All else being equal: Projection as similarity over context sets

Lisa Hofmann

lisa.hofmann@ling.uni-stuttgart.de

Universität Stuttgart

TbiLLC
September 9th, 2025

Presupposition projection from counterfactual contexts

Empirical issue: Presuppositions triggered in counterfactual contexts, i.e., clauses that express a proposition that is entailed to be false

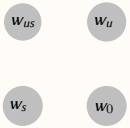
(1) Negation: *Anna didn't quit smoking.*

(2) Counterfactual conditionals: *If Anna quit smoking, she would go crazy.*

- Local-context based analyses of projection (Heim 1983, 1992; Schlenker 2009) undergenerate for presupposition triggers in counterfactual contexts
- Introduce dynamic local-context based approach to projection using similarity over context sets (drawing on Lewis 1973; Stalnaker 1978)
- Also address triggering problem: treat presuppositions as entailments (Abrusán 2011) and derive projection by calculating similarity over QUD-partitions of the context set (see also Scontras and Tonhauser 2025 for a unified account of projection and triggering using Rational Speech Acts)
- Analysis implemented using context set partition in propositional CDRT, using propositional variables to model local and global context sets (Stone 1999; Brasoveanu 2006; AnderBois et al. 2015; Hofmann 2025)

Heimian update semantics

My starting point will be a Heimian update semantics (Heim 1983, 1992; Kadmon 2001)

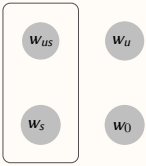


Stalnaker 1978, 2002:

- Context set of worlds compatible with what is known in the context

Heimian update semantics

My starting point will be a Heimian update semantics (Heim 1983, 1992; Kadmon 2001)



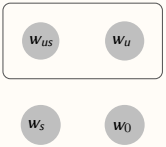
Anna smokes:
$[\![s]\!] = \{w_{us}, w_s\}$

Stalnaker 1978, 2002:

- Context set of worlds compatible with what is known in the context

Heimian update semantics

My starting point will be a Heimian update semantics (Heim 1983, 1992; Kadmon 2001)



Anna smokes:
$[\![s]\!] = \{w_{us}, w_s\}$

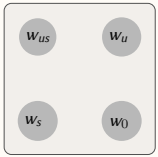
Anna used to smoke:
$[\![u]\!] = \{w_{us}, w_u\}$

Stalnaker 1978, 2002:

- Context set of worlds compatible with what is known in the context

Heimian update semantics

My starting point will be a Heimian update semantics (Heim 1983, 1992; Kadmon 2001)



Input context:

- $C_0 = \{w_{us}, w_u, w_s, w_0\}$

Anna smokes:
$[\![s]\!] = \{w_{us}, w_s\}$

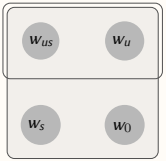
Anna used to smoke:
$[\![u]\!] = \{w_{us}, w_u\}$

Stalnaker 1978, 2002:

- Context set of worlds compatible with what is known in the context
- Intersective assertion: $C_{in} + p = C_{in} \cap p$

Heimian update semantics

My starting point will be a Heimian update semantics (Heim 1983, 1992; Kadmon 2001)



Input context:
- $C_0 = \{w_{us}, w_u, w_s, w_0\}$

A used to smoke:
- $C_1 = C_0 + u = \{w_{us}, w_u\}$

Anna smokes:
$[\![s]\!] = \{w_{us}, w_s\}$

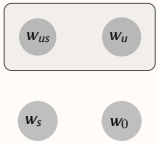
Anna used to smoke:
$[\![u]\!] = \{w_{us}, w_u\}$

Stalnaker 1978, 2002:

- Context set of worlds compatible with what is known in the context
- Intersective assertion: $C_{in} + p = C_{in} \cap p$

Heimian update semantics

My starting point will be a Heimian update semantics (Heim 1983, 1992; Kadmon 2001)



Input context:
- $C_0 = \{w_{us}, w_u, w_s, w_0\}$

A used to smoke:
- $C_1 = C_0 + u = \{w_{us}, w_u\}$

Anna smokes:
$[\![s]\!] = \{w_{us}, w_s\}$

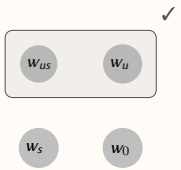
Anna used to smoke:
$[\![u]\!] = \{w_{us}, w_u\}$

Stalnaker 1978, 2002:

- Context set of worlds compatible with what is known in the context
- Intersective assertion: $C_{in} + p = C_{in} \cap p$

Heimian update semantics

My starting point will be a Heimian update semantics (Heim 1983, 1992; Kadmon 2001)



Input context: ▶ $C_0 = \{w_{us}, w_u, w_s, w_0\}$

A used to smoke: ▶ $C_1 = C_0 + u = \{w_{us}, w_u\}$

A quit smoking: ▶ $C_2 = \underline{C_1 + \partial u} + \neg s = \{w_u\}$

Anna smokes:
$[\![s]\!] = \{w_{us}, w_s\}$

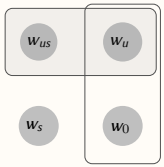
Anna used to smoke:
$[\![u]\!] = \{w_{us}, w_u\}$

Stalnaker 1978, 2002:

