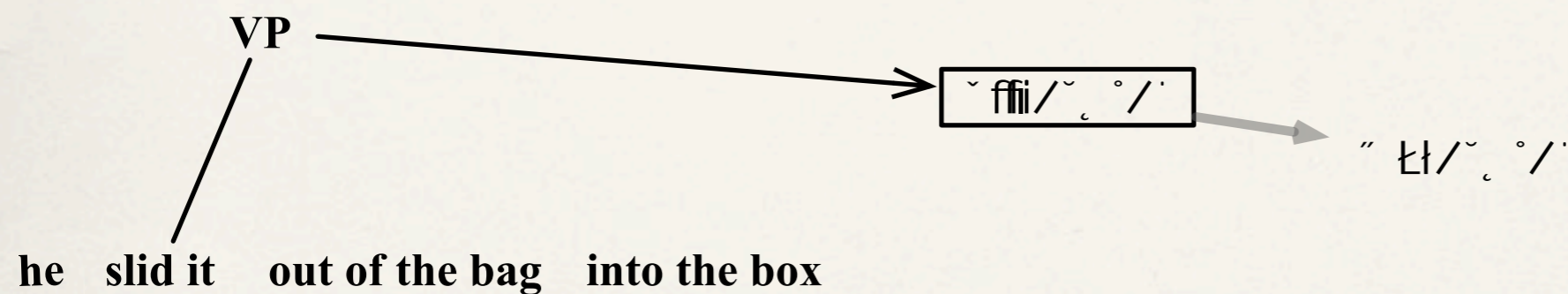


Compositionally Constructing Entailments

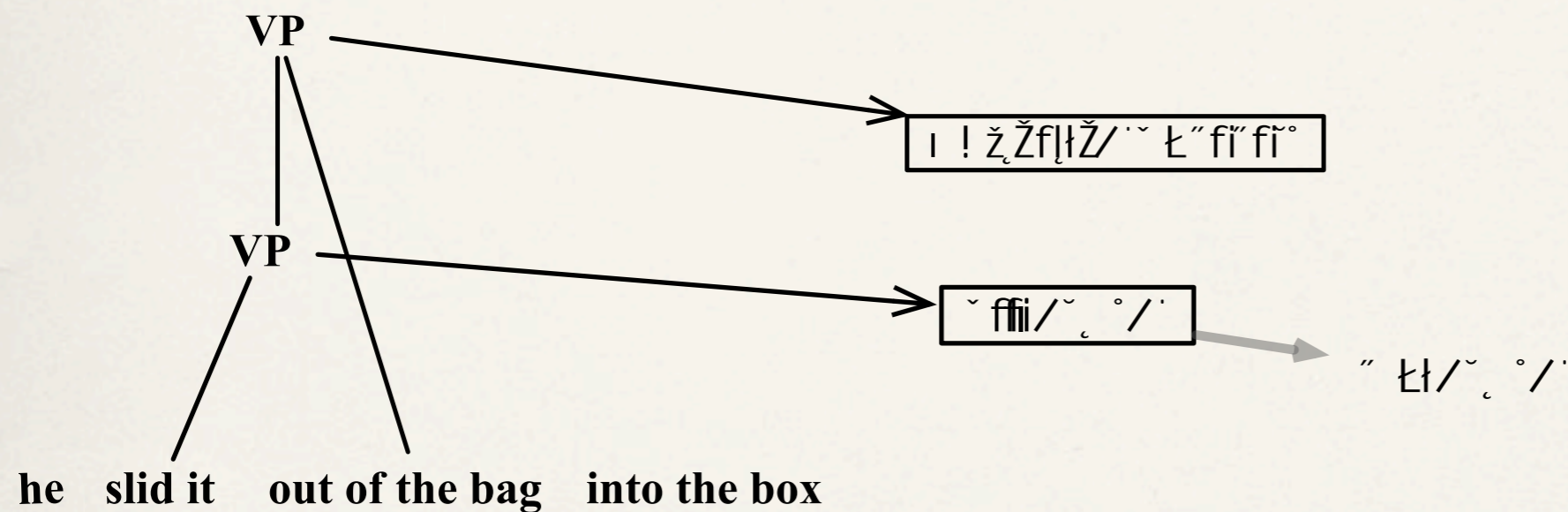
