Experimenting with Meaning:

Some case-studies in presupposition projection

Franklin Institute Symposium

The Past, Present and Future of Formal Semantics

April 19th, 2021

Florian Schwarz
Department of Linguistics

The Nature of Semantics?

Semantics - Mathematics or Psychology?

Barbara Hall Partee
University of Massachusetts, Amherst

University of Konstanz Colloquium "Semantics from Different Points of View" September, 1978

of mathematics and psychology for a general answer to be possible. What I have tried to suggest is that the linguist's concern for psychological representation may be relevant to every semanticist's concern for an account of the semantics of propositional attitudes. So far I don't see how to achieve either goal; my only positive suggestion is that a good theory might be expected to achieve both at once.

Penn
University of Pennsylvania

Meaning: an Empirical Phenomenon

- **Studying** Natural Language Meaning is inherently an empirical endeavor (at least in part):

  Our **explanandum** is linguistic behavior,

  e.g., in form of intuitions about

  - truth of sentences in a given situation
  - reference
  - entailments / meaning relations between sentences
  - acceptability in contexts

Penn
University of Pennsylvania

Experimenting with Meaning

- **Experiments** are a key tool for empirical science
- They can help us:
  - **test fine-grained predictions** of ever more sophisticated theories
  - **identify** and **tease apart factors** at play in judgment patterns
- Taking the variety of factors seriously leads to…

Penn
University of Pennsylvania

Semantics as Cognitive Science

- **Empirical nature** forces us to
  get into the weeds of the cognitive reality of language:
- **Theoretical constructs** must have
  some reflex in cognitive representations

  (to explain empirically observed linguistic behavior)

- Experiments can help us **test hypotheses** about
  these cognitive representations

Penn
University of Pennsylvania

Not just what, but how?

- **Theoretical controversies** not just about outcomes, but also how outcomes are derived
- Investigating **cognitive processes** involved in reaching an interpretation

  —> hope for differentiating such theories

  (based on suitable linking hypotheses)

Penn
University of Pennsylvania

Language Specific or Domain General

- A **central question** in accounting for any given linguistic phenomenon:

  Best explained in terms of

  Language-specific knowledge or

  Domain general cognition ?

- Again, **experiments** can provide a tool for teasing these apart

Penn
University of Pennsylvania

Plan for this talk

- Case studies on **presupposition projection** as illustrations
  - **Cognitive representations** at play in presupposition projection
  - The role of `**left-to-right' processing** in theories of presupposition projection
- Reflections on the **role of experiments** in the field of semantics and pragmatics

Penn
University of Pennsylvania

Background:

Presuppositions & Projection

Penn
University of Pennsylvania

Presuppositions

- Presuppositions (Ps): a type of meaning that is (typically) **taken for granted**