- Context set of worlds compatible with what is known in the context
- Intersective assertion: $C_{in} + p = C_{in} \cap p$
- Presuppositions as input definedness conditions: $C_{in} + \partial p = C_{in}$, iff $C_{in} \subseteq p$, otherwise undefined
- Anna quit smoking $\rightsquigarrow \partial u + \neg s$

Heimian update semantics

My starting point will be a Heimian update semantics (Heim 1983, 1992; Kadmon 2001)



Input context: ▶ $C_0 = \{w_{us}, w_u, w_s, w_0\}$

A used to smoke: ▶ $C_1 = C_0 + u = \{w_{us}, w_u\}$

A quit smoking: ▶ $C_2 = C_1 + \partial u + \underline{\neg s} = \{w_u\}$

Anna smokes:
$[\![s]\!] = \{w_{us}, w_s\}$

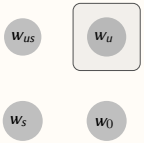
Anna used to smoke:
$[\![u]\!] = \{w_{us}, w_u\}$

Stalnaker 1978, 2002:

- Context set of worlds compatible with what is known in the context
- Intersective assertion: $C_{in} + p = C_{in} \cap p$
- Presuppositions as input definedness conditions: $C_{in} + \partial p = C_{in}$, iff $C_{in} \subseteq p$, otherwise undefined
- Anna quit smoking $\rightsquigarrow \partial u + \neg s$

Heimian update semantics

My starting point will be a Heimian update semantics (Heim 1983, 1992; Kadmon 2001)



Input context: ▶ $C_0 = \{w_{us}, w_u, w_s, w_0\}$

A used to smoke: ▶ $C_1 = C_0 + u = \{w_{us}, w_u\}$

A quit smoking: ▶ $C_2 = C_1 + \partial u + \underline{\neg s} = \{w_u\}$

Anna smokes:
$[\![s]\!] = \{w_{us}, w_s\}$

Anna used to smoke:
$[\![u]\!] = \{w_{us}, w_u\}$

Stalnaker 1978, 2002:

- Context set of worlds compatible with what is known in the context
- Intersective assertion: $C_{in} + p = C_{in} \cap p$
- Presuppositions as input definedness conditions: $C_{in} + \partial p = C_{in}$, iff $C_{in} \subseteq p$, otherwise undefined
- Anna quit smoking $\rightsquigarrow \partial u + \neg s$

Heim negation

Negation specifies a local context LC by adding the embedded content to the input context C_{in},

- Dynamic negation: $C_{in} + \sim p = C_{in} - LC$, where $\underline{LC = C_{in} + p}$

Heim negation

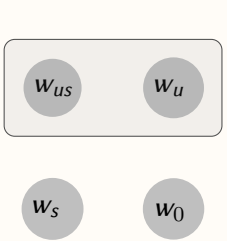
Negation specifies a local context LC by adding the embedded content to the input context C_{in}, and subtracts LC from C_{in}

- Dynamic negation: $C_{in} + \sim p = C_{in} - LC$, where $LC = C_{in} + p$

Heim negation

Negation specifies a local context LC by adding the embedded content to the input context C_{in}, and subtracts LC from C_{in}

- Dynamic negation: $C_{in} + \sim p = C_{in} - LC$, where $LC = C_{in} + p$



Input context:
- $C_0 = \{w_{us}, w_u, w_s, w_0\}$

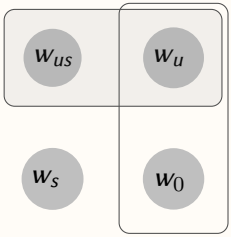
A used to smoke:
- $C_1 = C_0 + u = \{w_{us}, w_u\}$

A didn't quit smoking:
- $C_2 = C_1 - CL$
  $CL = \underline{C_1 + \partial u} + \neg s$

Heim negation

Negation specifies a local context LC by adding the embedded content to the input context C_{in}, and subtracts LC from C_{in}

- Dynamic negation: $C_{in} + \sim p = C_{in} - LC$, where $LC = C_{in} + p$



Input context:
- $C_0 = \{w_{us}, w_u, w_s, w_0\}$

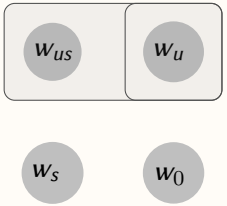
A used to smoke:
- $C_1 = C_0 + u = \{w_{us}, w_u\}$

A didn't quit smoking:
- $C_2 = C_1 - CL$
  $CL = C_1 + \partial u + \underline{\neg s}$

Heim negation

Negation specifies a local context LC by adding the embedded content to the input context C_{in}, and subtracts LC from C_{in}

- Dynamic negation: $C_{in} + \sim p = C_{in} - LC$, where $LC = C_{in} + p$



Input context:
- $C_0 = \{w_{us}, w_u, w_s, w_0\}$

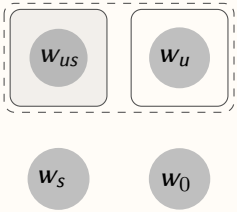
A used to smoke:
- $C_1 = C_0 + u = \{w_{us}, w_u\}$

A didn't quit smoking:
- $C_2 = C_1 - CL$
  $CL = C_1 + \partial u + \neg s = \{w_u\}$

Heim negation

Negation specifies a local context LC by adding the embedded content to the input context C_{in}, and subtracts LC from C_{in}

- Dynamic negation: $C_{in} + \sim p = C_{in} - LC$, where $LC = C_{in} + p$



Input context:
- $C_0 = \{w_{us}, w_u, w_s, w_0\}$

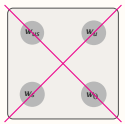
A used to smoke:
- $C_1 = C_0 + u = \{w_{us}, w_u\}$

A didn't quit smoking:
- $\dfrac{C_2 = C_1 - CL = \{w_{us}\}}{CL = C_1 + \partial u + \neg s = \{w_u\}}$

Note on terminology: LC is the *output local context*, i.e., a set of worlds where the embedded content is true

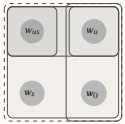
Local accommodation

If $C_{out} = C_{in} + S$ is undefined due to some presuppostional term ∂p, attempt repair by letting $C_{out} = C_{in} + p + S$.