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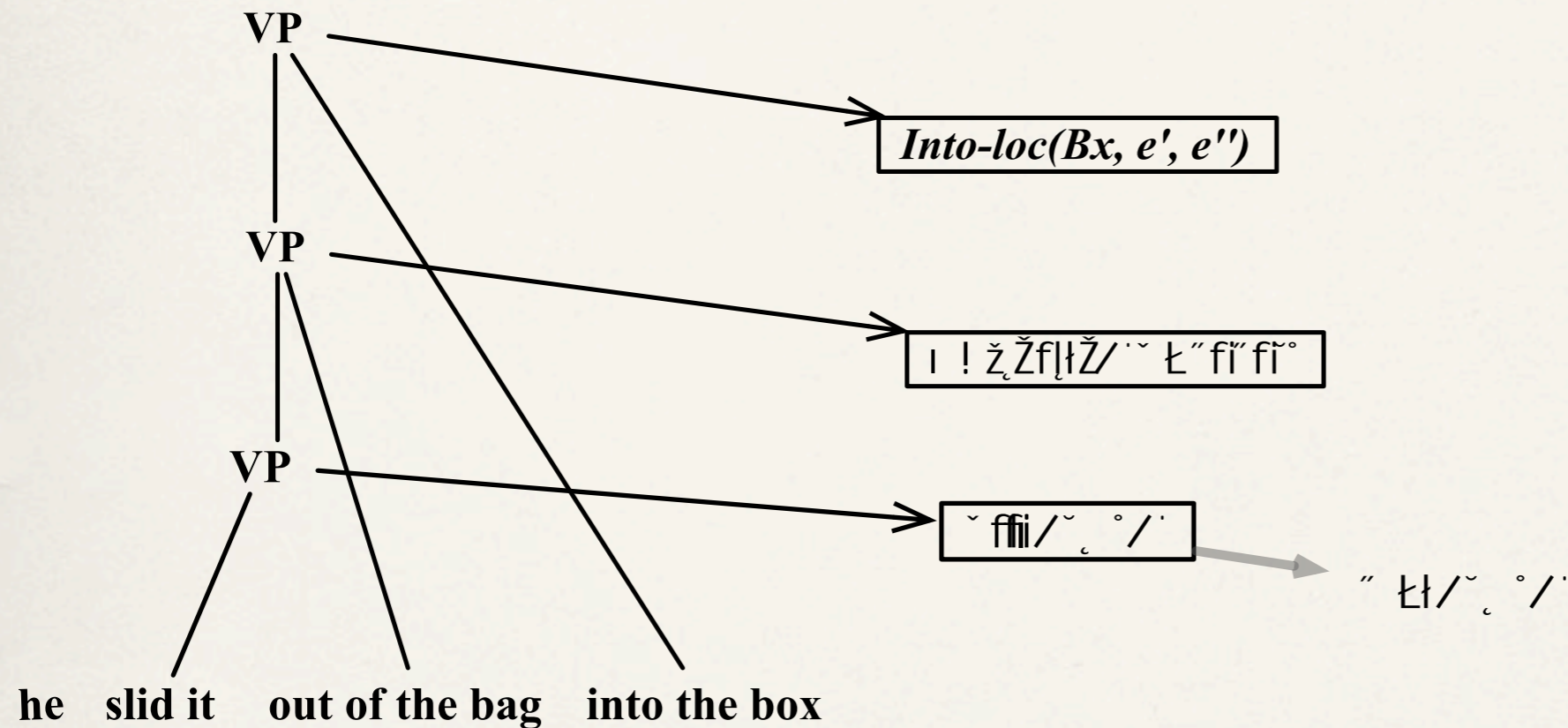
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