  Mary **stopped doing yoga**

  presupposes: she used to do yoga

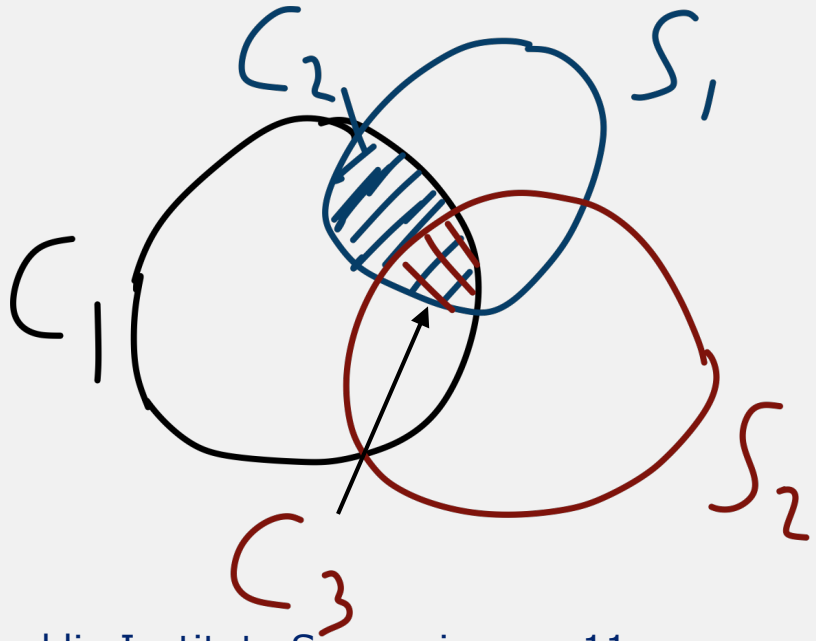
- Traditionally captured in

  Stalnaker's **Common Ground** model

Penn
University of Pennsylvania

Stalnakerian Context Updates

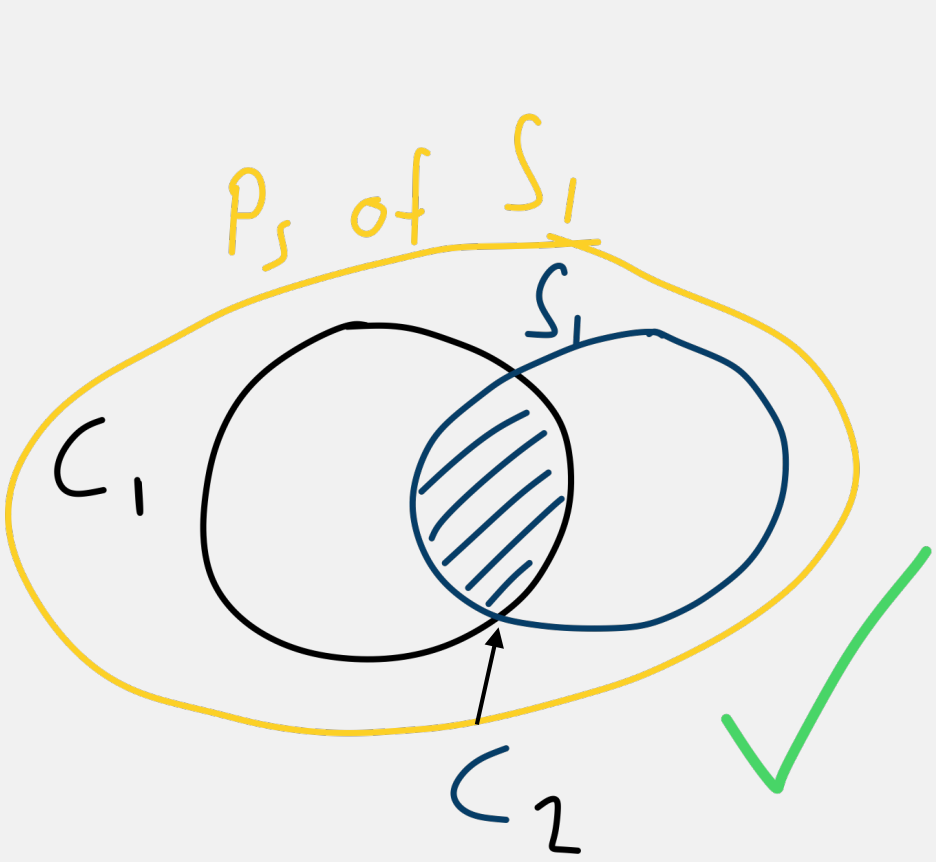
- **Goal of conversation**:
  increase mutually shared information
- **Common Ground (CG)**:
  worlds compatible with propositions mutually endorsed for purposes of conversation
- Sequence of **Assertions S_1, S_2** update contexts
  i.e., add constraints on CG worlds

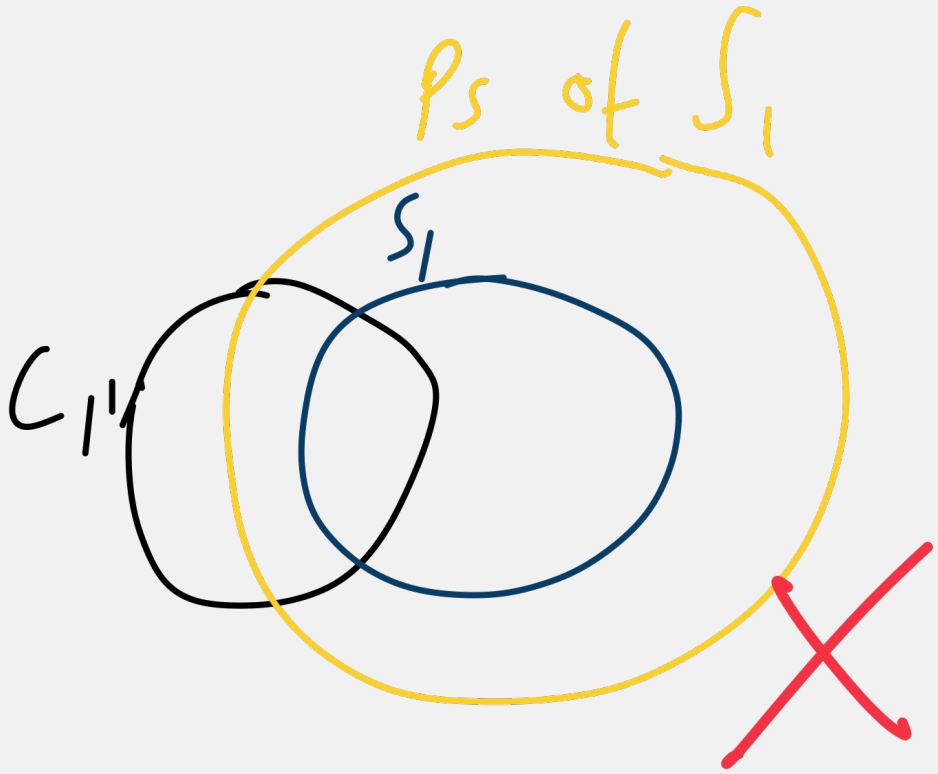


Penn
University of Pennsylvania

Presuppositions and Contexts

- **Presuppositions** as constraints on CG





Penn
University of Pennsylvania

Presupposition Projection

- Presuppositions **project,**
  i.e. they escape various embedding environments:

  a) Mary **didn't stop** doing yoga

  b) **Maybe** Mary **stopped** doing yoga

  c) **Did** Mary **stop** doing yoga?