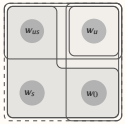
Input context:
A didn't quit smoking:

- $C_0 = \{w_{us}, w_u, w_s, w_0\}$
- $C_1 = C_0 - CL = \#$
  $CL = C_0 + \partial u + \neg s = \#$



Input context:
Global accommodation
A didn't quit smoking:

- $C_0 = \{w_{us}, w_u, w_s, w_0\}$
- $C_1 = C_0 + u$
- $C_2 = C_1 - CL$
  $CL = C_1 + \partial u + \neg s$



Input context:
A didn't quit smoking:

Local accommodation

- $C_0 = \{w_{us}, w_u, w_s, w_0\}$
- $C_1 = C_0 - CL$
  $CL = C_0 + \partial u + \neg s$
  ~~$CL = C_0 + \partial u + \neg s$~~
- $CL = C_0 \underline{+ u} + \partial u + \neg s$

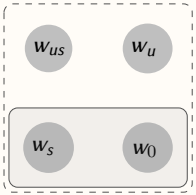
In any case, $CL \subseteq C_{in}$

The problem

Presuppositions that are already known to be false
(call these *counterfactual presuppositions*)

(3) *Anna didn't smoke in the past, so she didn't quit smoking.*

c.f. Kibble 1994: (31), Kadmon 2001, Ch. 8: (5)



Input context:

A didn't smoke in the past.

A didn't quit smoking:

- $C_0 = \{w_{us}, w_u, w_s, w_0\}$
- $C_1 = C_0 + \sim u = \{w_s, w_0\}$
- $C_2 = C_1 - CL$
  $CL = C_1 + \partial u + \neg s$

Because $C_1 \cap u = \emptyset$, (local or global) accommodation leads to empty set of worlds

Empty local contexts?

Maybe it's fine to have an empty local context here, because utterances like (3) are just uninformative?

(3) *Anna never smoked in the past, so she didn't quit smoking.*

No, the local context of the negative prejacent has real content and should not be empty:

1. Discourse can continue to say more about the possibilities invoked in the counterfactual local context, e.g., using propositional anaphora (4a) or modal subordination (4b)

   (4) a. *Even if Sue claimed that.*
   b. *She would have gone crazy.*

2. Counterfactual presuppositions can be embedded under emotive attitudes:

   (5) (I don't have kids.) *I am glad that I don't have to bring my kids to school every day.*

Relax, but not too much

- To handle counterfactual presuppositions, we need to relax the requirement that LC is a subset of C
- But projection is derived by checking presuppositions of embedded content against the global context, so this requirement is exactly what derives projection
- cf. Heim 1992: on non-veridical doxastic attitudes (e.g., English *believe*); analysis dissociates local from global contexts, and evaluates embedded presuppositions against the attitude holder's doxastic state, incorrectly predicting no projection.
- We still want some relationship between local and global context

Counterfactual conditionals

For counterfactual conditionals, the LC-based accounts also make faulty predictions:

- Heim 1992 (pp. 204 f.) assumes that presuppositions of conditional antecedent are (essentially) checked against the global context, again enforcing that embedded presuppositions are globally consistent.
- Schlenker 2009 predicts that the local context is the entire domain W allowing only presuppositions that hold throughout W

(Mackay 2023, see also Mandelkern and Romoli 2017, fn. 33)

Upshot and outlook

- Core innovation: loosen the requirement on determining local contexts, and derive projection by assuming that the global context is similar to the local context
- Based on analyses of counterfactual conditionals (Lewis 1973; Stalnaker 1968): use similarity over worlds to derive that local contexts are like the global context, except the embedded content is true. To derive projection, we assume the opposite

Projection as similarity

A negation updates the global context to

- satisfy the main assertion ($C - CL$), and
- contain only the worlds most similar to the local context $CL = \{w_u\}$

(6) a. **Dynamic negation:** $C + \sim p = Sim_{CL}(C - CL)$, where $C_L = p$
b. **Similarity:** $Sim_{C'}(C) := \{w \mid \exists w' \in C'(w \in sim_{w'}(C))\}$

- The local context of the negative prejacent is $\{w_u\}$, where its content is true
- i.e., the presupposition is treated on par with entailments here, following Abrusán 2011 (we get back to triggering later)

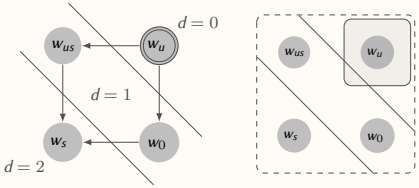
(7) a. *Anna quit smoking* $\rightsquigarrow (u \wedge \neg s)$, i.e., $\{w_u\}$
b. *Anna didn't quit smoking.* $\rightsquigarrow \sim(u \wedge \neg s)$

The negation (7b) states that, given the local context $CL = (u \wedge \neg s) = \{w_u\}$, the global output context is the set of worlds that is the subset of $C - CL$ that is closest to CL.