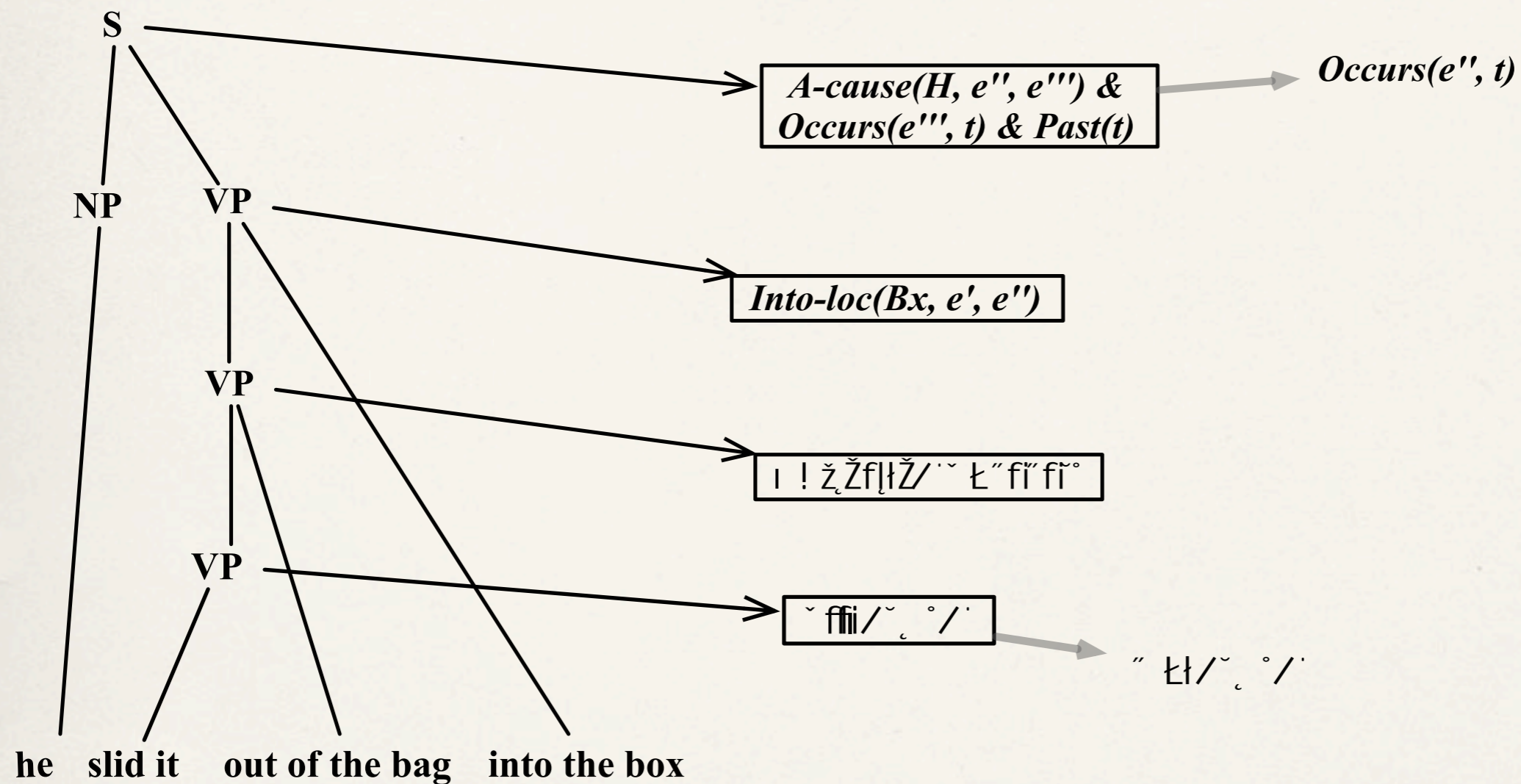
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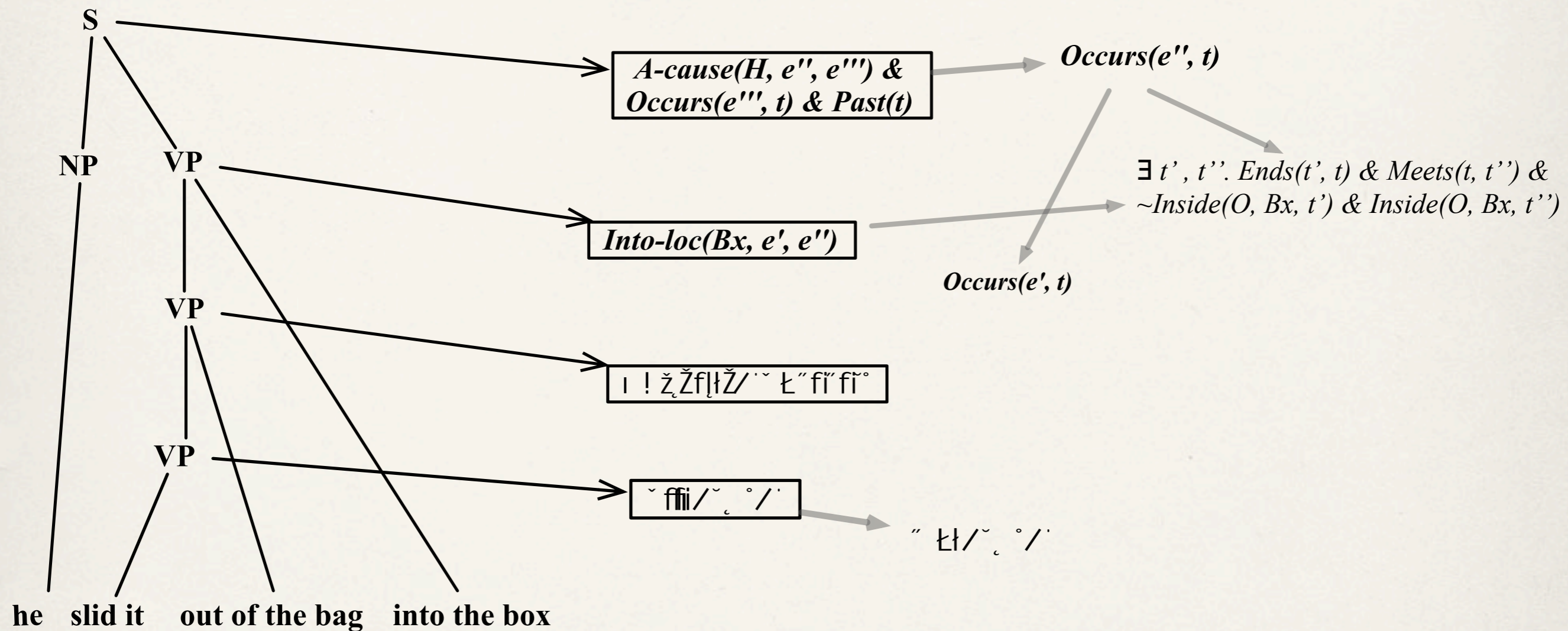