- All **still presuppose**: Mary used to do yoga

Penn
University of Pennsylvania

Presupposition Filtering

- Presuppositions in **Complex Sentences?**
- Mary is in bad health
  and she **stopped doing yoga**

  DOES **presuppose**: she used to do yoga
  (-> Projection)

- Mary used to do yoga
  and she **stopped doing yoga**

  Does **NOT presuppose**: she used to do yoga
  (-> NO Projection)

  (but entails it, via first conjunct)

Penn
University of Pennsylvania

Filtering in Conditionals

- If Mary is in bad health,
  then she **stopped doing yoga**

  DOES presuppose: she used to do yoga
  (-> Projection)

- If Mary used to do yoga,
  then she **stopped doing yoga**

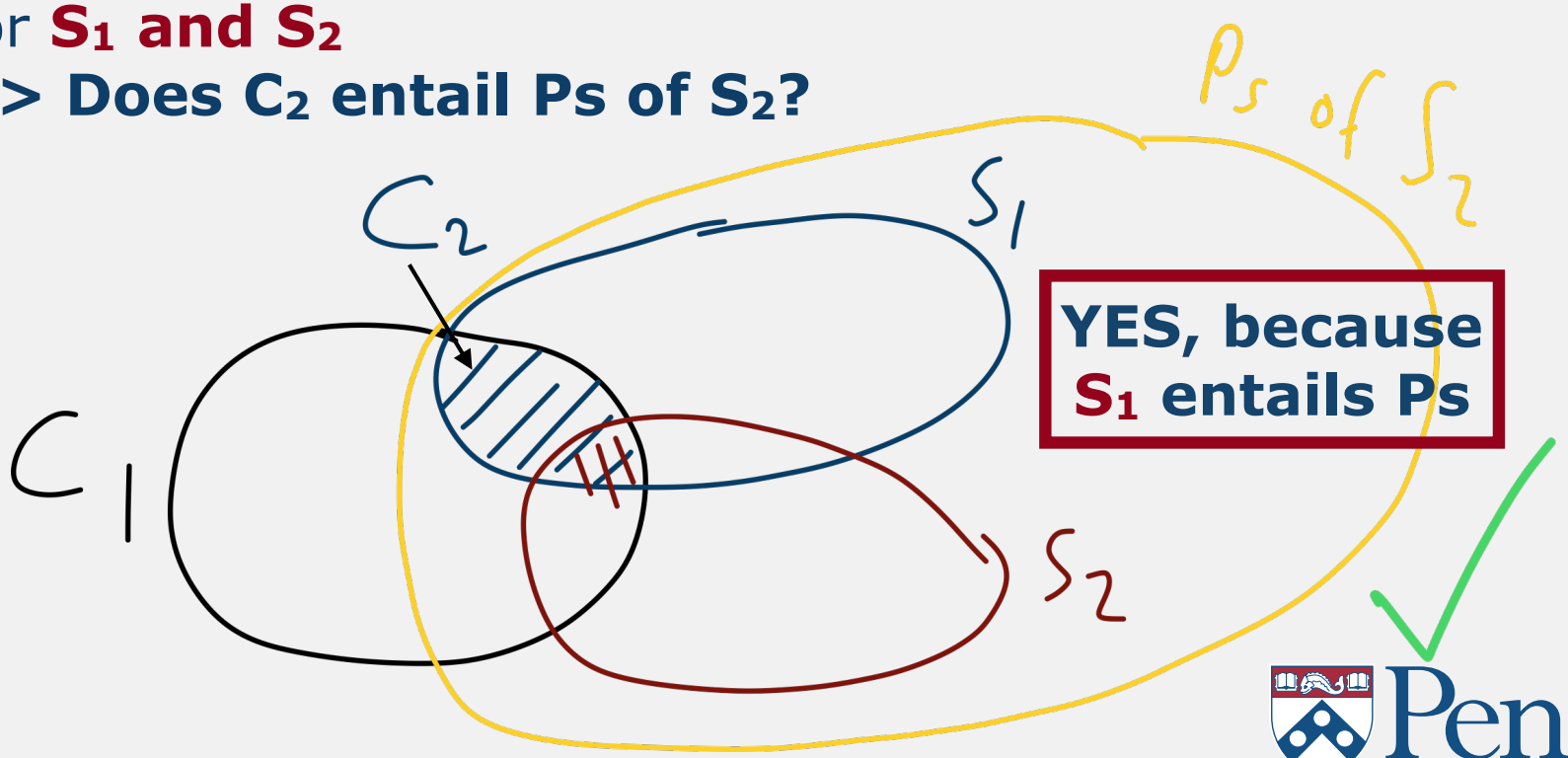
  Does **NOT presuppose**: she used to do yoga
  (-> NO Projection)

Penn
University of Pennsylvania

Evolving Contexts: Filtering

- Determining presuppositions of **complex sentences** requires relating their parts to one another
- **Classic Approach (Karttunen, Stalnaker)**: Presuppositional expressions are evaluated relative to their **Local Context:**

For **S_1 and S_2**
—> Does C_2 entail Ps of S_2?