Similarity-classes

Based on Lewis 1973, give an explicit definition of distance and similarity between worlds:

- Measure distance between worlds w, w' by counting the atomic propositions (wt constants) assigning distinct truth values to w, w'
- With some w as reference point, define an equivalence relation (8b), which holds of worlds w', w'', iff they are equidistant from w.
- The relation $sim_w(p)$ (8c) selects the equivalence class containing the w-closest worlds found in p.



(8)

a. $d_w(w') := |\lambda p \in \mathbf{Const}_{wt}.p(w) \neq p(w')|$

b. $\sim_w = \lambda w'.\lambda w''.d_w(w') = d_w(w'')$

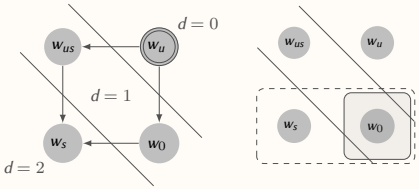
c. $sim_{w_u}(p) := \{w' \in p \mid \forall w'' \in p(d_{w_u}(w') \leq d_{w_u}(w''))\}$

- For w_u, equivalence classes on W are: $\{w_u\}$ ($d_{w_u} = 0$), $\{w_0, w_{su}\}$ ($d_{w_u} = 1$), and $\{w_s\}$ ($d_{w_u} = 2$)
- For instance, $sim_{w_u}(W) = \{w_u\}$ (with $d_{w_u} = 0$);

Similarity-classes

Based on Lewis 1973, give an explicit definition of distance and similarity between worlds:

- Measure distance between worlds w, w' by counting the atomic propositions (*wt* constants) assigning distinct truth values to w, w'
- With some w as reference point, define an equivalence relation (8b), which holds of worlds w', w'', iff they are equidistant from w.
- The relation $sim_w(p)$ (8c) selects the equivalence class containing the w-closest worlds found in p.



(8)

a. $d_w(w') := |\lambda p \in \mathbf{Const}_{wt}.p(w) \neq p(w')|$

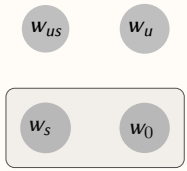
b. $\sim_w = \lambda w'.\lambda w''.d_w(w') = d_w(w'')$

c. $sim_{w_u}(p) := \{w' \in p \mid \forall w'' \in p(d_{w_u}(w') \leq d_{w_u}(w''))\}$

- For w_u, equivalence classes on W are: $\{w_u\}$ ($d_{w_u} = 0$), $\{w_0, w_{su}\}$ ($d_{w_u} = 1$), and $\{w_s\}$ ($d_{w_u} = 2$)
- For instance, $sim_{w_u}(W) = \{w_u\}$ (with $d_{w_u} = 0$);
- $sim_{w_u}(\{w_s, w_0\}) = \{w_0\}$ (with $d_{w_u} = 1$)

Avoiding the problem for counterfactual presuppositions

Negation: $C + \sim(u \wedge \neg s) = Sim_{CL}(C - CL)$, where $C_L = u \wedge \neg s$



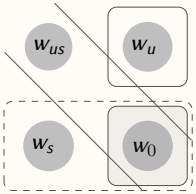
Input context, where
(A didn't smoke in the past.)

A didn't quit smoking:

- $C_0 = \{w_s, w_0\}$
- $C_1 = C_0 + \sim p =$
  $Sim_{CL}(C_1 - CL) = \{w_0\}$,
  $CL = (u \wedge \neg s) = \{w_u\}$

Avoiding the problem for counterfactual presuppositions

Negation: $C + \sim(u \wedge \neg s) = Sim_{CL}(C - CL)$, where $C_L = u \wedge \neg s$



Input context, where
(A didn't smoke in the past.)

A didn't quit smoking:

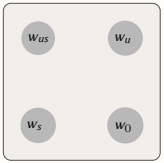
- $C_0 = \{w_s, w_0\}$
- $C_1 = C_0 + \sim p =$
  $Sim_{CL}(C_1 - CL) = \{w_0\}$,
  $CL = (u \wedge \neg s) = \{w_u\}$

- Additional inference predicted: A didn't just pick up smoking.

QUD-based triggering

Triggering: not all entailments behave like presuppositions

- derive presuppositions as entailments are not at-issue relative to the QUD (Abrusán 2011; Simons et al. 2017)
- Why? There are still contexts where the above mechanism underpredicts projection, $C_0 = W$



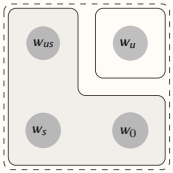
Input context

- $C_0 = \{w_{us}, w_u, w_s, w_0\}$

QUD-based triggering

Triggering: not all entailments behave like presuppositions

- derive presuppositions as entailments are not at-issue relative to the QUD (Abrusán 2011; Simons et al. 2017)
- Why? There are still contexts where the above mechanism underpredicts projection, $C_0 = W$



Input context

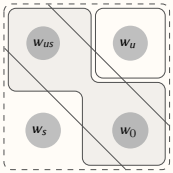
A didn't quit smoking:

