

Simple Negation Scope Resolution through Deep Parsing

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Negation: Who cares?

MT example:

- Japanese: 偏見は持つべきではない。
- Human: We shouldn't have any prejudice.
- Moses: You should have a bias.
- Moses loses negation 2/3 of the time!

(Bond, 2012)

Negation: Who cares?

IE Example

- Gmail automatically detects event invitations in your inbox:

The screenshot shows a Gmail inbox interface. At the top, there is a search bar containing the word "meeting" and a yellow envelope icon. To the right of the search bar, there is a tab labeled "Inbox" with a small "x" icon. Below the search bar, the email header for an email from "Woodley Packard" is visible, with the time "3:34 PM (0 m)". The email body contains the text "Actually, let's not have a meeting next Thursday. What other times are you free?". A tooltip box titled "Pencil it in" is overlaid on the email, explaining that clicking on a time or date with a dotted underline adds an event to the Google Calendar. The tooltip includes a "Try it now" button and a "Go to Google Calendar »" link. Below the email, a reply box is partially visible with the text "Click here to Reply or Forward".

2012 *SEM Shared Task

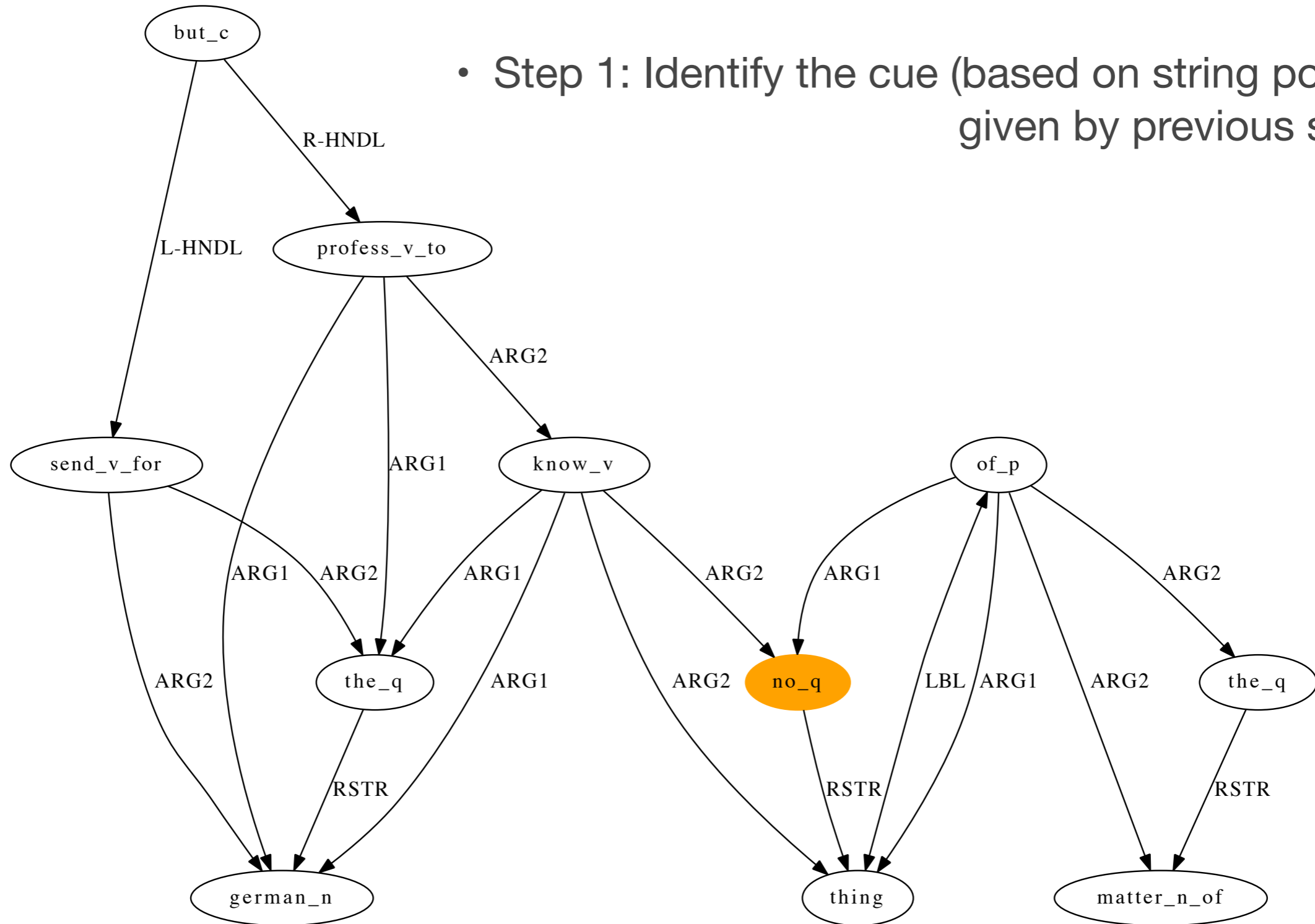
{The German} was sent for but professed
to {know} <**nothing**> {of the matter}.

It may be that {you are} <**not**> {yourself
luminous}, but you are a conductor of light.

“I trust that {there is} <**nothing**> {of
consequence which I have overlooked}?”