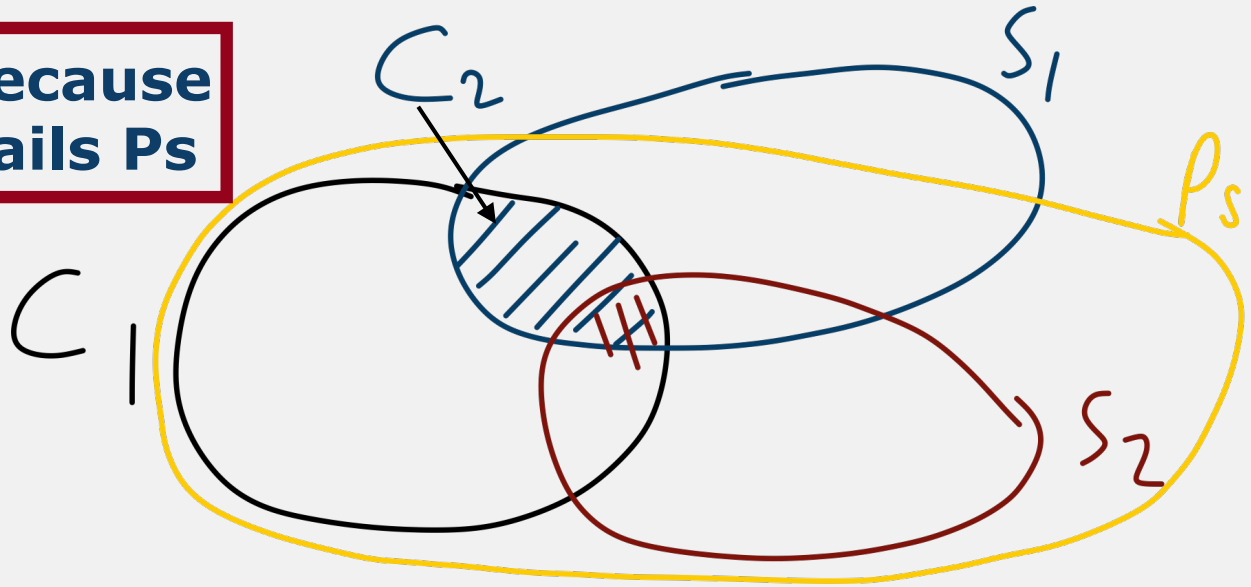
Penn
University of Pennsylvania

Evolving Contexts: Projection

- Determining presuppositions of **complex sentences** requires relating their parts to one another
- **Classic Approach (Karttunen, Stalnaker)**: Presuppositional expressions are evaluated relative to their **Local Context:**

  For **S_1 and S_2**
  —> Does C_2 entail Ps of S_2?

YES, because C_1 entails Ps



Penn
University of Pennsylvania

Representations of Linguistic Context

Penn
University of Pennsylvania

Representations of Context

- Set of issues in **relating linguistic input** to Context:

  What **structures** are present in
  the cognitive representation of context?

  How do they relate to **linguistic structures**?

- Schwarz & Tiemann 2016:

  Test **Discourse Representation Theory** (**DRT**)
  predictions for
  different locations of support for presupposition

Penn
University of Pennsylvania

Projection in Processing

[Schwarz & Tiemann 2016]

- Eye-tracking during reading
- German **wieder** (again) in **then**-clauses
- **Ps-support** in **if**-clause or discourse context
- Additional embedding variation: **negation**

- **Target** (not > again version):

  … she is **not** [going ice-skating **again**] today

  Ps: There is a salient prior event of her ice-skating

Penn
University of Pennsylvania

Varying Location of Support

- **German** materials, **disambiguating** scope of **again** and negation

Context:
Tina was last week (a. **not** / b. --) ice-skating.

If she yesterday (a. -- / b. **not**) ice-skating was, then...