- $C_0 = \{w_{us}, w_u, w_s, w_0\}$
- $C_1 = C_0 + \sim p = Sim_{CL}(C_1 - CL) = \{w_0\}$, $CL = (u \wedge \neg s) = \{w_u\}$

QUD-based triggering

Triggering: not all entailments behave like presuppositions

- derive presuppositions as entailments are not at-issue relative to the QUD (Abrusán 2011; Simons et al. 2017)
- Why? There are still contexts where the above mechanism underpredicts projection, $C_0 = W$



Input context

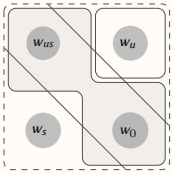
A didn't quit smoking:

- $C_0 = \{w_{us}, w_u, w_s, w_0\}$
- $C_1 = C_0 + \sim p = Sim_{CL}(C_1 - CL) = \{w_0\}$, $CL = (u \wedge \neg s) = \{w_u\}$

QUD-based triggering

Triggering: not all entailments behave like presuppositions

- derive presuppositions as entailments are not at-issue relative to the QUD (Abrusán 2011; Simons et al. 2017)
- Why? There are still contexts where the above mechanism underpredicts projection, $C_0 = W$



Input context

A didn't quit smoking:

- $C_0 = \{w_{us}, w_u, w_s, w_0\}$
- $C_1 = C_0 + \sim p = Sim_{CL}(C_1 - CL) = \{w_0\}$, $CL = (u \wedge \neg s) = \{w_u\}$

Depending on the preceding context, either one of these worlds may be eliminated by the update.

(9) Q: *Does Anna smoke?* A: *She didn't quit.*

a. suggests answer: s (yes, A smokes)
b. projects: u (A used to smoke)
i.e., $\{w_{us}\}$

(10) Q: *Did Anna use to smoke in the past?* A: *She didn't quit.*

a. suggests answer: $\neg u$ (no, A never used to smoke)
b. projects: $\neg s$ (no, A doesn't smoke)
i.e., $\{w_0\}$

Something needs to be said about the empirical status of (10b)

Discussion: Lexical contribution

(9) Q: *Does Anna smoke?* A: *She didn't quit.*

a. suggests answer: s (yes, A smokes)
b. projects: u (A used to smoke)
i.e., $\{w_{us}\}$

(10) Q: *Did Anna use to smoke in the past?* A: *She didn't quit.*

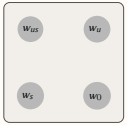
a. suggests answer: $\neg u$ (no, A never used to smoke)
b. projects: $\neg s$ (no, A doesn't smoke)
i.e., $\{w_0\}$

Ok, well, (10b) is not so good

- Though in English, we can add *well, at least* (c.f. German *jedenfalls*), to signal that we are not addressing the QUD in the usual way
- Presupposition cannot be used to settle the QUD (Aravind and Hackl 2017; Doron and Wehbe 2022, attributed to Heim)
- Lexical semantics should give us some information about which of the expressed propositions is "conventionally marked" to be at issue (c.f. Simons et al. 2017) and which one isn't
- Scontras and Tonhauser (2025) provide experimental evidence that the belief-inference of *know* (which is usually not taken to be presupposed, similarly to ¬s here) can project to some extent, depending on the QUD
- Inference remains debated, inviting further study, this work provides a proof of concept for systematically deriving such inferences.

Similarity over QUD-partitions of the context set

- Model QUD as context set partition (Ginzburg 1996; Roberts 1996)

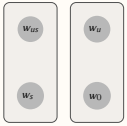


Input context:

- $C_0 = \{w_{us}, w_u, w_s, w_0\}$

Similarity over QUD-partitions of the context set

- Model QUD as context set partition (Ginzburg 1996; Roberts 1996)
- Prune QUD alternatives by picking worlds most similar to LC



Input context:
$?s$

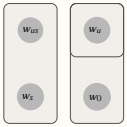
- $C_0 = \{w_{us}, w_u, w_s, w_0\}$
- $QUD = \{\{w_s, w_{su}\}, \{w_0, w_u\}\}$

Input context:
$?u$

- $C_0 = \{w_{us}, w_u, w_s, w_0\}$
- $QUD = \{\{w_u, w_{su}\}, \{w_0, w_s\}\}$

Similarity over QUD-partitions of the context set

- Model QUD as context set partition (Ginzburg 1996; Roberts 1996)
- Prune QUD alternatives by picking worlds most similar to LC



Input context:
$?s$
A didn't quit smoking

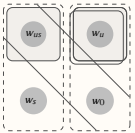
- $C_0 = \{w_{us}, w_u, w_s, w_0\}$
- $QUD = \{\{w_s, w_{su}\}, \{w_0, w_u\}\}$
- $CL = u + \neg s = \{w_u\}$

Input context:
$?u$
A didn't quit smoking:

- $C_0 = \{w_{us}, w_u, w_s, w_0\}$
- $QUD = \{\{w_u, w_{su}\}, \{w_0, w_s\}\}$
- $CL = u + \neg s = \{w_u\}$

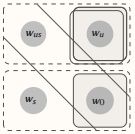
Similarity over QUD-partitions of the context set

- Model QUD as context set partition (Ginzburg 1996; Roberts 1996)
- Prune QUD alternatives by picking worlds most similar to LC



Input context:
$?s$
A didn't quit smoking
Similarity

- $C_0 = \{w_{us}, w_u, w_s, w_0\}$
- $QUD = \{\{w_s, w_{su}\}, \{w_0, w_u\}\}$
- $CL = u + \neg s = \{w_u\}$
- $\{Sim_{\{w_u\}}(c) \mid c \in ?s\} = \{\{w_{su}\}, \{w_u\}\}$