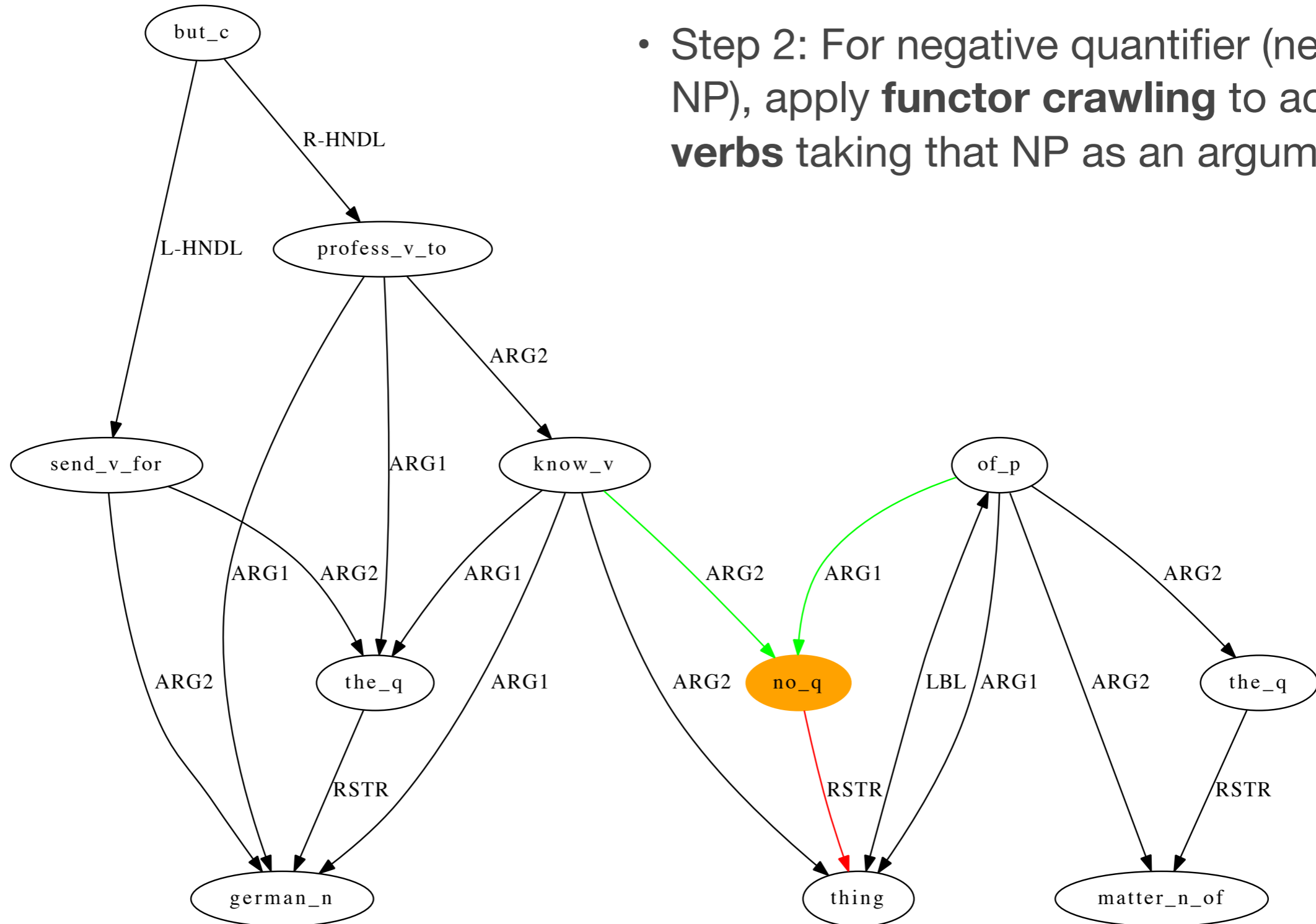
Scope of Negation from MRS

- Step 1: Identify the cue (based on string position given by previous stage)



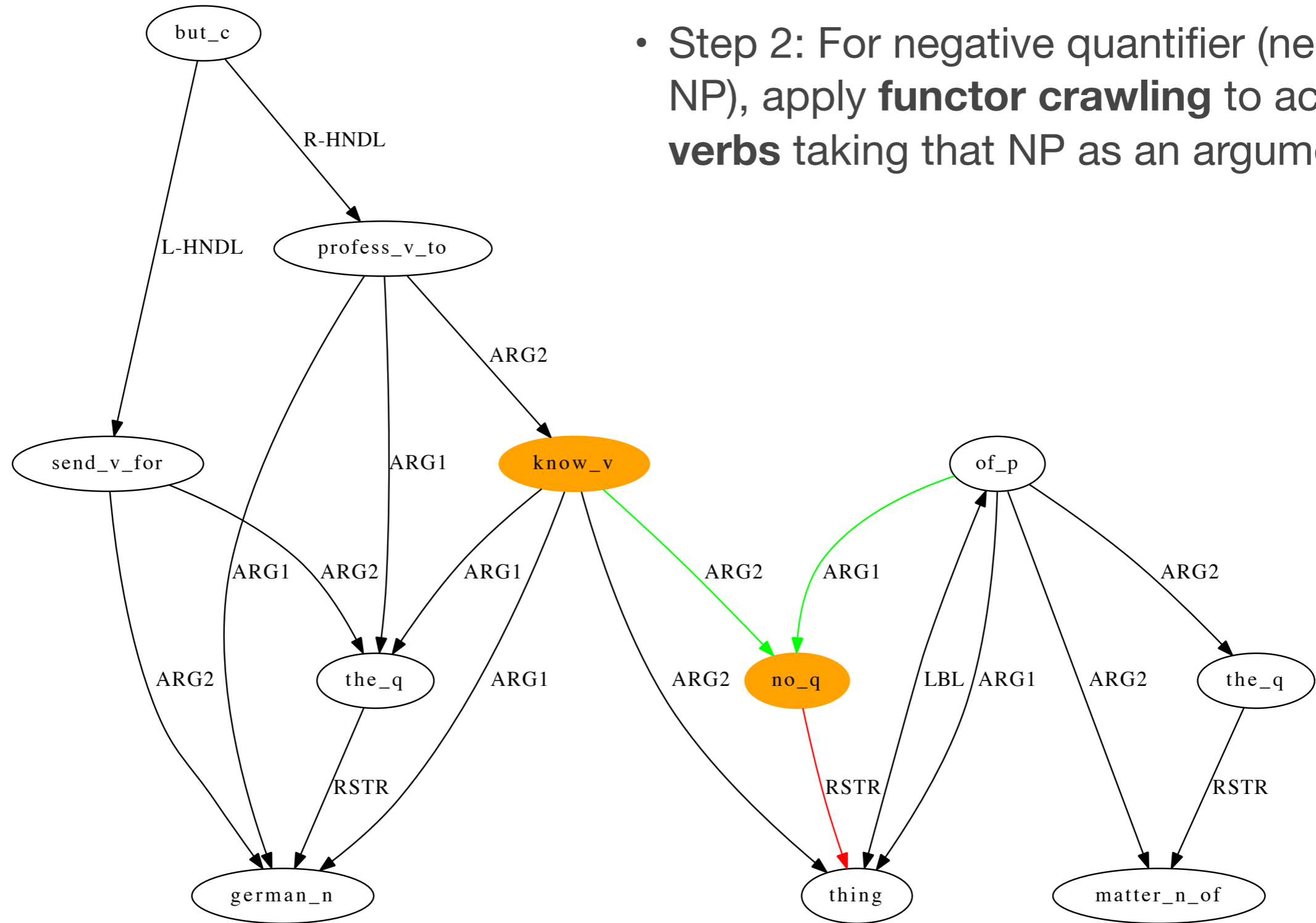
Scope of Negation from MRS

- Step 2: For negative quantifier (negated NP), apply **functor crawling** to activate **verbs** taking that NP as an argument.



