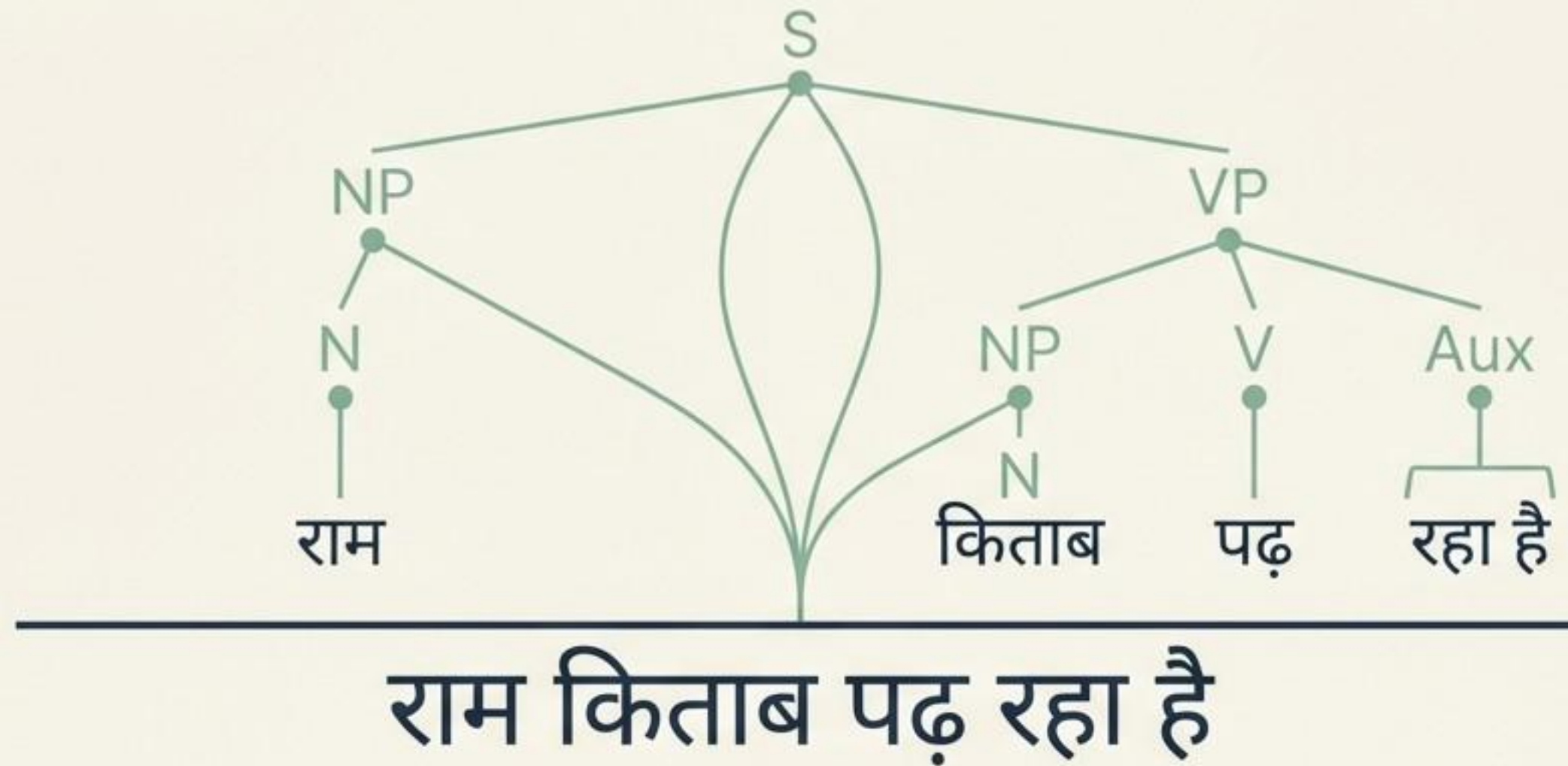


Vākya to Vṛkṣa: Visualizing the Hidden Structure of Hindi

Bridging the gap between surface grammar and structural intuition.



But our tree will be inverted.

The Learner's Paradox

Knowing the Words but Missing the Meaning

Linear order alone is insufficient to reveal syntactic relationships.

1. Selective Case Marking:

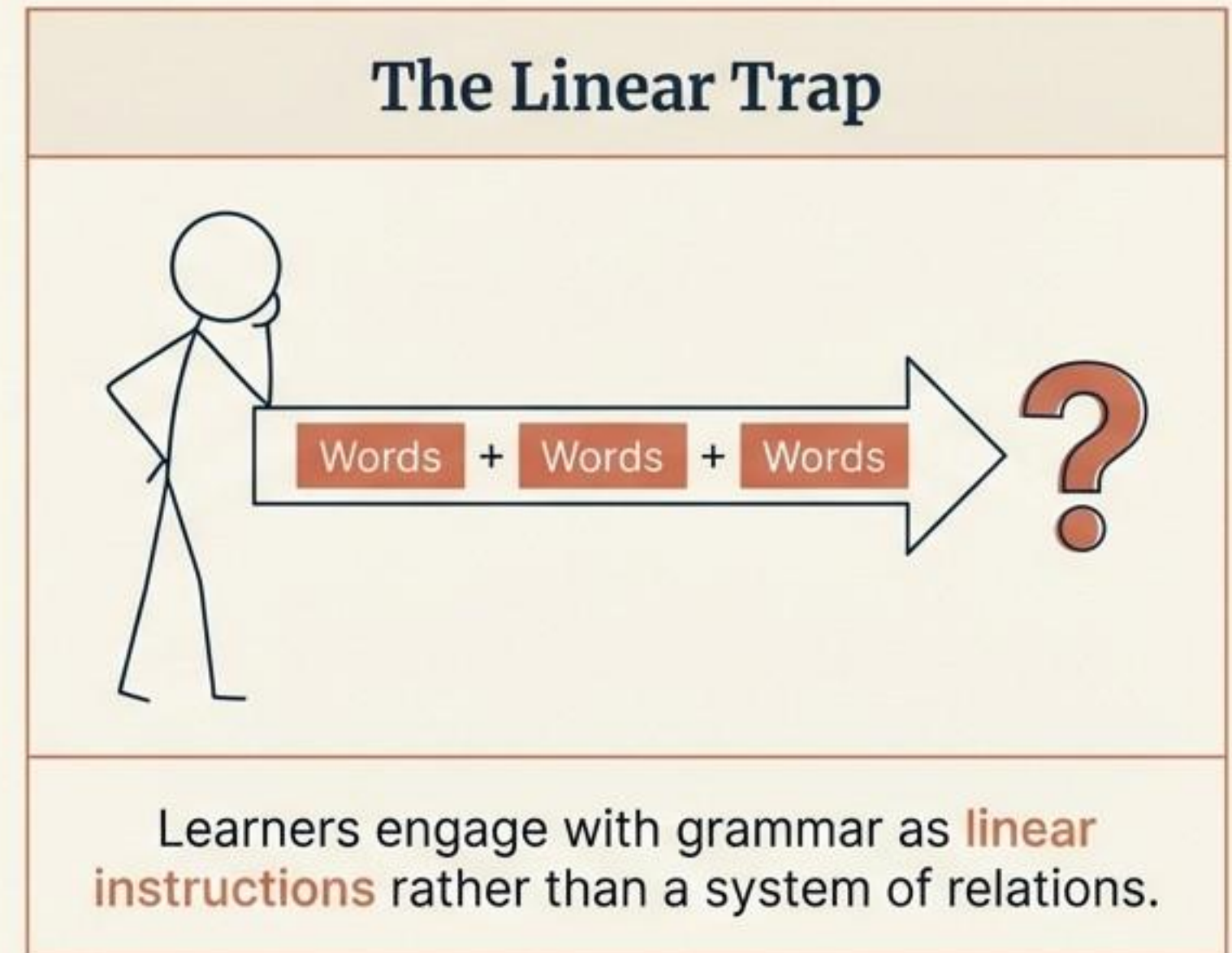
- Why do some objects take 'ko' and others don't?