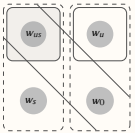
Input context:
$?u$
A didn't quit smoking:
Similarity:

- $C_0 = \{w_{us}, w_u, w_s, w_0\}$
- $QUD = \{\{w_u, w_{su}\}, \{w_0, w_s\}\}$
- $CL = u + \neg s = \{w_u\}$
- $\{Sim_{\{w_u\}}(c) \mid c \in ?u\} = \{\{w_u\}, \{w_0\}\}$

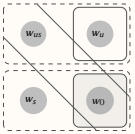
Assume that inference projects if entailed by every context partition.
(c.f. Abusch 2010: presupposition triggering from alternative sets)

Similarity over QUD-partitions of the context set

- Model QUD as context set partition (Ginzburg 1996; Roberts 1996)
- Prune QUD alternatives by picking worlds most similar to LC
- Reject answers that are contradicted by the assertion



Input context:	$C_0 = \{w_{us}, w_u, w_s, w_0\}$
$?s$	$QUD = \{\{w_s, w_{su}\}, \{w_0, w_u\}\}$
A didn't quit smoking	$CL = u + \neg s = \{w_u\}$
Similarity	$\{Sim_{\{w_u\}}(c) \mid c \in ?s\} = \{\{w_{su}\}, \{w_u\}\}$
Assertion	$C_1 = \{w_u\}$



Input context:	$C_0 = \{w_{us}, w_u, w_s, w_0\}$
$?u$	$QUD = \{\{w_u, w_{su}\}, \{w_0, w_s\}\}$
A didn't quit smoking:	$CL = u + \neg s = \{w_u\}$
Similarity:	$\{Sim_{\{w_u\}}(c) \mid c \in ?u\} = \{\{w_u\}, \{w_0\}\}$
Assertion	$C_1 = \{w_0\}$

Assume that inference projects if entailed by every context partition.
(c.f. Abusch 2010: presupposition triggering from alternative sets)

Formal account

Implement analysis in a version of CDRT with propositional drefs for (local/global) context sets (Brasoveanu 2006, 2010; AnderBois et al. 2015; Hofmann 2019, 2022, 2025)

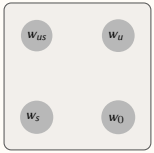
- Discourse states (sets of variable assignments) are updated distributively
- Updates (11) are relations between input assignment g and output h, that a propositional discourse referent ϕ and a series of conditions.

(11) Propositional CDRT update:
$[\![[\phi \mid C_1, \ldots C_n]]\!]^{M,} = \{h \mid \exists p \subseteq D_w : h = g[\phi \mapsto p], [\![C_1 \wedge \cdots \wedge C_n]\!]^{M,h} = 1\}$

Discourse states store designated propositional variables:

- ϕ_{CS} represents current context set
- ϕ_{PS} to model projected set of possible future common grounds; storing the proposal made by an assertion (based on Farkas and Bruce 2010),
- ϕ_{QUD} for QUD-partitions of the context set

g :	ϕ_{cs}	ϕ_{QUD}	ϕ_{PS}
	$\{w_{su}, w_s, w_u, w_\emptyset\}$	$\{w_{su}, w_s, w_u, w_\emptyset\}$	$\{w_{su}, w_s, w_u, w_\emptyset\}$



Polar questions: $?s$

The question *Does Anna smoke?*

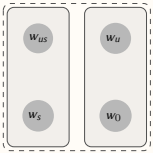
(12) $?s := [\phi_{QUD} \mid \phi_{QUD} \subseteq \phi_{cs},\ \phi_{QUD} \subseteq s \vee \phi_{QUD} \subseteq \neg s];\ \ [\phi_{PS} \mid \phi_{PS} = \phi_{QUD}]$

- stores question-alternatives as possible values of ϕ_{QUD}
- by reintroducing the dref for ϕ_{QUD} to allow for multiple possible values, and stating that any value is a subset of ϕ_{CS} entailing either s or $\neg s$
- Also adds possible answers to the projected set.

g :	ϕ_{cs}	ϕ_{QUD}	ϕ_{PS}
	$\{w_{su}, w_s, w_u, w_\emptyset\}$	$\{w_{su}, w_s, w_u, w_\emptyset\}$	$\{w_{su}, w_s, w_u, w_\emptyset\}$

$\Rightarrow$

	ϕ_{cs}	ϕ_{QUD}	ϕ_{PS}
h_1 :	$\{w_{su}, w_s, w_u, w_\emptyset\}$	$\{w_{su}, w_s\}$	$\{w_{su}, w_s\}$
h_2 :	$\{w_{su}, w_s, w_u, w_\emptyset\}$	$\{w_u, w_\emptyset\}$	$\{w_u, w_\emptyset\}$



Assertion

Asserting *Anna smokes* (13) after (12)

(13) $\textsc{assert}(s) := [\phi_1 \mid \phi_1 = s]; [\phi_{PS} \mid \phi_{PS} = \phi_{QUD} \vee \phi_{PS} = \emptyset,\ \phi_{PS} \subseteq \phi_1]$