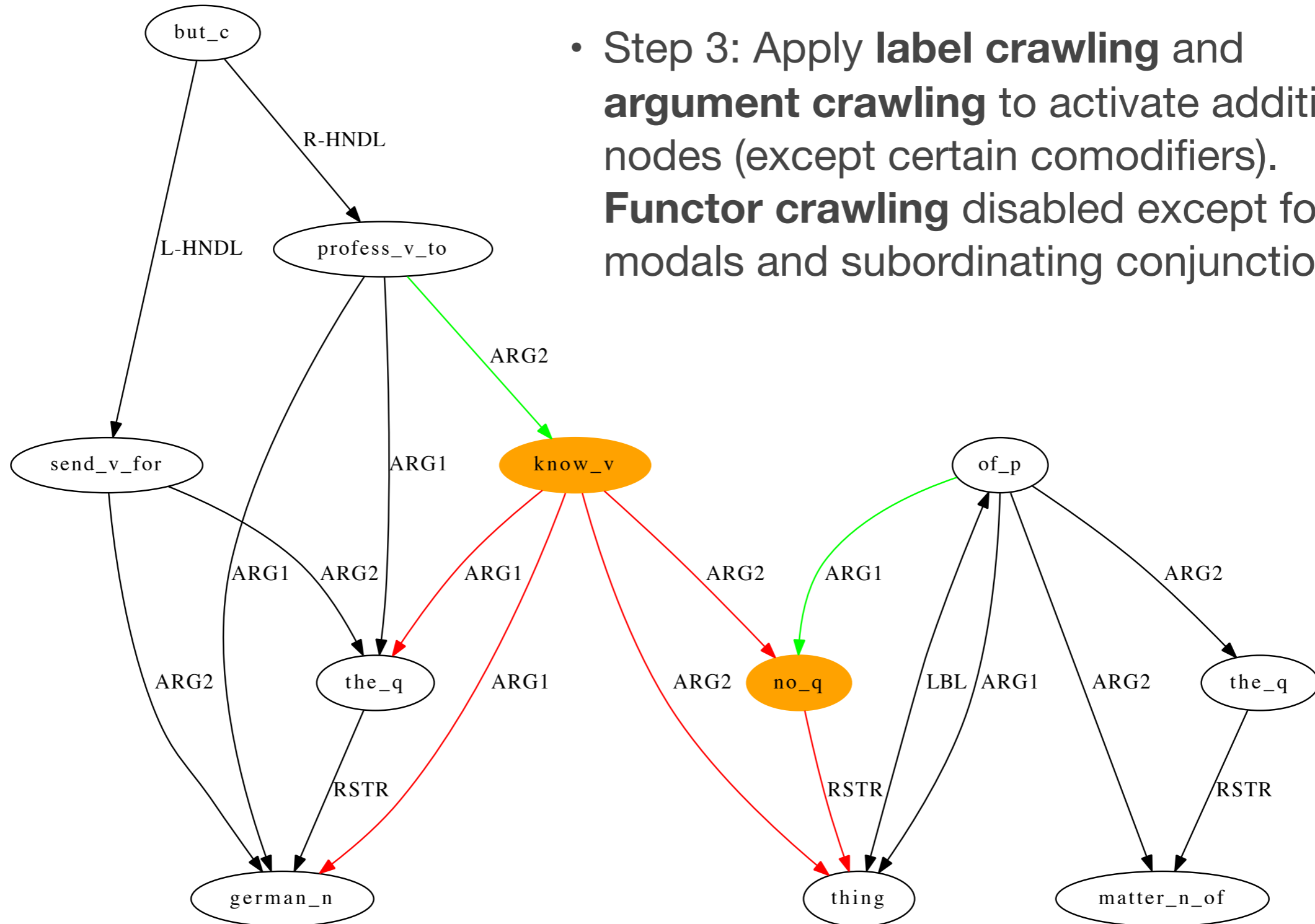
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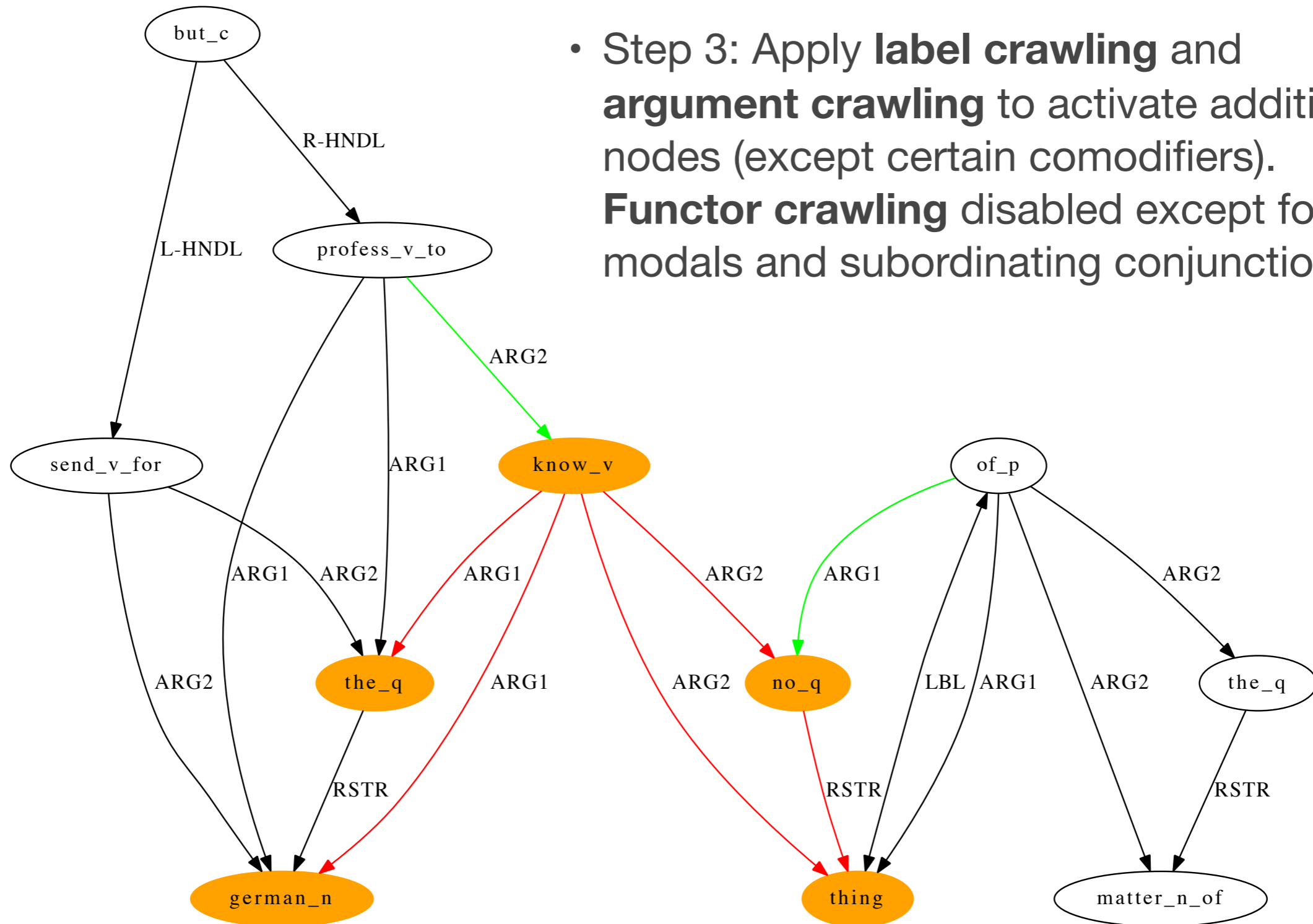
Scope of Negation from MRS

- Step 3: Apply **label crawling** and **argument crawling** to activate additional nodes (except certain comodifiers). **Functor crawling** disabled except for modals and subordinating conjunctions.