2. Complex Predicates:

- Where does the verb end and the auxiliary begin?

3. Free Constituent Ordering:

- Words move, but relationships remain fixed.



The Limitations of Instruction via Linear Text

Traditional instruction focuses on Vākya (sentence-level correctness) and parts of speech. This creates a gap in understanding:

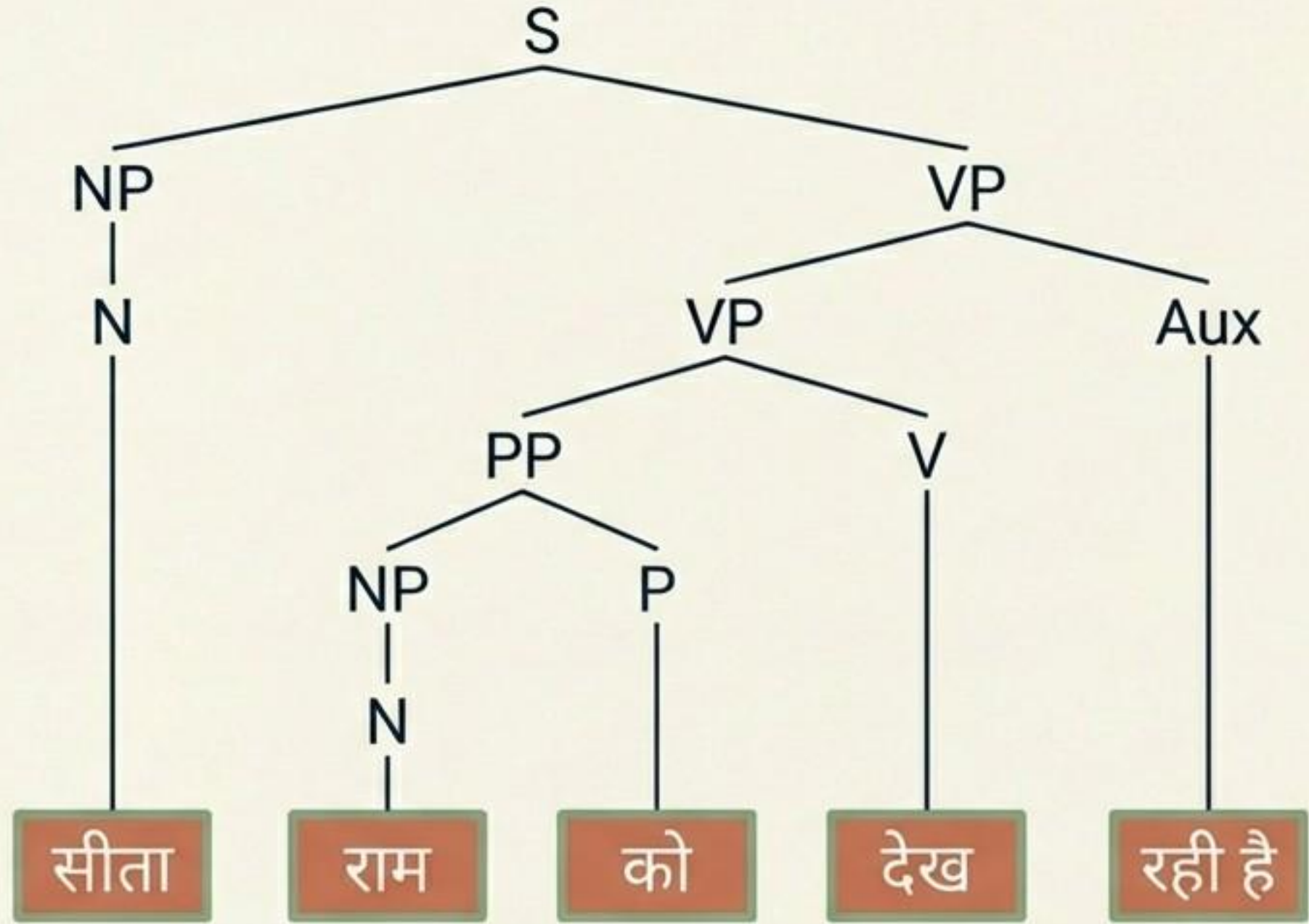
- Rules are memorized as isolated lists.
- Hierarchical organization (NP/VP interaction) remains implicit.
- Learners lack an internal model of the sentence.

“Learners frequently engage with grammar as a set of instructions rather than as a structured system of relations.”

From Linear String to Structured Entity

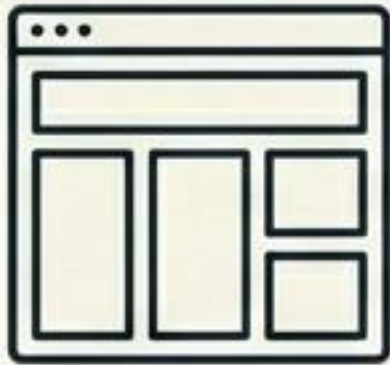
Introducing **Hindi Tree (HT)**:
A web-based visualization
system.

- Transforms input into tree representations to reveal:
 - Subject–Predicate organization
 - Object marking
 - Adjuncts



A visual grammar space for observation.

The Methodology: Why Phrase Structure Grammar (PSG)?



Transparency

PSG offers a flat representation of syntactic organization. No hidden layers.



Intuition

Focuses on Constituency—grouping words into units (NPs, VPs) that match native speaker intuition.



Accessibility

Avoids complex 'Black Box' theoretical mechanisms like merge, movement, or traces.

Goal: To externalize the hidden organization without requiring a degree in formal syntax.