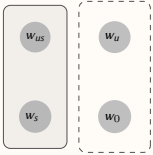
- Proposal to update the context set, directly change only the projected set (Farkas and Bruce 2010)
- Introduce propositional dref ϕ_1
- Update ϕ_{PS} eliminate QUD-answer(s) contradicted by the assertion

Update when asserting s after asking whether $?s$ in g:

	ϕ_{CS}	ϕ_{QUD}	ϕ_{PS}
h_1 :	$\{w_{su}, w_s, w_u, w_\emptyset\}$	$\{w_{su}, w_s\}$	$\{w_{su}, w_s\}$
h_2 :	$\{w_{su}, w_s, w_u, w_\emptyset\}$	$\{w_u, w_\emptyset\}$	$\{w_u, w_\emptyset\}$

$\Rightarrow$

	ϕ_{CS}	ϕ_{QUD}	ϕ_{PS}	ϕ_1
i_1 :	$\{w_{su}, w_s, w_u, w_\emptyset\}$	$\{w_{su}, w_s\}$	$\{w_{su}, w_s\}$	$\{w_{su}, w_s\}$
i_2 :	$\{w_{su}, w_s, w_u, w_\emptyset\}$	$\{w_u, w_\emptyset\}$	$\emptyset$	$\{w_{su}, w_s\}$



If ϕ_{PS} has only one non-empty value, the assertion can be accepted by letting: $\phi_{CS} = \phi_{PS}, \phi_{CS} \neq \emptyset$.

Projection

Following the question (12), we could instead assert *Anna didn't quit smoking*:

(14) ASSERT(NOT($u \wedge \neg s$)) :=

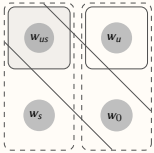
a. $[\phi_1, \phi_2 \mid \phi_1 = \overline{\phi_2},\ \phi_2 = (u \wedge \neg s)]$;
b. $[\phi_{QUD} \mid \phi_{QUD} \subseteq \phi_{PS}, \mathit{Sim}(\phi_{QUD}, \phi_2)]$;
c. $[\phi_{PS} \mid \phi_{PS} = \phi_{QUD} \vee \phi_{PS} = \emptyset,\ \phi_{PS} \subseteq \phi_1]$

- (14a) contributes dref ϕ_2 for local context $\{w_u\}$ where negative prejacent is true
- (14a) introduces dref ϕ_1 for main clause $\{w_{su}, w_s, w_\emptyset\}$, as the complement of ϕ_2, implementing truth-condtional semantics of negation
- (14b) derives projection of *Anna used to smoke* (u) by updating ϕ_{QUD} s.t., for each QUD-partition, only the worlds most similar to the local context are retained
- (14c) updates ϕ_{PS} to contain only answers to the QUD entailed by the assertion

	ϕ_{cs}	ϕ_{QUD}	ϕ_{PS}
h_1 :	$\{w_{su}, w_s, w_u, w_\emptyset\}$	$\{w_{su}, w_s\}$	$\{w_{su}, w_s\}$
h_2 :	$\{w_{su}, w_s, w_u, w_\emptyset\}$	$\{w_u, w_\emptyset\}$	$\{w_u, w_\emptyset\}$

$\Rightarrow$

	ϕ_{cs}	ϕ_1	ϕ_2	ϕ_{QUD}	ϕ_{PS}
i_1 :	$\{w_{su}, w_s, w_u, w_\emptyset\}$	$\{w_{su}, w_s, w_\emptyset\}$	$\{w_u\}$	$\{w_{su}\}$	$\{w_{su}\}$
i_2 :	$\{w_{su}, w_s, w_u, w_\emptyset\}$	$\{w_{su}, w_s, w_\emptyset\}$	$\{w_u\}$	$\{w_u\}$	$\emptyset$



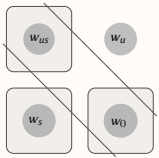
Why is Anna nervous?

Also look at (15): Qing et al. (2016) suggest that questions like these in this context are equivalent to QUD_{max}, asking which is the actual world.

(15) Q: *Why is Anna nervous?* A: *(Well,) she didn't quit smoking.*

a. suggests partial answer: $\neg(u \wedge \neg s)$ (It's not that Anna is nervous because she quit smoking)

b. no projection



Pragmatic similarity across context sets

- Presuppositions are entailments that project when they are not at-issue, providing a formal basis for theoretical generalizations in Abrusán 2011; Simons et al. 2010
- This resolves problems with counterfactual presuppositions for local-context based accounts in Heim (1983, 1992); Schlenker (2009)
- In the proposed analysis, accommodation is not a repair-strategy, but the root of projection and triggering:
- Accommodation and triggering through the same mechanism: by assuming that modulo what is at-issue, we assume some consistency across all invoked scenarios
- I take this to be a pragmatic mechanism, which may be suspended, e.g., when we in speech reports attributed to a notorious liar, or dream reports.

References I

Abrusán, Márta. 2011. Predicting the presuppositions of soft triggers. *Linguistics and Philosophy* 34(6):491–535.

Abusch, Dorit. 2010. Presupposition triggering from alternatives. *Journal of Semantics* 27(1):37–80.

AnderBois, Scott, Adrian Brasoveanu, and Robert Henderson. 2015. At-issue proposals and appositive impositions in discourse. *Journal of Semantics* 32(1):93–138.

Aravind, Athulya and Martin Hackl. 2017. Factivity and at-issueness in the acquisition of forget and remember. In *Proceedings of the Boston University Conference on Language Development (BUCLD)*, vol. 41, page 46.