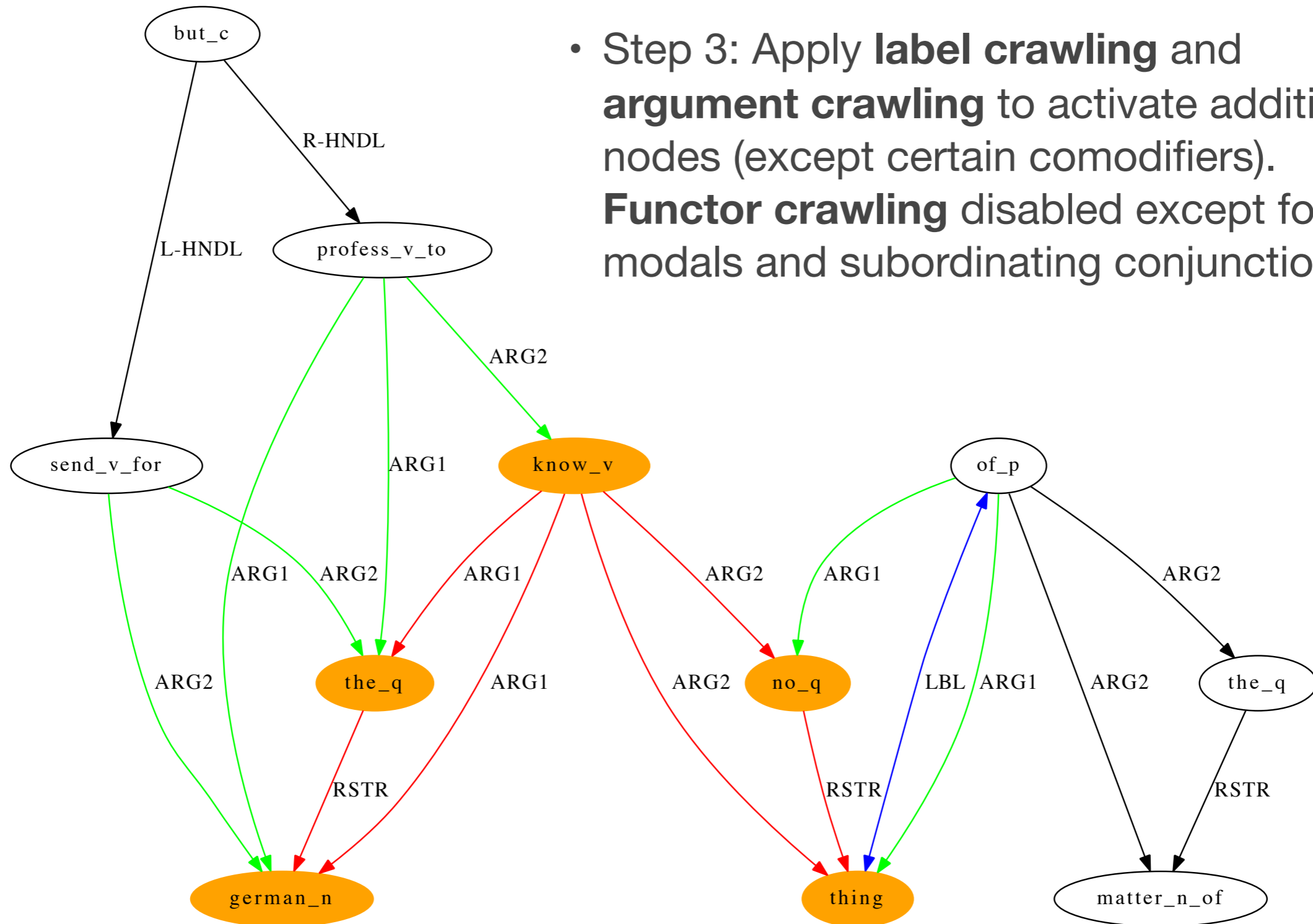
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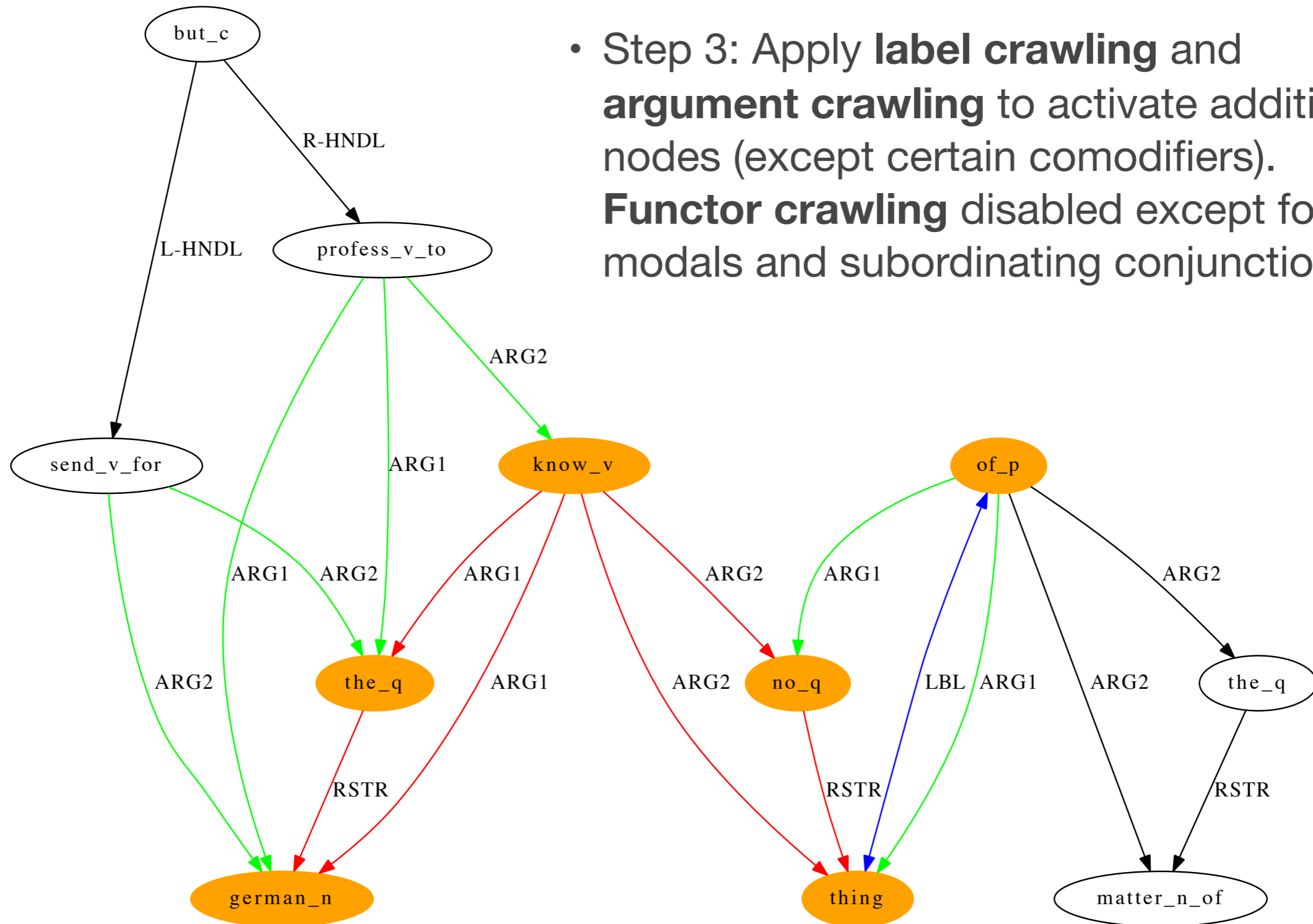
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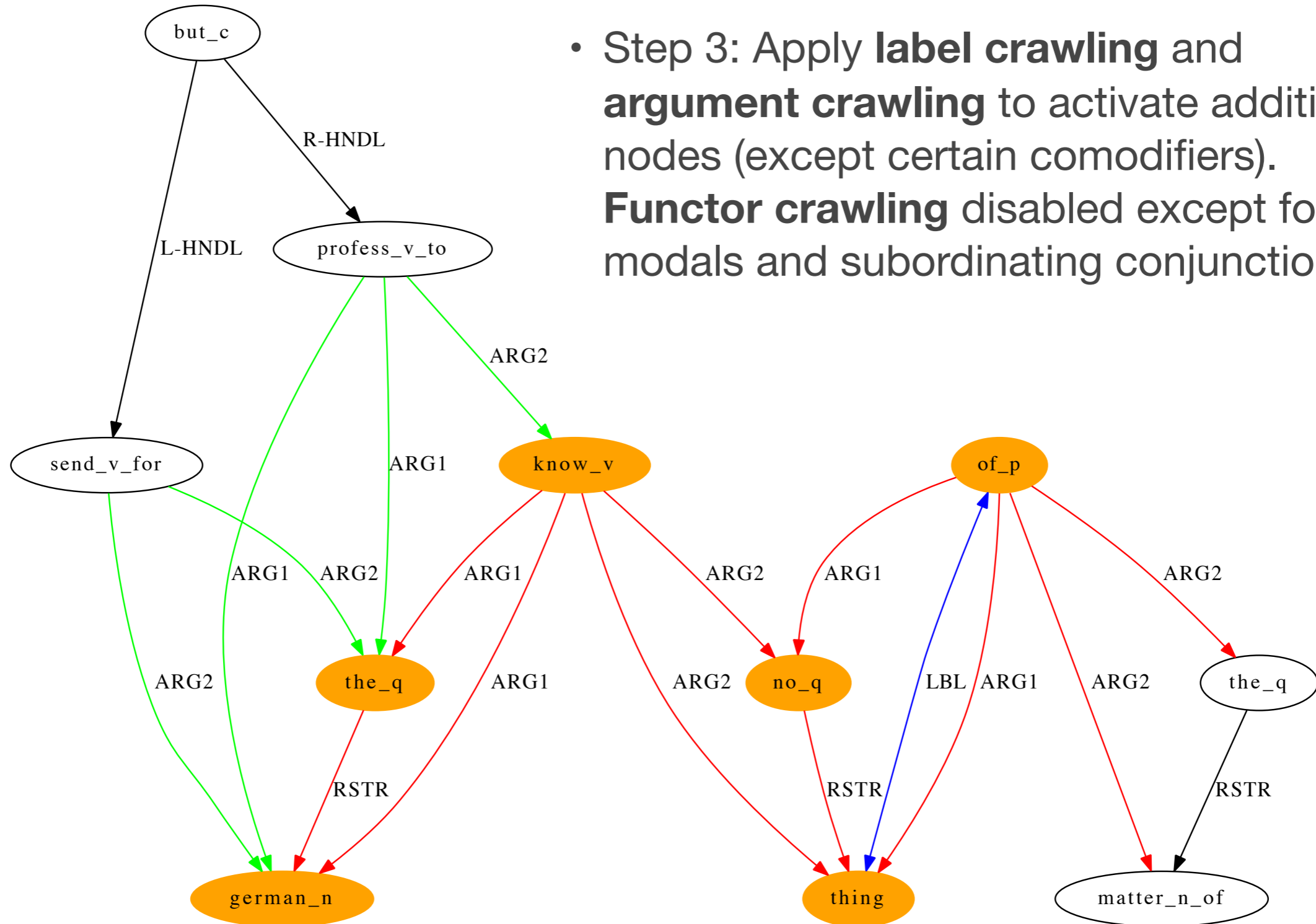