Case Study: Decoding the Selective 'Ko'

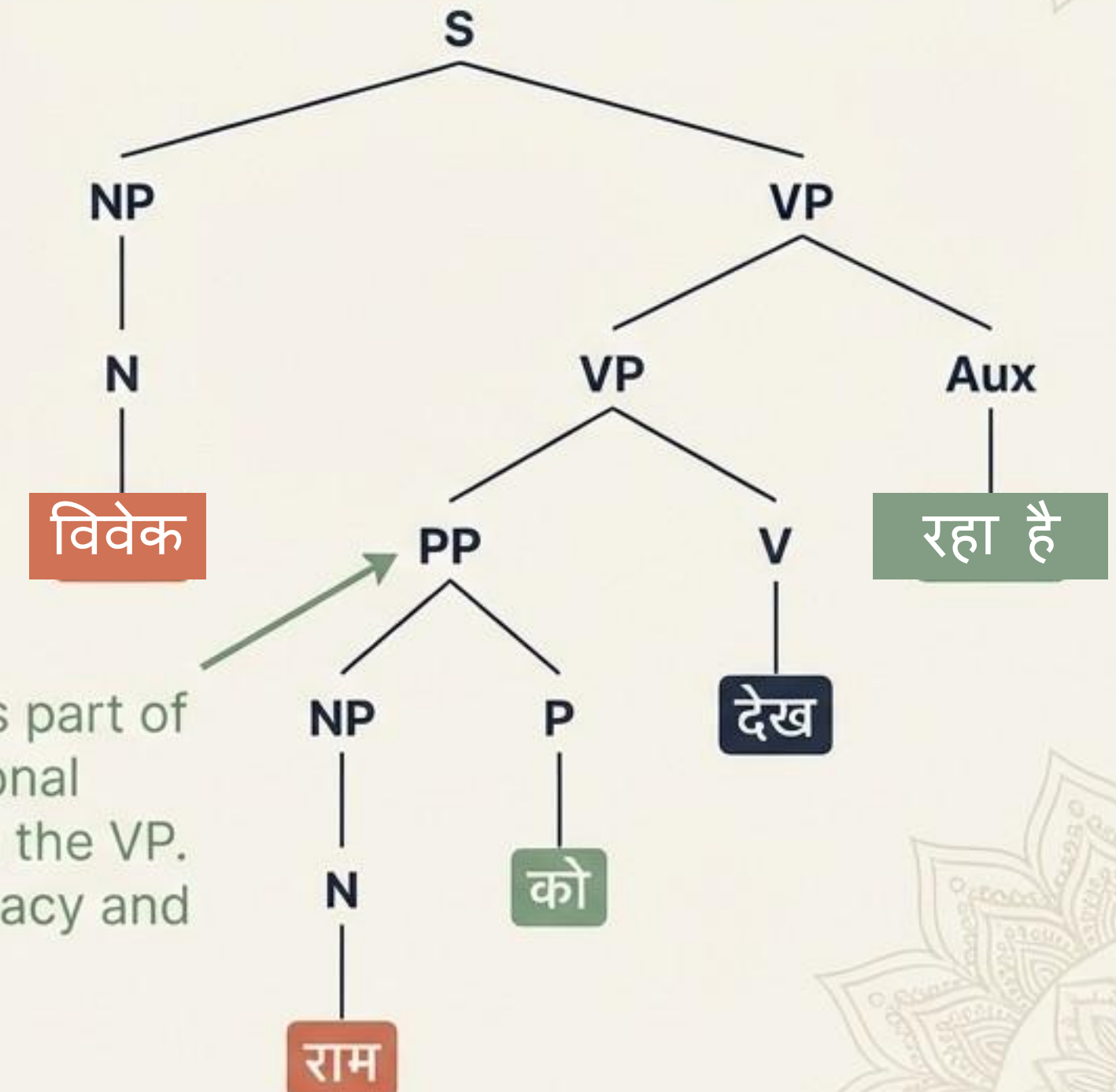
The Confusion

Vivek mobile dekh raha hai (No 'ko')

Vivek Ram ko dekh raha hai (Uses 'ko')

Learner Question: Why?

The Structural Reveal



The tree shows 'ko' is part of a specific Postpositional Phrase nested within the VP. It interacts with animacy and specificity.

Case Study

The Auxiliary Ambiguity: Where is the Anchor?

Example A

मैं गिर गया

Main gir gaya



Participle (mistaken for tense).

Example B

मैं गिर गया हूँ

Main gir gaya hoon

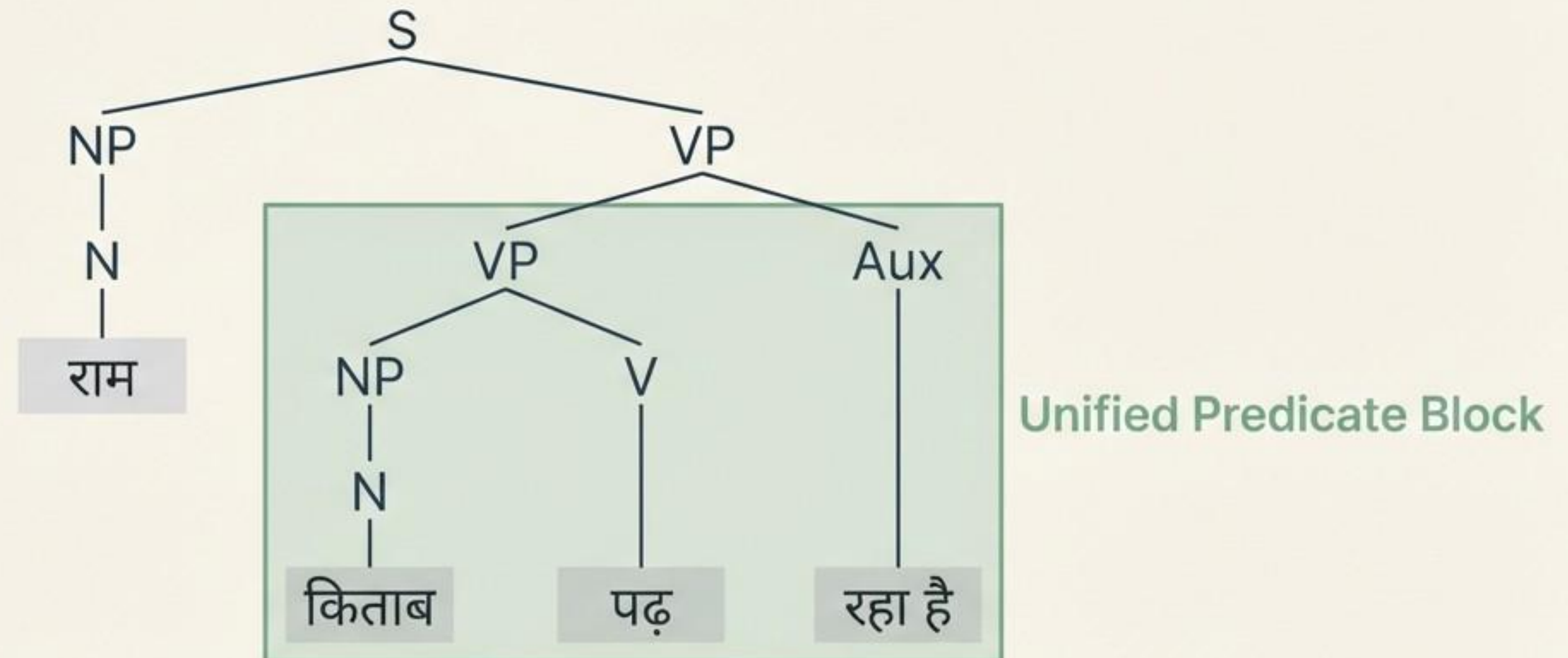


The **True Anchor** (Auxiliary).