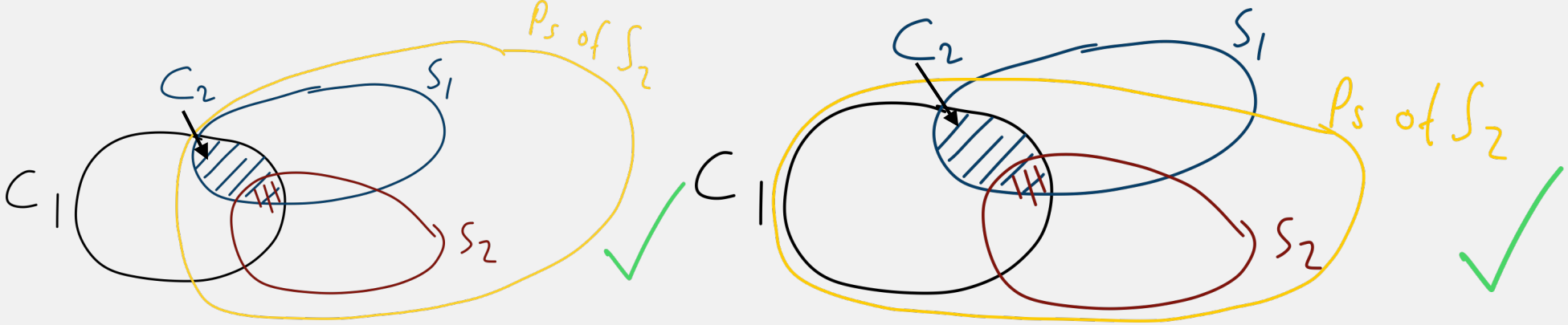
Target:
...goes she today **(i. not) again (ii. not)** ice-skating

Penn
University of Pennsylvania

Does Context History Matter?

- Parallel question illustrated for conjunction example:
- **Local Context:** For **S_1 and S_2**

  —> Does C_2 entail Ps of S_2?



- Are these scenarios differentiated in processing?

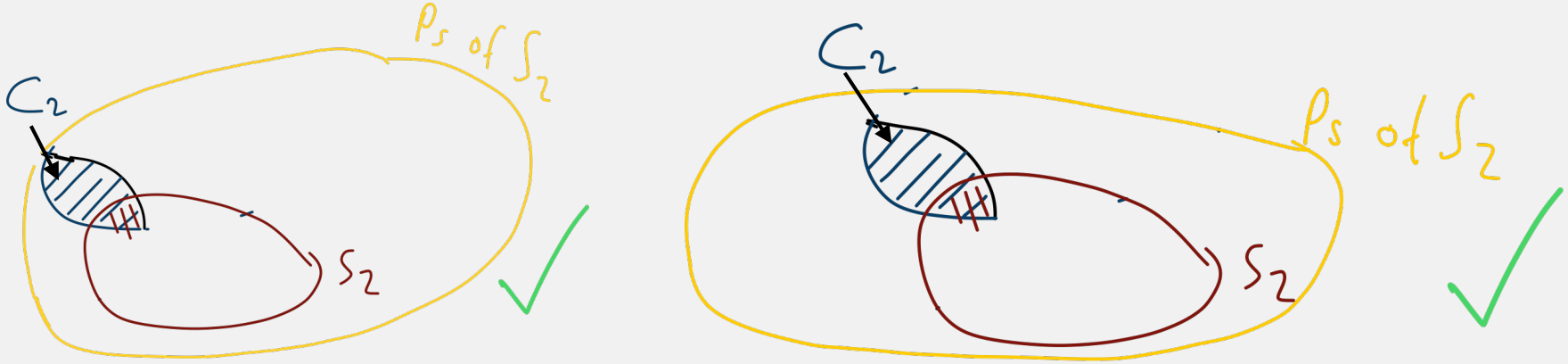
  —> In **interpreting S_2,**
  do you only have access to C_2?

Penn
University of Pennsylvania

Does Context History Matter?

- Parallel question illustrated for conjunction example:
- **Local Context:** For **S_1 and S_2**

  —> Does C_2 entail Ps of S_2?



- Are these scenarios differentiated in processing?