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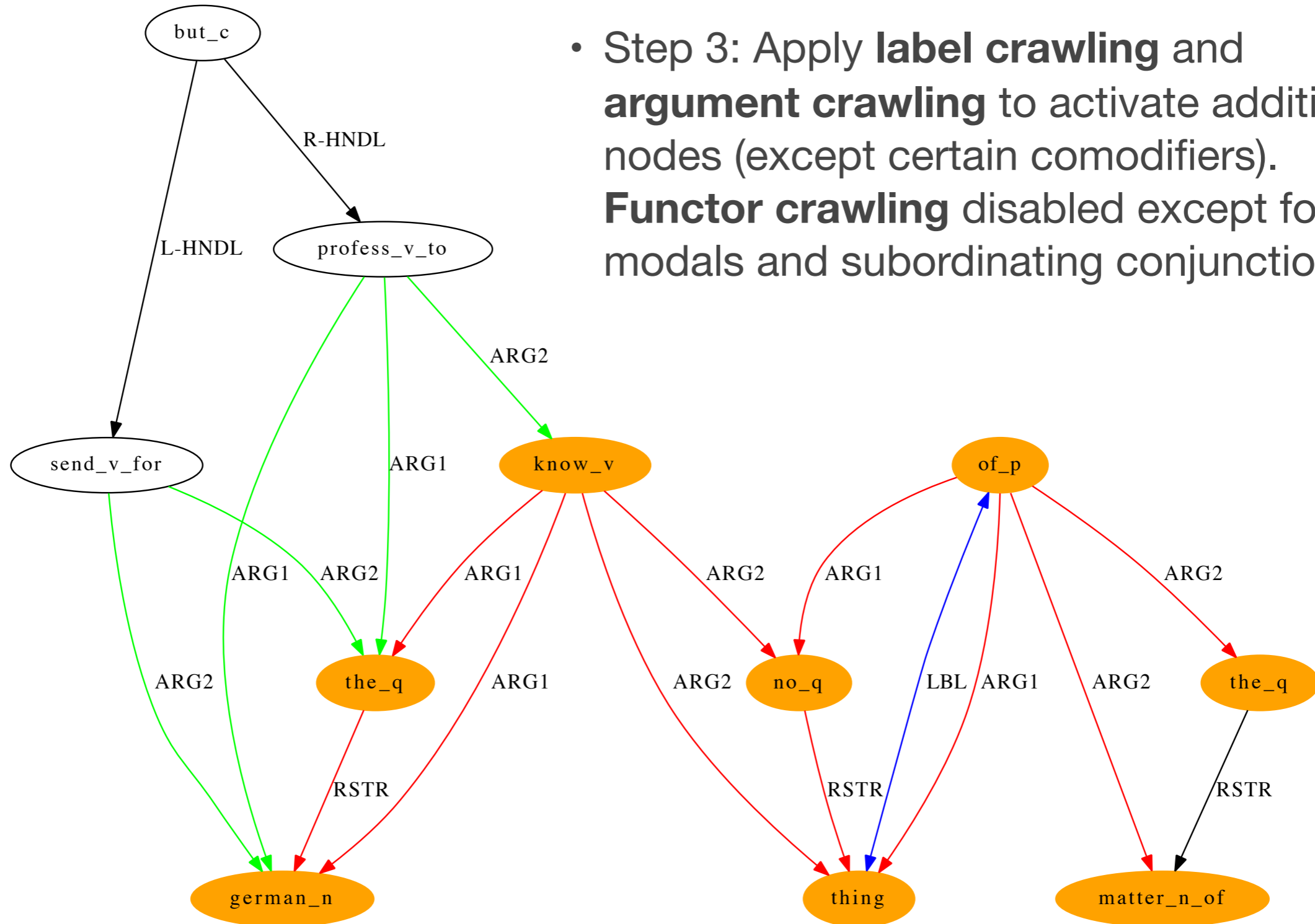