- ❖ **The Conflict:** Linear reading leads learners to conflate the participle with the tense marker.
- ❖ **Missing Context:** Without seeing the hierarchy, the learner misses that 'hoon' acts as the structural anchor, while 'gaya' is merely participial.

Case Study: Visualizing the Unified Verbal Complex

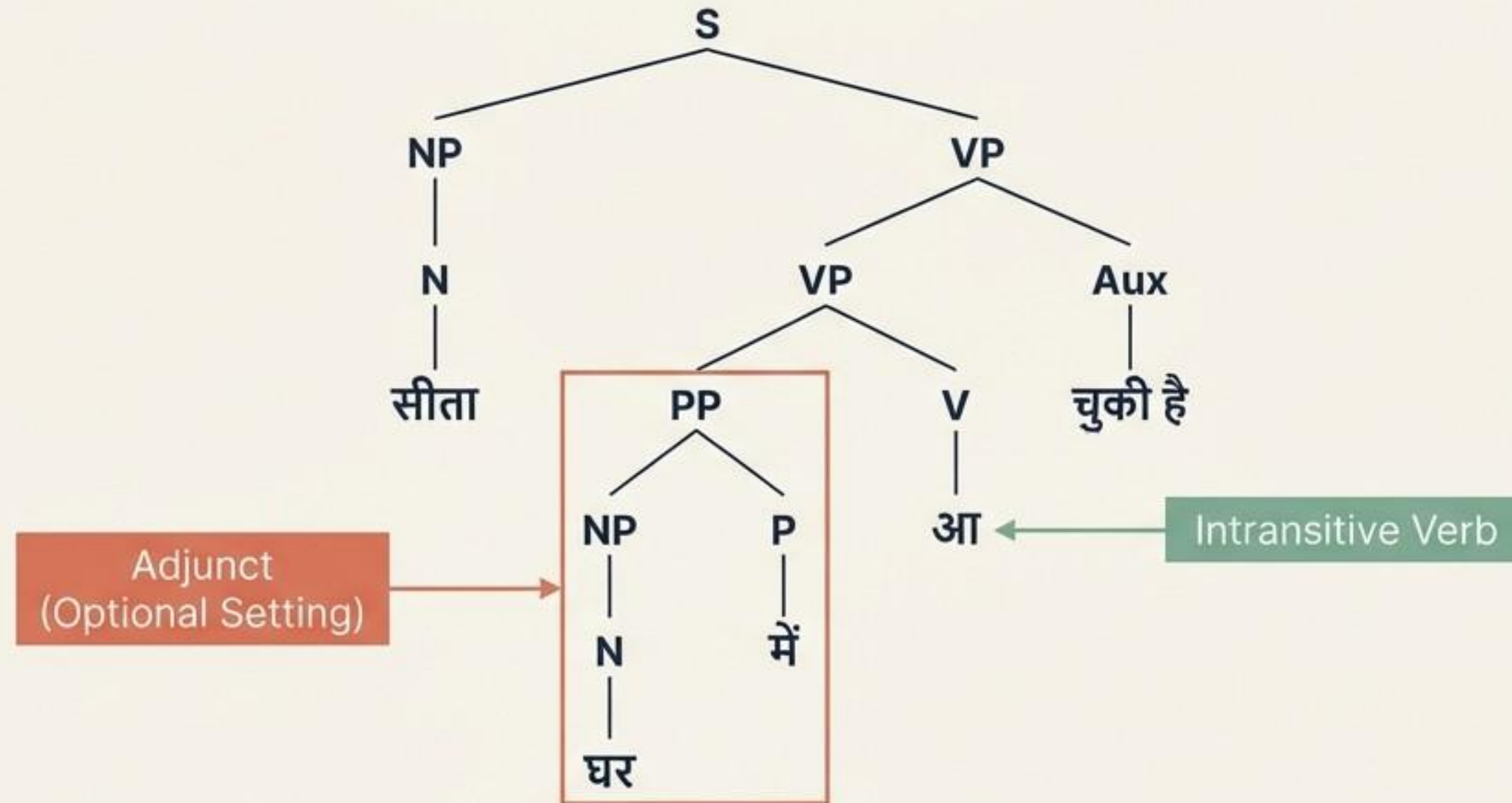
The Trap: Mistaking participial elements for the final tense marker.



The tree unifies the lexical verb and the auxiliary. The auxiliary ('hūn/hai') anchors the clause, preventing fragmented understanding.