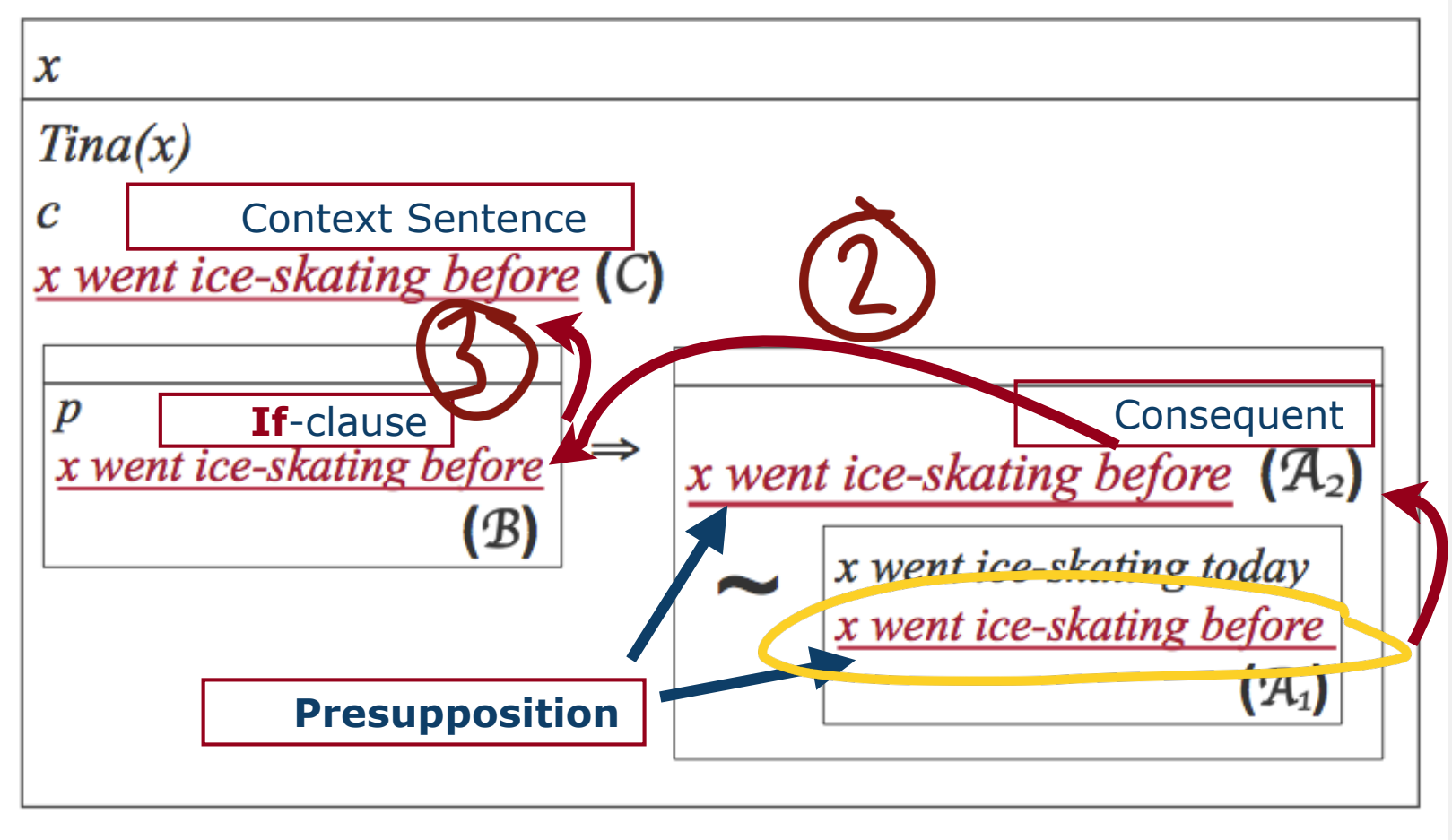
  —> In **interpreting S_2,**
  do you only have access to C_2?

Penn
University of Pennsylvania

Projection in DRT

[Kamp 1981, van der Sandt 1992]

… then goes she today (not) again (not) ice-skating



- Are there processing reflexes of DRT structures?

Penn
University of Pennsylvania

DRT Prediction

Order	Support in	Projection path length
again not	antecedent	1
	context	2
not again	antecedent	
	context	3

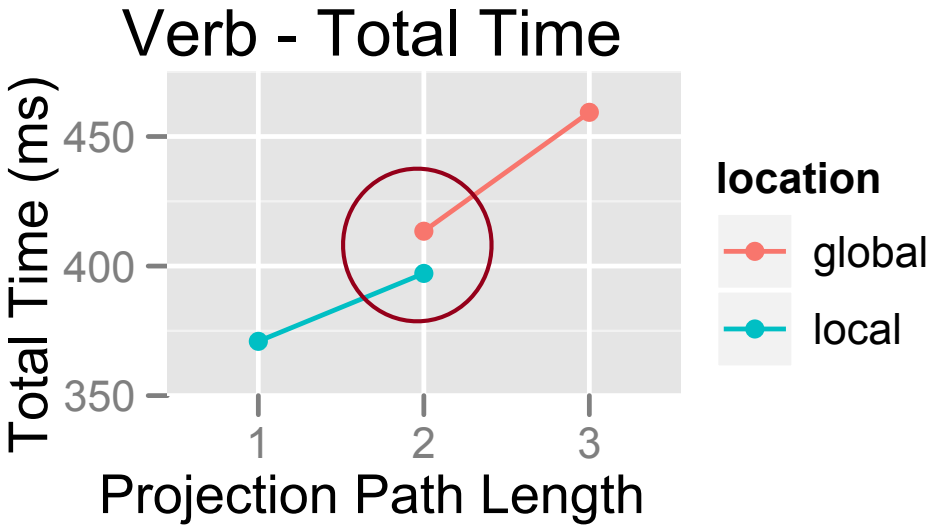
- **Note**: **Distinct** from simple distance-hypothesis!