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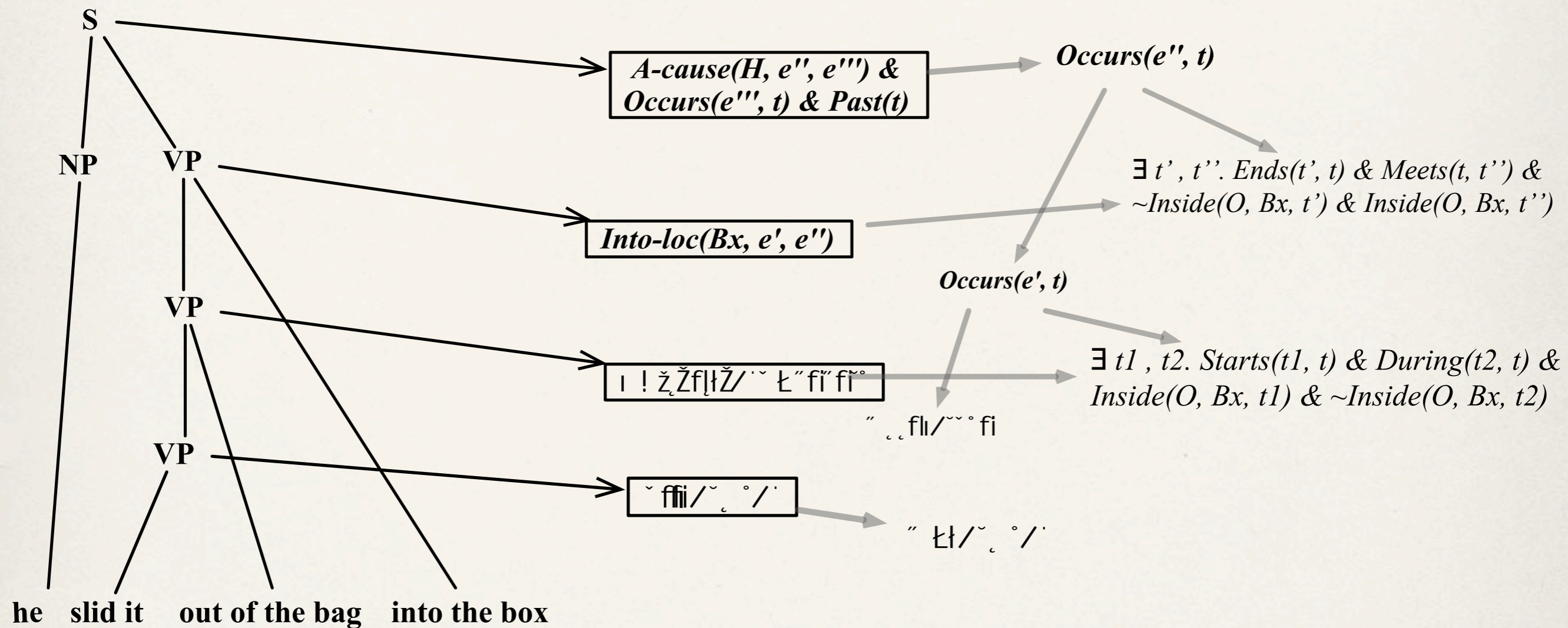