Arguments vs. Adjuncts: The 'Home' Illusion

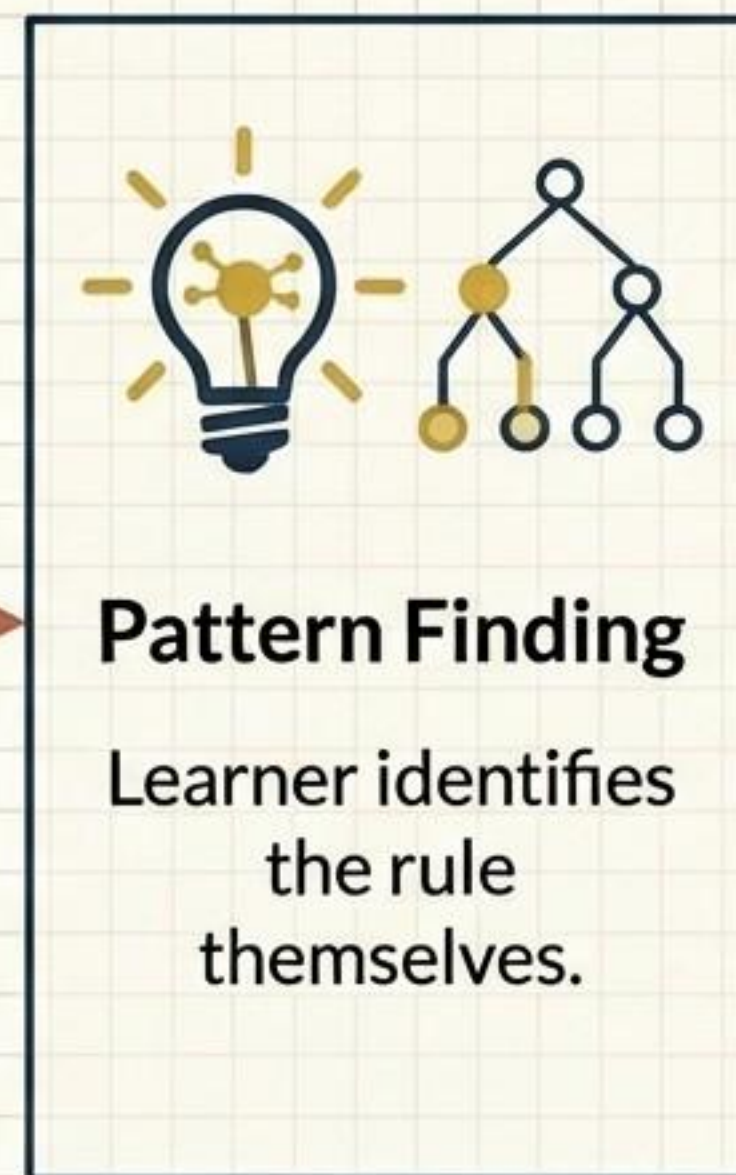
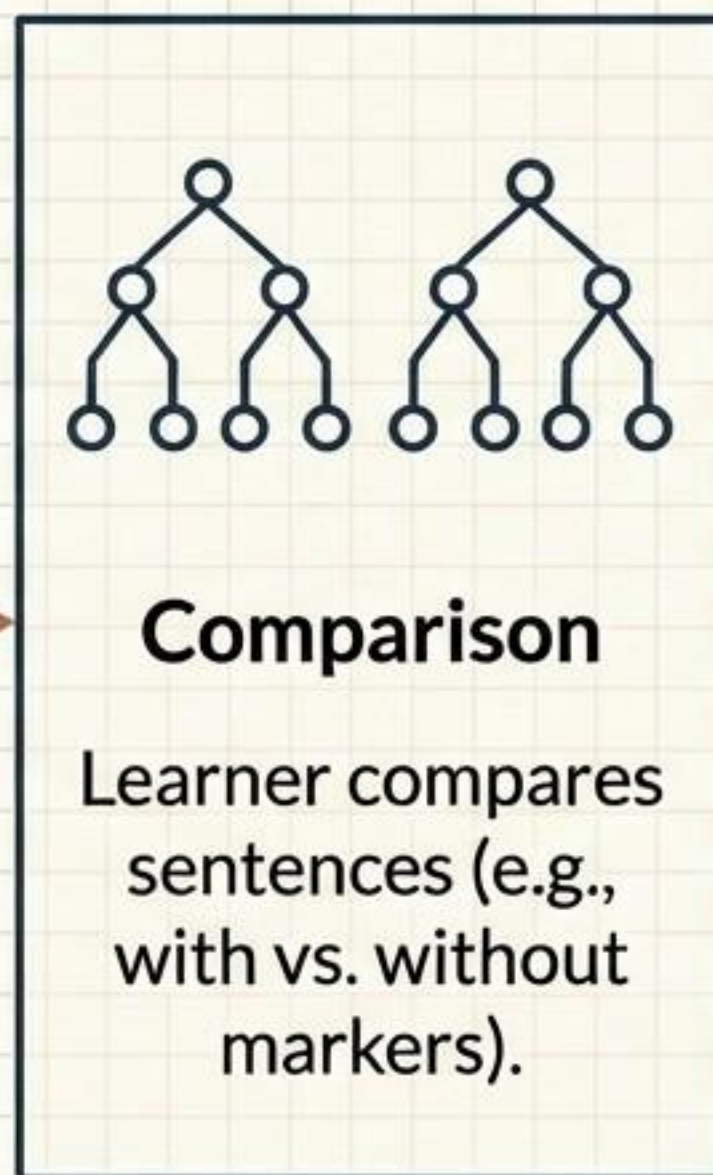
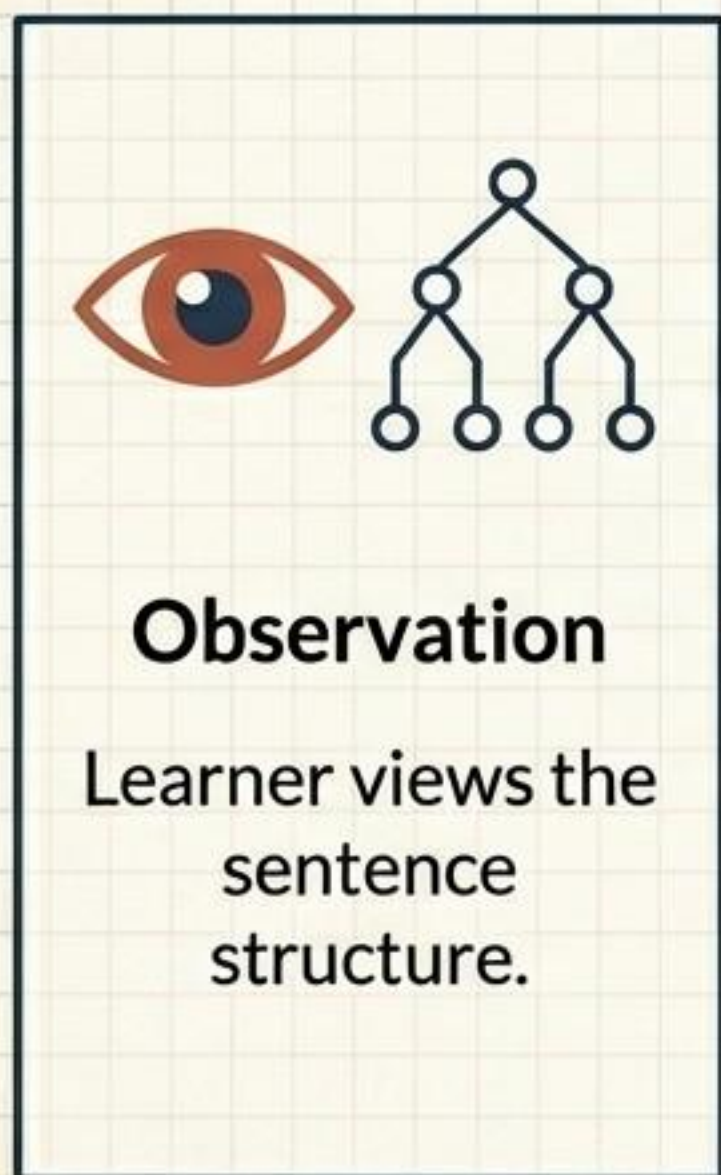
In 'Sita ghar me aa chuki hai', learners often confuse the location 'home' for a direct object.



The tree explicitly shows 'ghar me' attaching as a modifier within the predicate, not as a direct object.