Antecedent + Not Again = Context + AgainNot

Penn
University of Pennsylvania

Results

- **DRT Distance measure** predicts reading time
- **No difference** between If-clause vs. context support paired with **Not Again** vs. **Again Not**
- What seems to matter are **projection steps**, not intra- vs. inter-sentential support



Penn
University of Pennsylvania

The Structure of Contexts

- Context Histories DO matter:

  Cognitive context representations
  can access richer structure than local contexts

- DRT offers **linguistic representations**
  with a structure consistent with results

- **But**: structure could also be at **more general level** of contextual representation that goes beyond linguistic structure

Penn
University of Pennsylvania

Left-to-Right Processing and Theories of Projection

Projection Asymmetries

- Filtering seems to **only work** when the relevant material comes before the presupposition

  Mary used to do yoga
  and she **stopped doing yoga**

  #Mary **stopped doing yoga**
  and she used to do yoga

- **(Tentative) Upshot**: Local Contexts **only** include preceding linguistic material

Penn
University of Pennsylvania

Source of Asymmetry?

- Is asymmetry part of **semantics of conjunction**?
- Or rooted in general aspect of **language use**:

  Signal unfolds in time
  —> **asymmetry** between before & after

Penn
University of Pennsylvania

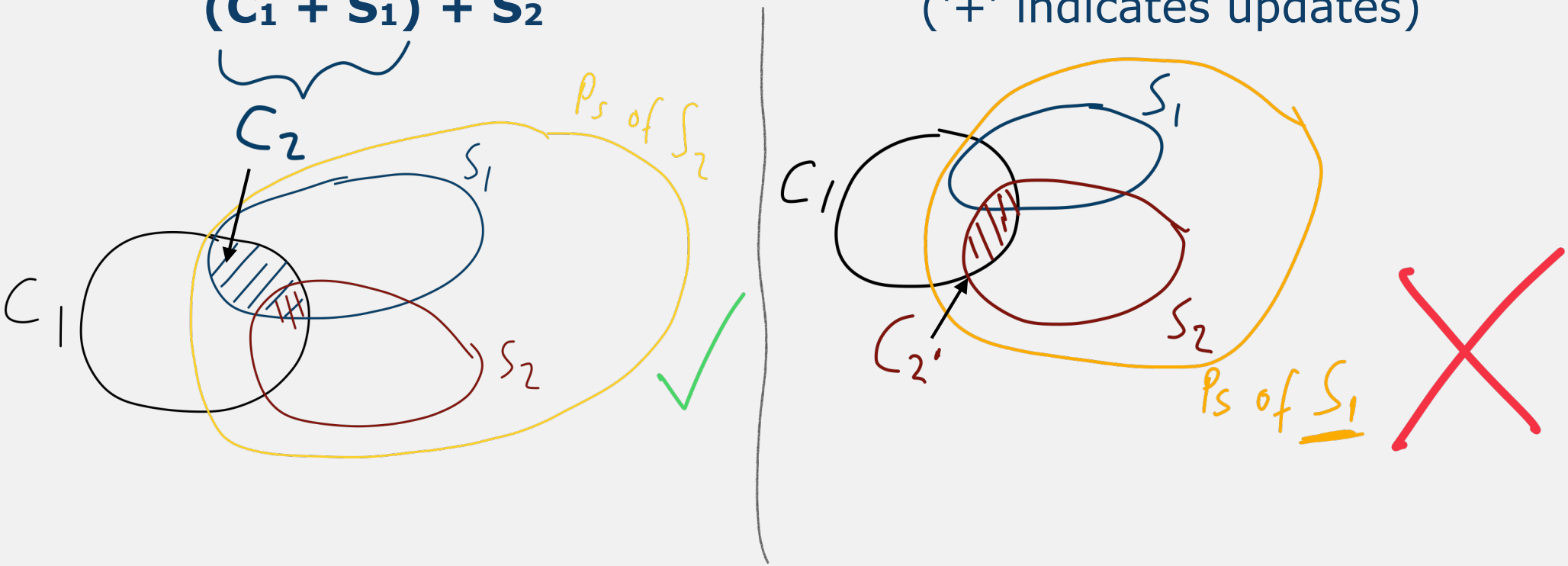
Asymmetries in Semantics?

- **Semantic** approach (Heim; and similarly Kamp):

  The **semantics** of conjunction is asymmetric:

  S_1 and S_2 uttered in context C_1:
  $(C_1 + S_1) + S_2$

  ('+' indicates updates)