Scope of Negation from MRS



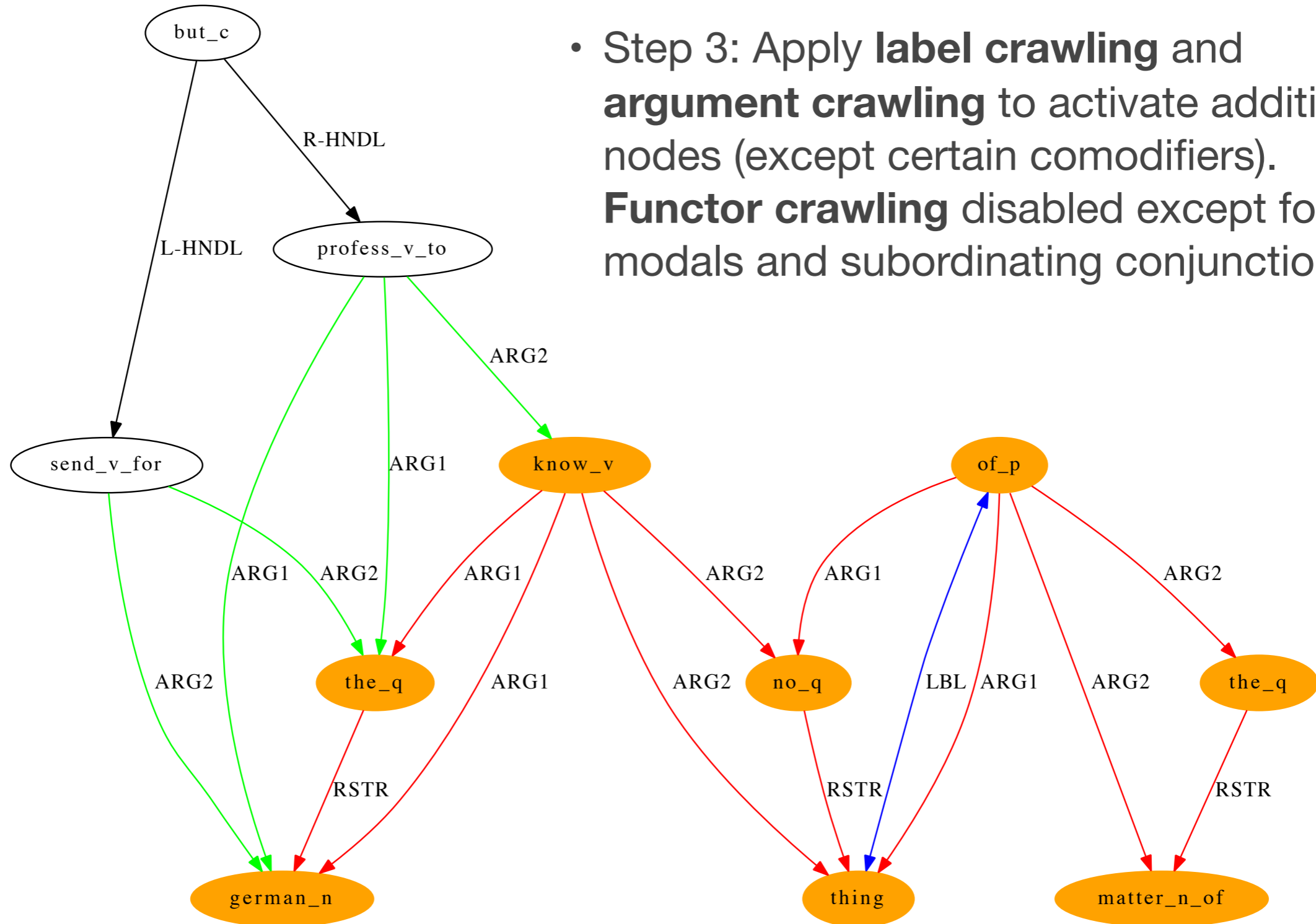
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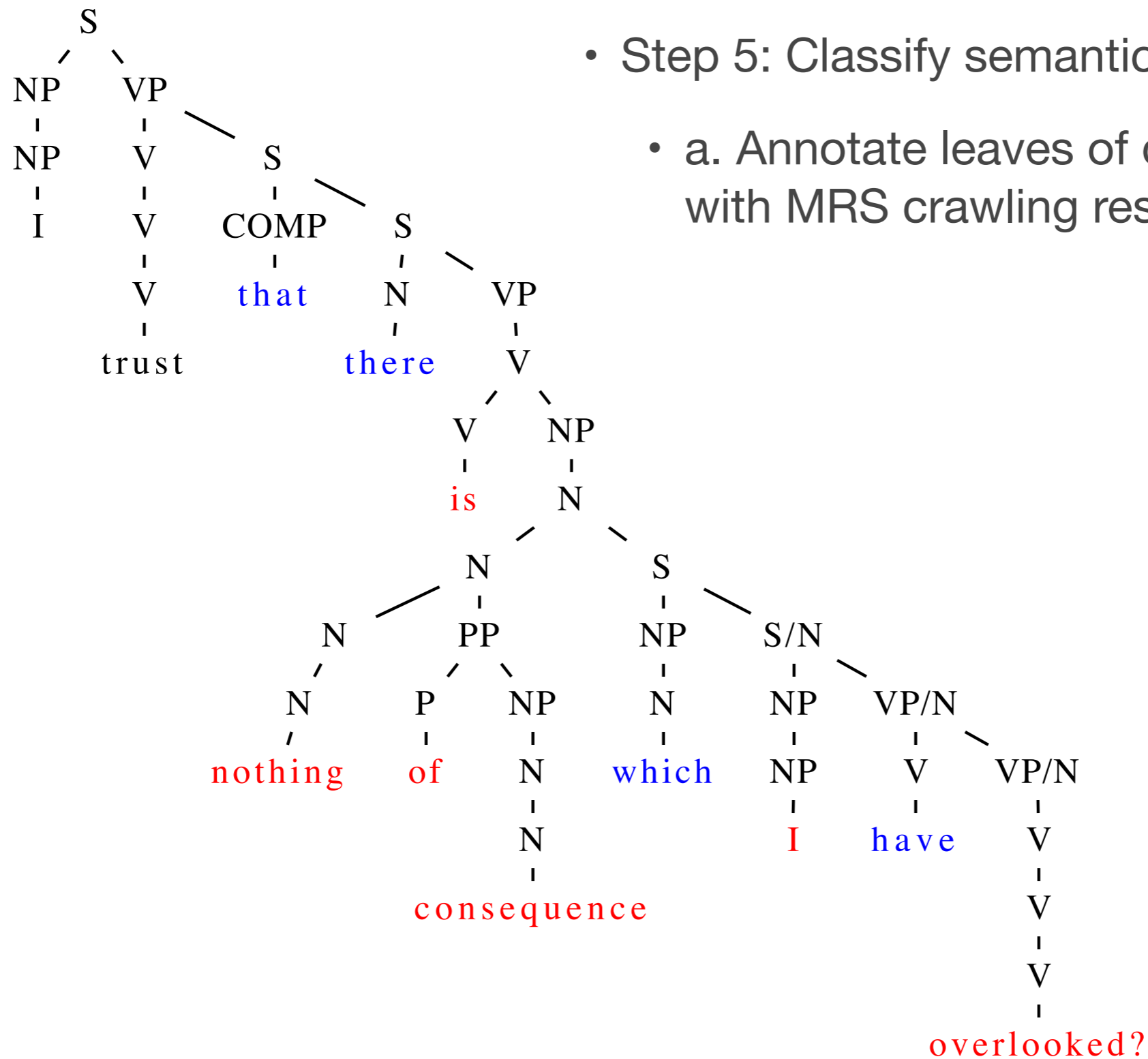
Scope of Negation from MRS

- Step 4: Project activated EPs to surface strings.