From Recognition to Reasoning

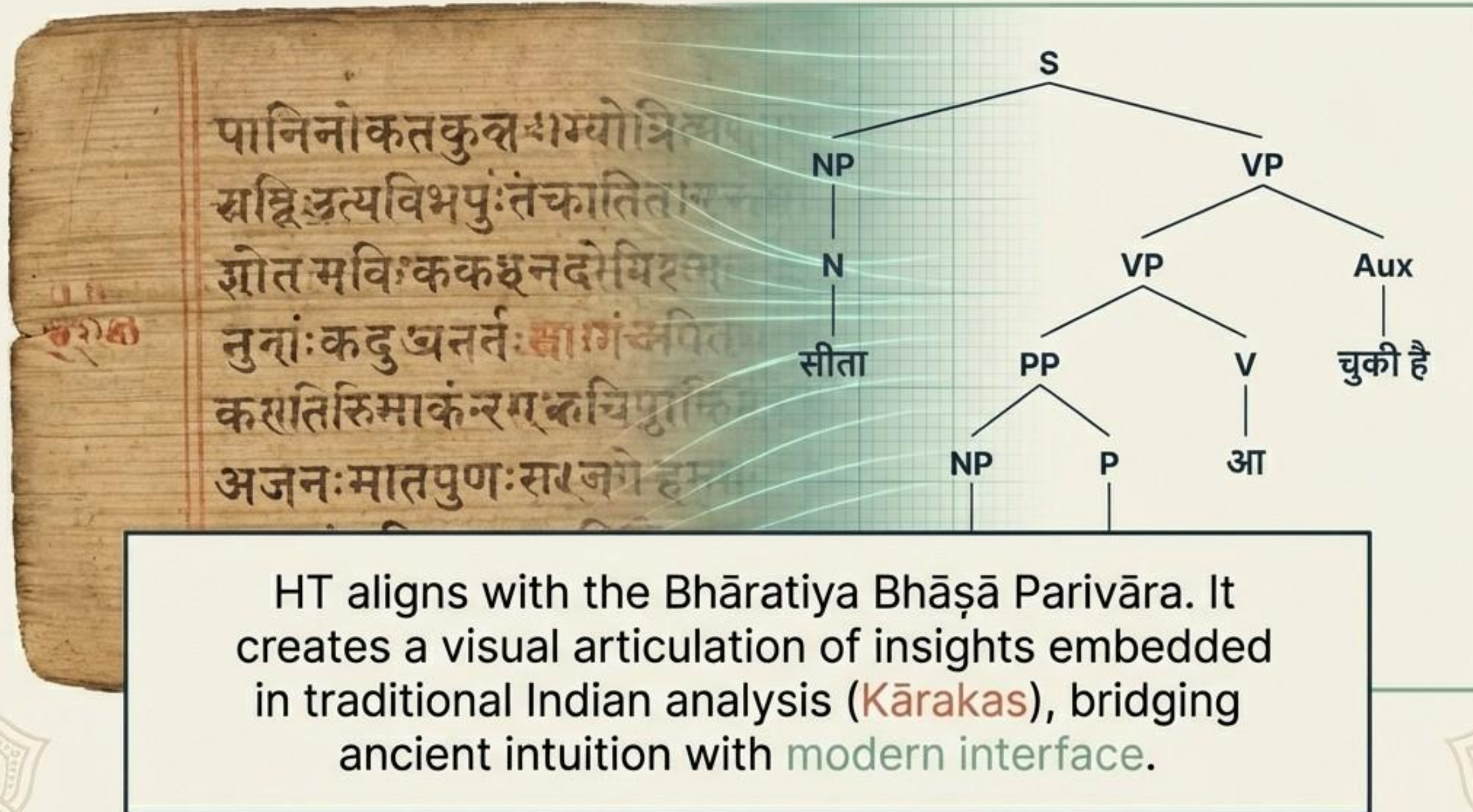
Inductive Learning



**Not Replacing,
But Bridging.**

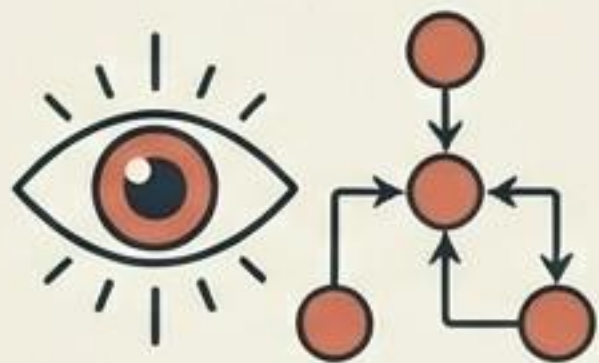
Hindi Tree doesn't replace traditional grammar; it visualizes it. It acts as a bridge between abstract rules and concrete perceptual learning.

Cultural Continuity: A Digital Avatar of Indian Tradition



An Open Ecosystem for Language Learning

Students



Visualizing patterns
to confirm intuition.

Teachers



Explaining sentence
construction beyond
linear rules.