Brasoveanu, Adrian. 2006. *Structured nominal and modal reference*. Doctoral dissertation, Rutgers University, New Brunswick, NJ.

Brasoveanu, Adrian. 2010. Decomposing modal quantification. *Journal of Semantics* 27(4):437–527.

Chatain, Keny and Philippe Schlenker. 2024. On the Syntactic Reality of Pragmatic Operators: the Case of Non-Redundancy accepted in Rivista di Grammatica Generativa.

Doron, Omri and Jad Wehbe. 2022. A constraint on presupposition accommodation. In *Proceedings of the 23nd Amsterdam Colloquium*, vol. 23.

References II

Farkas, Donka and Kim Bruce. 2010. On reacting to assertions and polar questions. *Journal of Semantics* 27(1):81–118.

Ginzburg, Jonathan. 1996. Interrogatives: Questions, facts and dialogue. *The handbook of contemporary semantic theory* 5(18):359–423. Publisher: Citeseer.

Heim, Irene. 1983. On the projection problem for presuppositions. In M. T. Wescoat and M. Barlow, eds., *Second West Coast Conference on Formal Linguistics (WCCFL)*, pages 114–125. Stanford, CA. (Reprinted in Portner, Paul and Barbara Partee (eds.). 2002. *Formal semantics: The essential Readings* Linguistics: The Essential Readings, 249–260. Hoboken, NJ: Wiley-Blackwell.).

Heim, Irene. 1992. Presupposition projection and the semantics of attitude verbs. *Journal of Semantics* 9(3):183–221.

Hofmann, Lisa. 2019. The anaphoric potential of indefinites under negation and disjunction. In J. J. Schlöder, D. McHugh, and F. Roelofsen, eds., *22nd Amsterdam Colloquium*, pages 181–190.

Hofmann, Lisa. 2022. *Anaphora and negation*. Doctoral dissertation, University of California Santa Cruz.

Hofmann, Lisa. 2025. Anaphoric accessibility with flat update. *Semantics and Pragmatics* 18(3).

References III

Kadmon, Nirit. 2001. *Formal pragmatics: Semantics, pragmatics, presupposition, and focus.* Hoboken, NJ: Wiley-Blackwell.

Kibble, Rodger. 1994. Dynamics of epistemic modality and anaphora. pages 121–130. Tilburg: ITK.

Lewis, David. 1973. *Counterfactuals.* Cambridge, MA: Harvard University Press.

Mackay, John. 2023. Counterfactual epistemic scenarios. *Noûs* 57(1):188–208. Publisher: John Wiley & Sons, Ltd.

Mandelkern, Matt and Jacopo Romoli. 2017. Parsing and presuppositions in the calculation of local contexts. *Semantics and Pragmatics* 10:7–EA.

Qing, Ciyang, Noah D. Goodman, and Daniel Lassiter. 2016. A rational speech-act model of projective content. In *Proceedings of the Annual Meeting of the Cognitive Science Society*, vol. 38.

Roberts, Craige. 1996. Information Structure in Discourse: Towards an Integrated Formal Theory of Pragmatics. In J. H. Yoon and A. Kathol, eds., *Ohio State University Working Papers in Linguistics*, vol. 49. The Ohio State University, Department of Linguistics.

Schlenker, Philippe. 2009. Local contexts. *Semantics and Pragmatics* 2(3):1–78.

References IV

Scontras, Gregory and Judith Tonhauser. 2025. Projection without presupposition: A model for know. In *Sinn und Bedeutung (SuB) 29*. To appear.

Simons, Mandy, David Beaver, Craige Roberts, and Judith Tonhauser. 2017. The best question: Explaining the projection behavior of factives. *Discourse Processes* 54(3):187–206.

Simons, Mandy, Judith Tonhauser, David Beaver, and Craige Roberts. 2010. What projects and why. In *Semantics and linguistic theory*, vol. 20, pages 309–327.

Stalnaker, Robert C. 1968. A Theory of Conditionals. In N. Resher, ed., *Studies in Logical Theory*. Oxford, UK: Blackwell.

Stalnaker, Robert C. 1978. Assertion. In P. Cole, ed., *Pragmatics*, no. 9 in Syntax and Semantics, pages 315–332. Leiden, Netherlands: Brill.

Stalnaker, Robert C. 2002. Common ground. *Linguistics and Philosophy* 25:701–721.

Stone, Matthew. 1999. Reference to possible worlds. Tech. Rep. 49, Rutgers Center for Cognitive Science, New Brunswick, NJ.

Lexical contribution

So what is the role of lexical semantics here?

1. Lexical semantics should give us some information about which of the contents is at issue and which one isn't (c.f. Simons et al. 2017)
2. The logical relationship between the two contents. I purposefully chose one where we can reason about the two inferences independently. But things should be different when one entails the other (...)

Other analyses

A-operator

- Syntactifying accommodation using A-operator also works for counterfactual contexts
- But there may be other reasons for not assuming that (see discussion in Chatain and Schlenker 2024)

RSA-analyses

- RSA analyses of presupposition projection can derive QUD-sensitive triggering and projection (e.g., Qing et al. 2016; Scontras and Tonhauser 2025)
- But those rely on informativeness and are formulated for negation
- For entailment-cancelling operators of opposite monotonictiy (epistemic modals, questions...), those may not work in the same way
- Similarity-based account can apply to modals, questions, conditional antecedents as well as negation