The German was sent for but professed to **know nothing of the matter**.

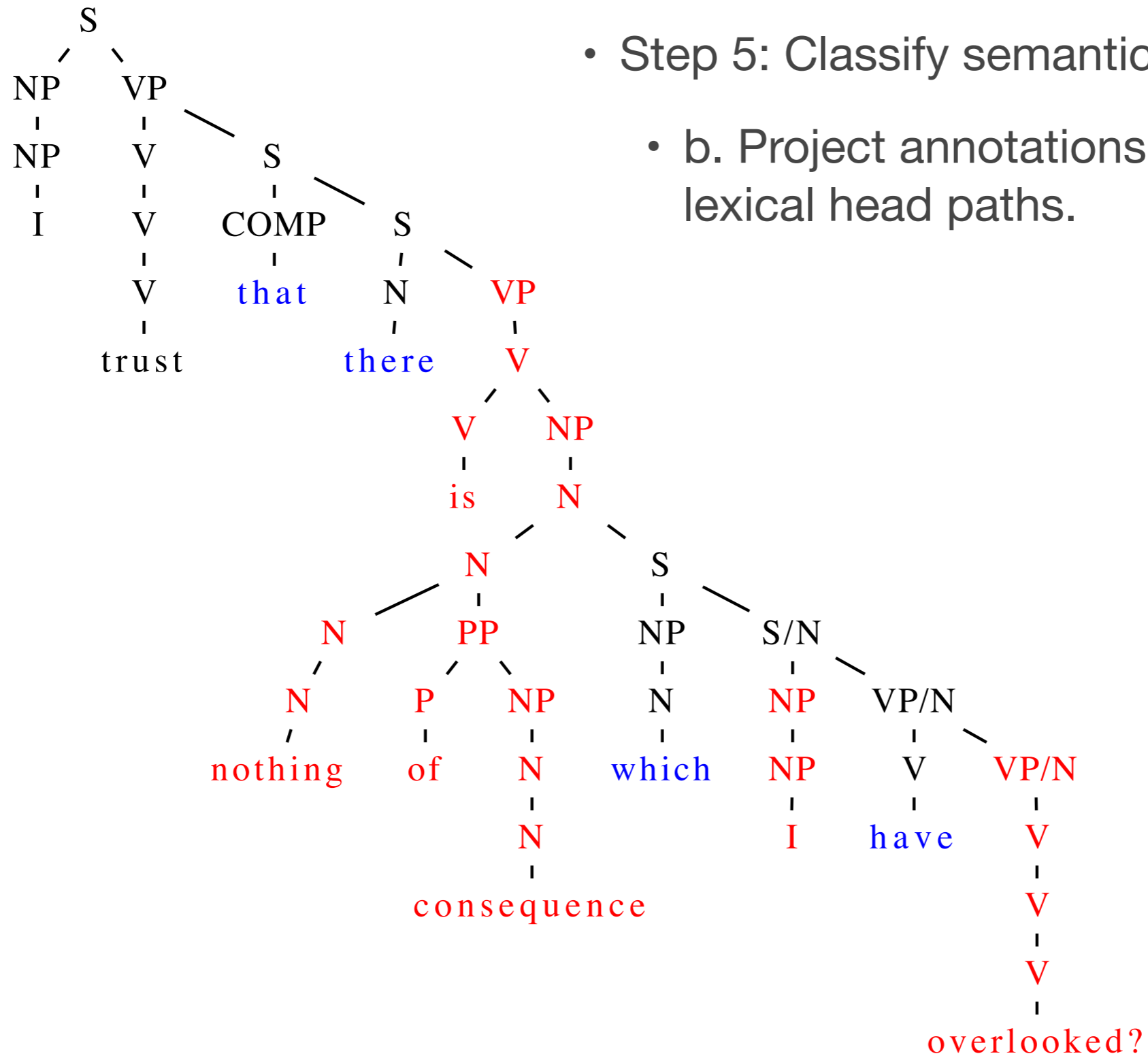
- In this example, we are done!
- Some sentences contain **semantically empty words**, i.e. function words that act as syntactic glue but do not correspond to any EP in the MRS:
"I trust **that** {**there is**} <**no**>{**thing of consequence which I have overlooked**}?"
- For these, have to work slightly harder — resort to the parse tree.

Scope of Negation from MRS



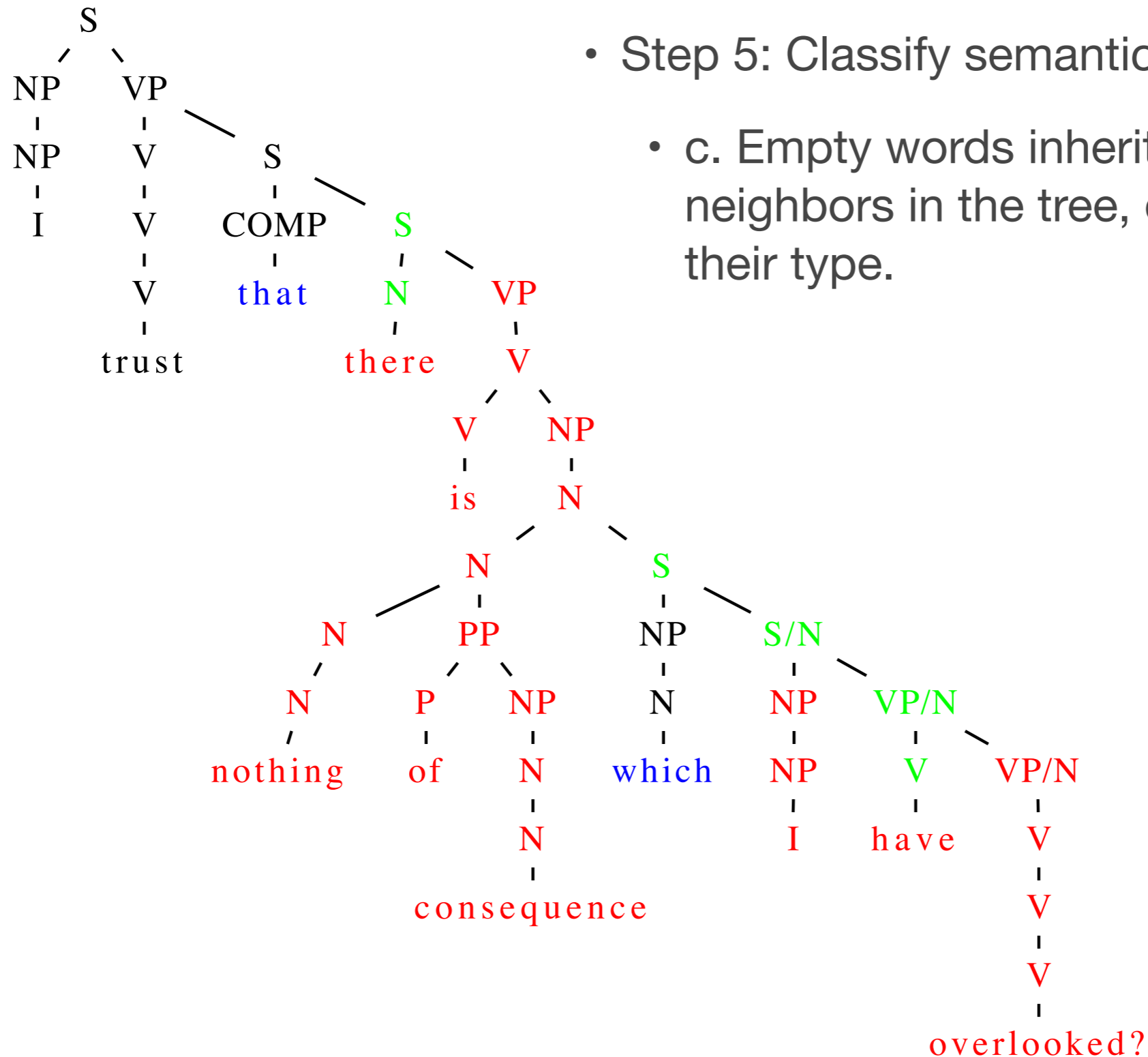
- Step 5: Classify semantically empty words.
 - a. Annotate leaves of derivation tree with MRS crawling results.