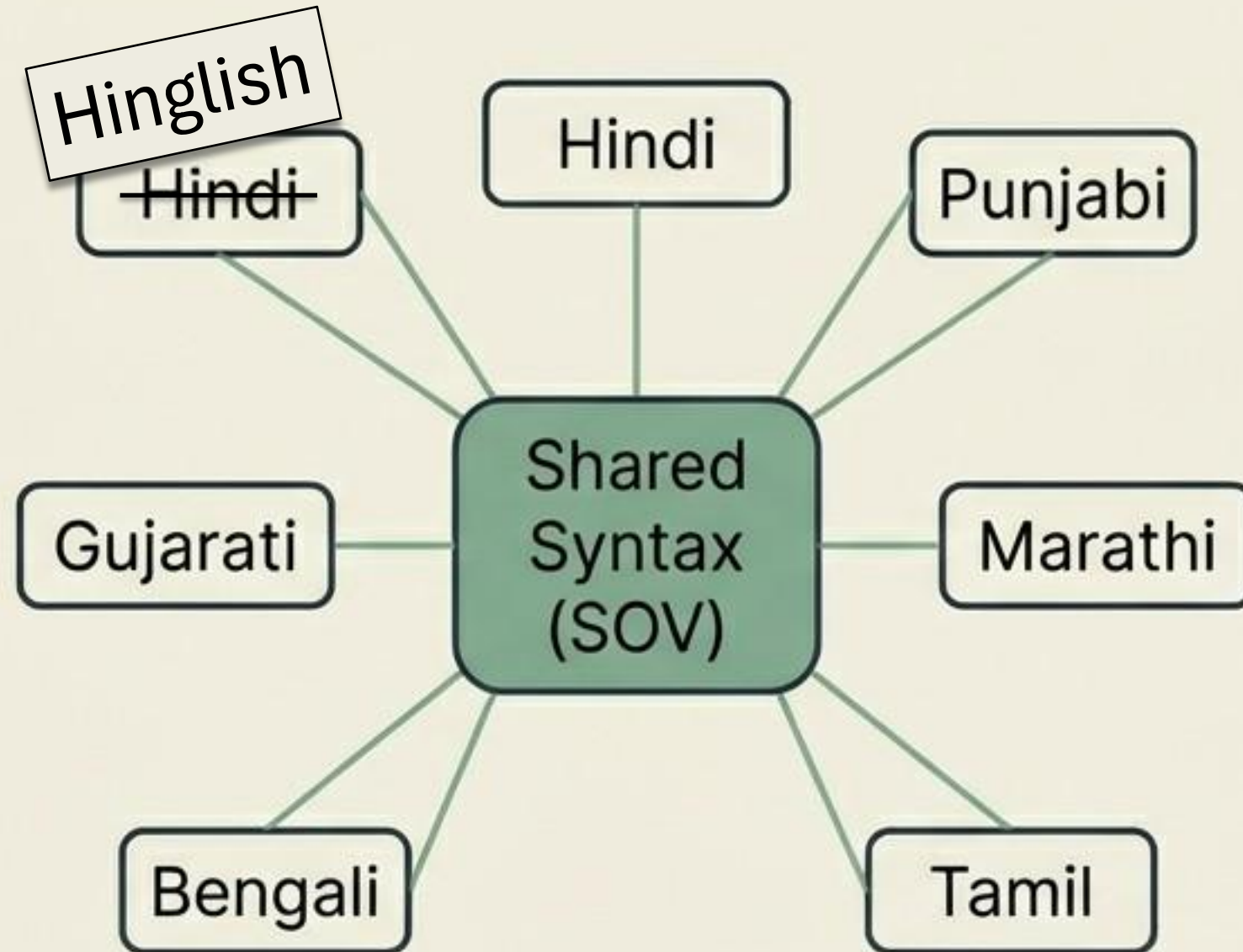
Researchers



Analyzing structure
without proprietary
software.

Democratizing access to structural linguistics
with an open-source, exploratory interface.

Beyond Hindi: The Bhāratiya Bhāṣā Parivāra

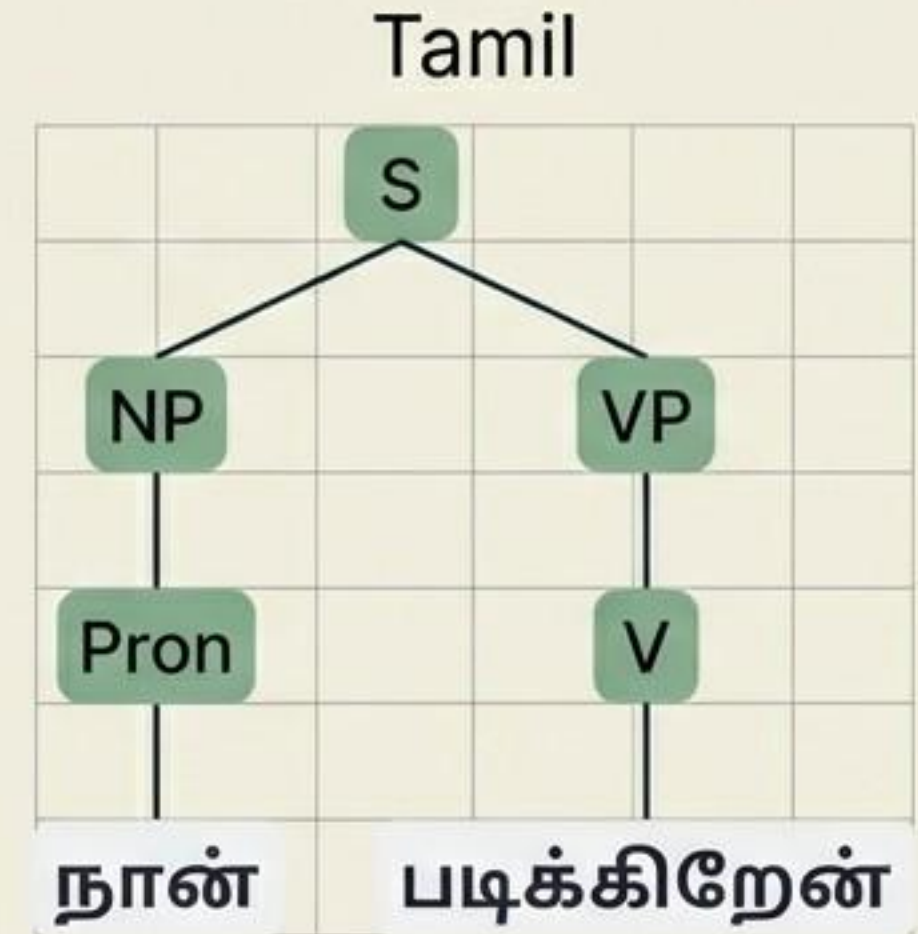
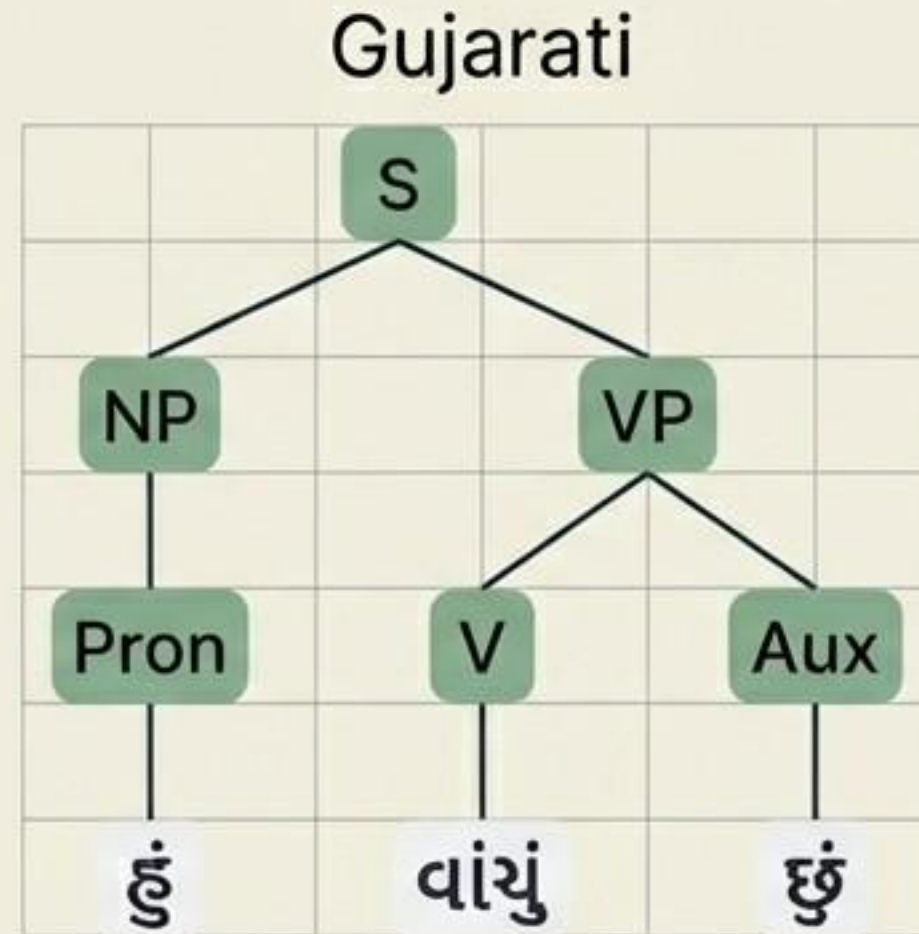
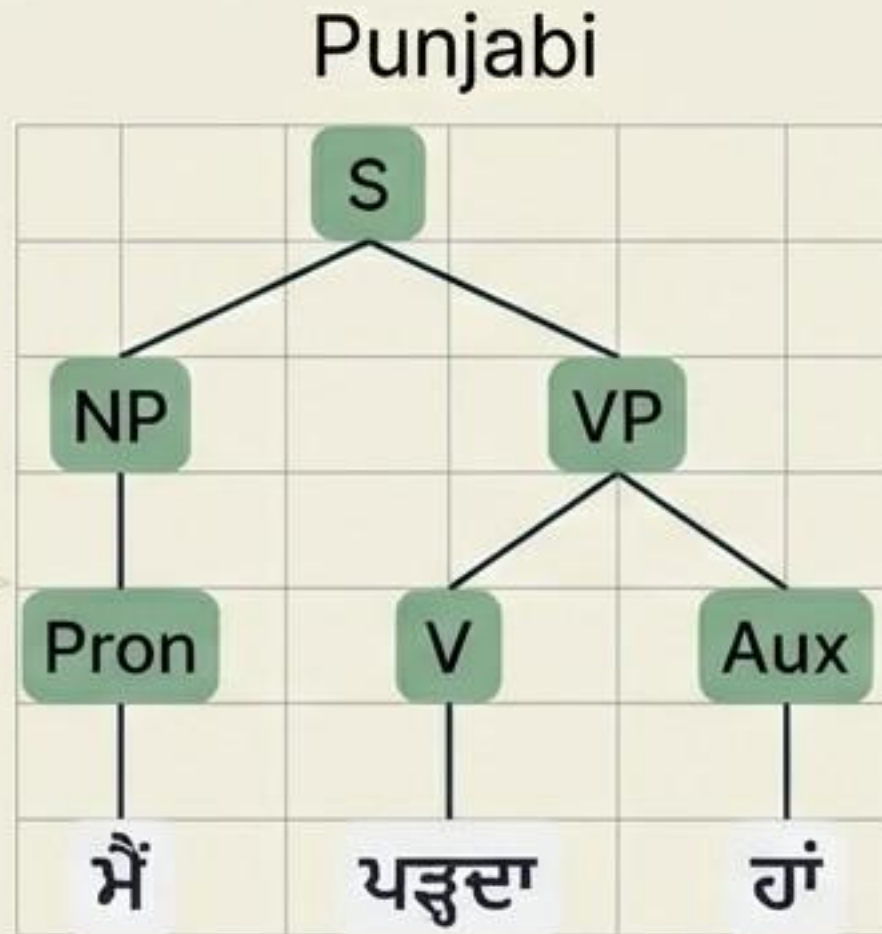