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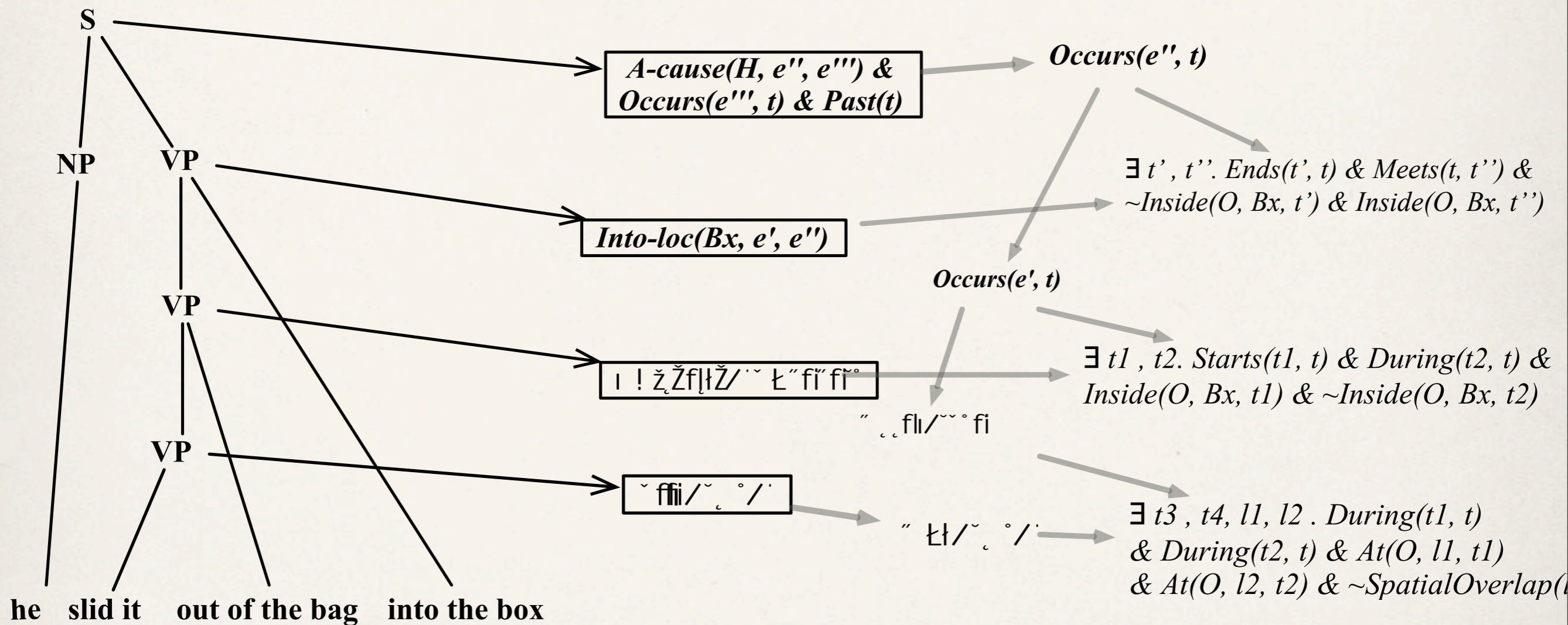
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