Scope of Negation from MRS



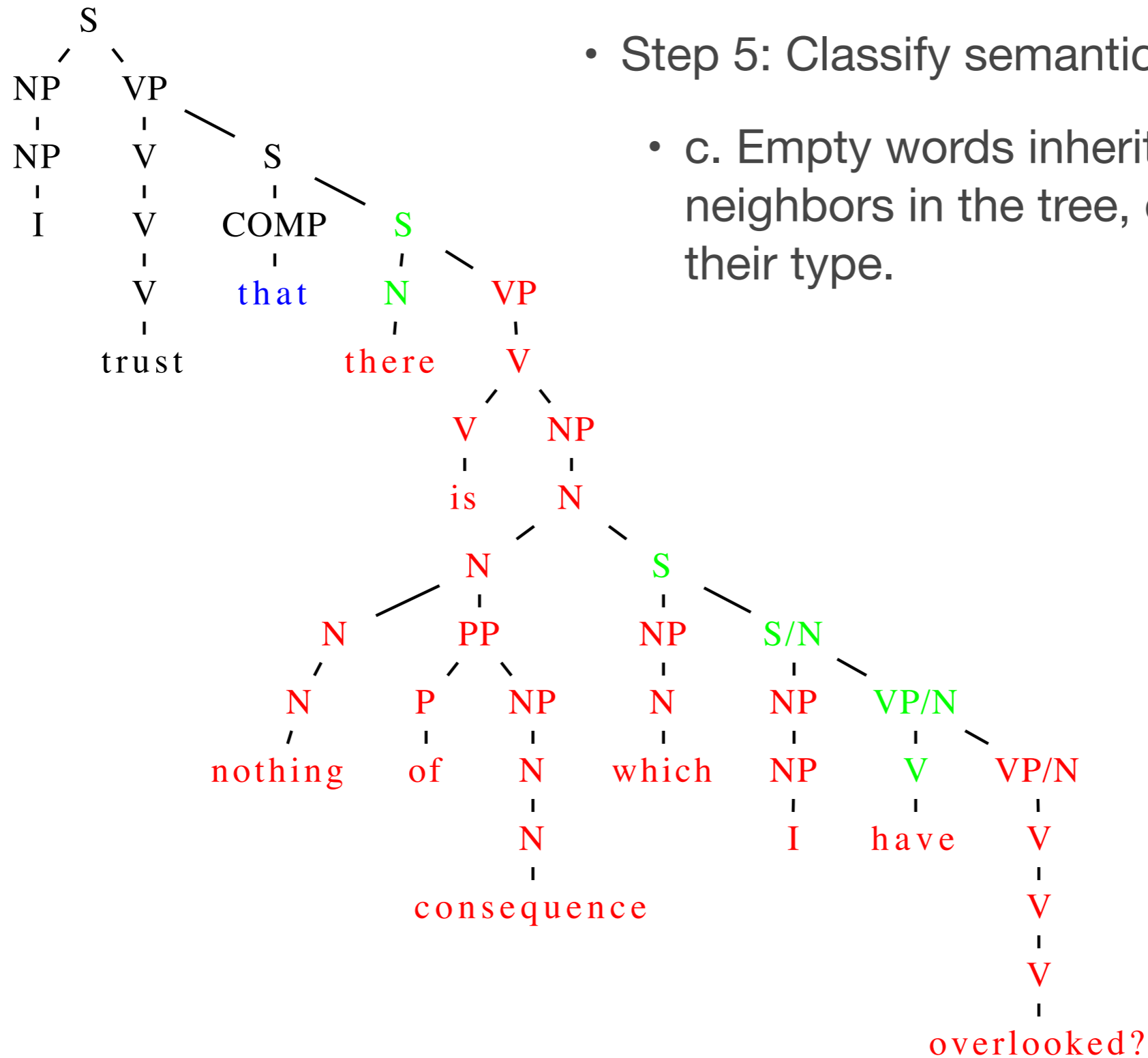
- Step 5: Classify semantically empty words.
 - b. Project annotations up syntactic lexical head paths.

Scope of Negation from MRS



- Step 5: Classify semantically empty words.
 - c. Empty words inherit from appropriate neighbors in the tree, depending on their type.

Scope of Negation from MRS



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Experimental Setup

- *SEM Shared Task corpora: Sherlock Holmes stories
- Designated train/dev/test split
- Gold cues
- MRS crawling rules designed mostly by examination of and error analysis on the *training* data (several cycles)
 - one round of error analysis on the *dev* data
- MRS crawling system applied to 1-best analysis from ERG

Results

<i>Dev</i>	P	R	F1	<i>Test</i>	P	R	F1
Scopes	100	53	69.3	Scopes	100	44.2	61.3
Tokens	89.3	67.0	76.6	Tokens	85.8	68.4	76.1

- High precision: the rules are doing the right thing
- Low recall: sometimes there's no parse, or the 1-best parse is incorrect, or it involves a rare cue that the rules don't know about, or...
- Idea: system combination with a higher recall, lower precision system

System Combination

- Use MRS crawler when results available
- Otherwise fall back to Read et al. (2012)

<i>Dev</i>	P	R	F1	<i>Test</i>	P	R	F1
Scopes	100	64.9	78.7	Scopes	98.6	56.6	71.9
Tokens	89.0	83.5	86.1	Tokens	83.8	88.4	86.1

- Much, much better — but not consistently better than Read et al. (2012) yet.
- Haven't addressed parse selection failure.
→ confidence metric

System Combination (2)

- Use MRS crawler when results available and confidence > 0.5
- Fall back to Read et al. (2012) otherwise

Combined

<i>Dev</i>	P	R	F1	<i>Test</i>	P	R	F1
Scopes	100	70.2	82.5	Scopes	98.8	65.5	78.7
Tokens	86.4	86.8	86.6	Tokens	86.1	90.4	88.2

Read et al. (2012)

<i>Dev</i>	P	R	F1	<i>Test</i>	P	R	F1
Scopes	100	68.5	81.3	Scopes	98.8	64.3	77.9
Tokens	84.8	86.8	85.8	Tokens	85.3	90.7	87.9

Conclusion

- MRS-based system is high-precision but low-recall
- In system combination, outperforms best published results
- Our crawling rules were implemented independently of the guidelines, but nonetheless model them quite closely
 - Convergence lends credence to both the annotations and the MRS structures
 - Underscores the value of explicit semantic representations for tasks related to extracting meaning
- Thank you!

References

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