Shared Features

1. Subject-Object-Verb (SOV) order.
2. Postpositions following Noun Phrases.
3. Auxiliaries at the clause periphery.

The 'Skeleton' of Hindi is shared across the Indian Language Family.
One visualization framework serves many languages.

Script Agnostic, Structure Specific

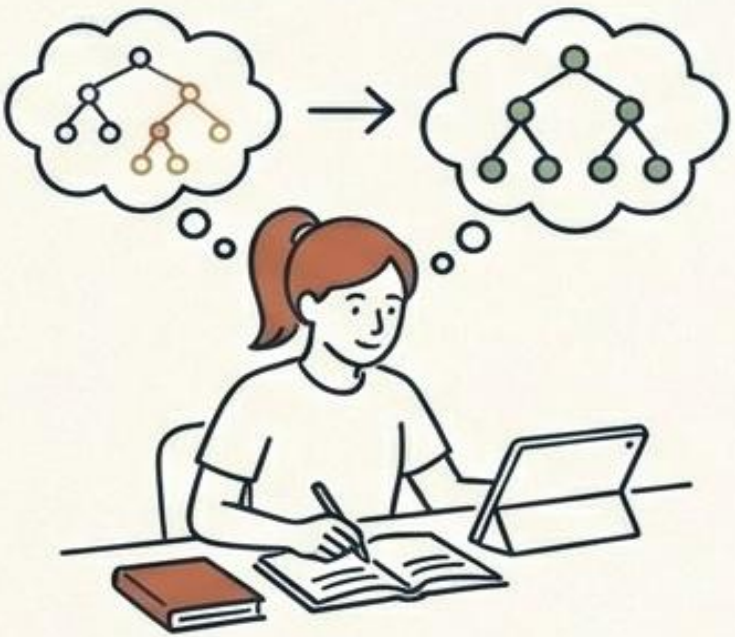
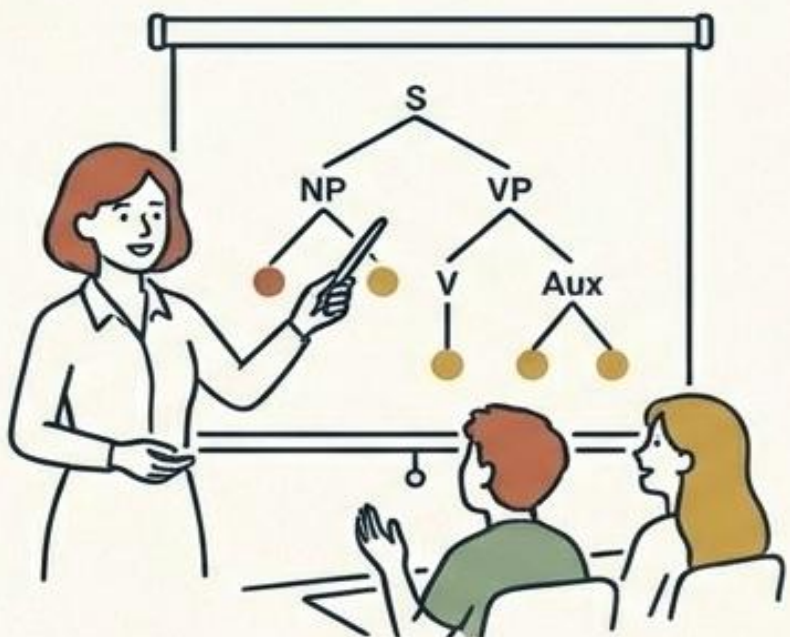



Visualizing the universal grammar beneath the specific orthography.

The 'Skeleton' of Hindi is shared across the Indian Language Family.
One visualization framework serves many languages.

Summary of Impact

Indian languages deserve tools that respect their structure.

| For Learners | For Teachers | Open Access |
|---|--|--|
|  <p>Moving from rote memorization to structural intuition.</p> |  <p>A visual aid to explain complex syntactic rules.</p> |  <p>An exploratory interface that requires no prior training in formal syntax.</p> |

A necessary infrastructure for the future of Indian language education.