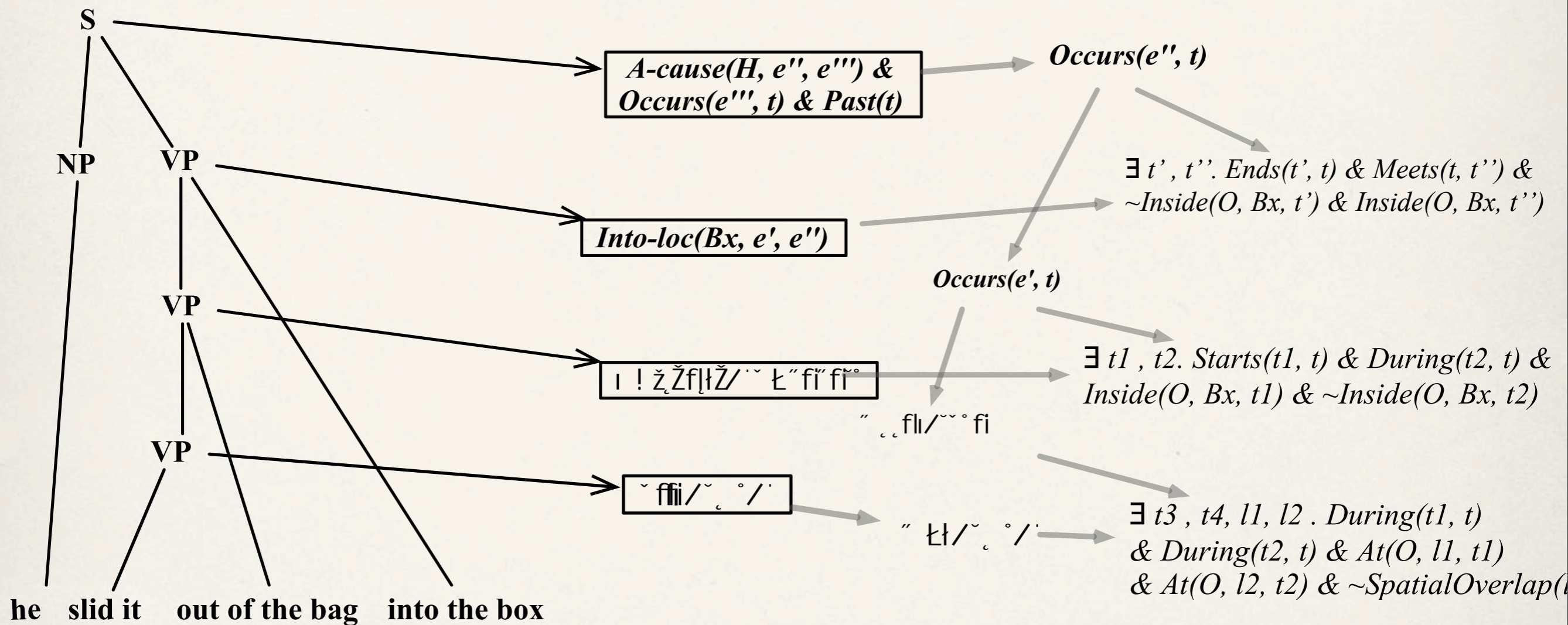
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Compositionally Constructing Entailments



