquire complex grammar with very limited input.

Internalized Language — An individual's specific state of language faculty after a person has been exposed to a particular language environment; in other words, knowledge and perception, or competence.

External Language — An abstraction of the actual speech, texts, and linguistic behavior produced by a community, influenced by non-linguistic factors such as social, political, and historical; essentially what most people refer to simply as language.

Cognition — The entire mental system; mental processes such as perception, memory, reasoning, conceptual structure involved in acquiring knowledge and understanding through thought, experience, and the senses.

Generative — Structure-building by way of rules.

Related Work

- **Universal Grammar (UG) and Innateness Hypothesis** — The biological basis of Universal Grammar and the innateness of the language faculty are defended in contemporary form by Berwick & Chomsky (2016).
- **Cognitive Linguistics** — Croft (2004) grounds language in broader cognitive processes.

- **Linguistic Typology** — Comrie (1981) provides a foundational account of cross-linguistic universals.