- ❖ Interpretation and entailment are computed incrementally
- ❖ Selectional restrictions arise as deriving contradictions
- ❖ *This all works even if we have only a vague idea of what sliding means!*

Rethinking Semantic Roles

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 - ❖ and if we keep the to/into distinction in a spatial theory, what additional information does the Goal role give us?
- ❖ Possible Motivation: Semantic roles identify verbs that can take Goal constructions
 - ❖ but this can be encoded in knowledge about the preposition, e.g.,
 - ❖ $\forall o, e, e'. \text{Into}(l, e, e') \Rightarrow \exists o. \text{Motion}(o, e)$
 - ❖ *i.e., if some event causes an Into event then it must be a form of motion*

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 - ❖ indirect object can go to Destination / Goal, Beneficiary & Recipient roles
 - ❖ entailments in each case can be distinguished by the type of event
- ❖ Direct Arguments (subject and object)
 - ❖ Core sense of poke: $\exists e. \text{Poke}(N, B, e)$ (e.g., *the needle comes in contact with the ball*)
 - ❖ *Jill poked the ball* $\exists e, e', x. A\text{-cause}(H, e, e') \ \& \ \text{Poke}(x, B, e)$
 - ❖ Remaining Issue: *Jill poked the needle into the ball*

Exploiting Abstraction

- * The following cases are typically different senses of *move* because of the different entailments
 - * *He moved to the corner*
 - * *He moved from elation to depression*
 - * *He moved to Chicago*

Can we construct one abstract sense to cover these cases?

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Can we construct one abstract sense to cover these cases?

- ❖ Abstracted Motion
 - ❖ Motion = change of state
- ❖ To do this, we need abstracted preposition senses as well
 - ❖ *From* = relates an event with a state true at the start
 - ❖ *To* = relates an event to a state at the end
- ❖ Specific meanings arise from likely entailments
 - ❖ e.g., if subject and object are physical object => change location
 - ❖ e.g., if subject is intentional and object an emotion => change emotional state

Generativity of Language

- ❖ Treating prepositions seriously gives us a better foundation for handling words for which we only have a vague notion of meaning (if any at all)
- ❖ e.g., *He zooped the soup into the pan*
 - ❖ *zoop* is unknown, BUT
 - ❖ we know about the agent construction -- this looks like one
 - ❖ $\Rightarrow A\text{-cause}(H, e, e') \& \text{Zoop}(S, e) \& \text{Occurs}(T)$
 - ❖ we know the meaning on *Into*
 - ▶ $\text{Ends}(t', T) \& \text{Meets}(T, t'') \& \sim \text{In}(S, P, t') \& \text{In}(S, P, t'')$
 - ❖ doesn't matter much what zoop means, but it seems like some sort of motion

Issue

Is this really different than the neo-Davidsonian approach?

Our approach

$\exists e, e', e''. \text{Push}(S, B, e) \ \& \ \text{Into-loc}(Bx, e, e') \ \& \ \text{A-Cause}(S, e', e'') \ \& \ \text{Occurs}(e'', t)$

Neo-Davidsonian

$\exists e, p, t. \text{Agent}(e, J) \ \& \ \text{Motion}(e) \ \& \ \text{Theme}(e, p) \ \& \ \text{Occurs}(e, t) \ \& \ \text{Past}(t)$

Differences

we have three events, Neo-Davidsonian has one

Is the extra complexity worth it?

clean alignment of eventualities and VPs

allows for cleaner compositional entailment axioms (maybe?)

allows for non-monotonic interpretation (is it needed?)

Comparison with Lexical Resources

- ❖ Verbnet

- ❖ captures direct entailments similar to the axioms here, but for **each** verb / subcategorization pattern
- ❖ Large difference in conciseness and generativity of entailments
 - ❖ this effort has many fewer verb senses
 - ❖ many entailments organized around the prepositions, and need be stated only once for all verbs
- ❖ Verbnet's strength is its subcategorization patterns

- ❖ Propbank

- ❖ very compatible in identification of verb senses
- ❖ but does not deal with entailments

Ending Comments

- ❖ This is a work in progress - many obstacles and puzzles remain!
- ❖ But shows promise for
 - ❖ dramatically reducing the number of required verb senses
 - ❖ while increasing the range of sentences that can be interpreted
 - ❖ tightly linking parsing / understanding with inference / entailment
 - ❖ allowing for different levels of understanding based on current knowledge