Penn
University of Pennsylvania

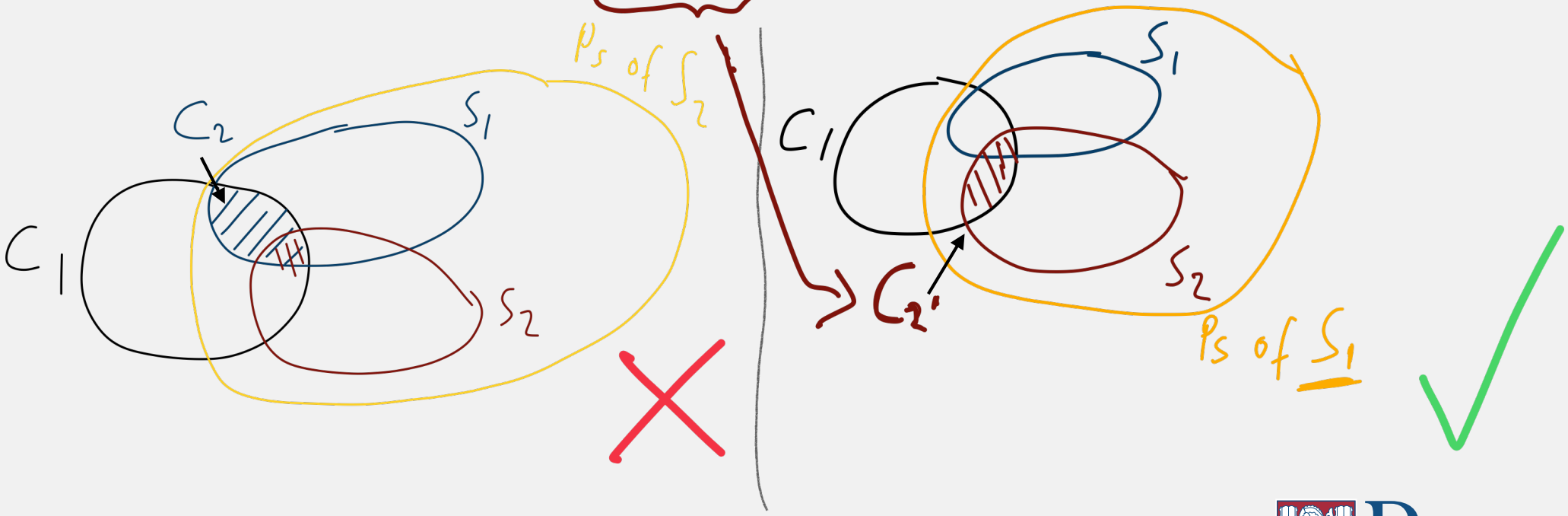
The Explanatory Challenge

- Rooth (in a letter to Heim; also sees Soames 1989):

  Asymmetry in **semantic** approach is stipulative:

  Why no **and'** that updates the other way around?

S_1 and' S_2 —> (C_1 + S_2) + S_1

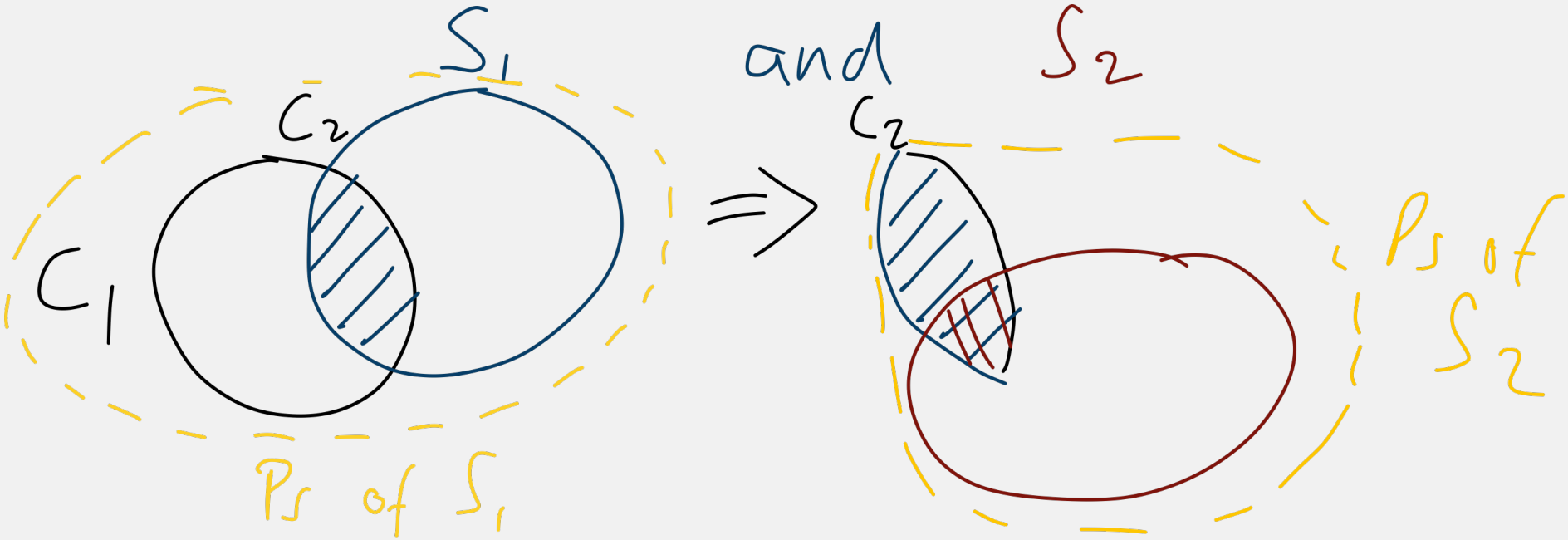


Penn
University of Pennsylvania

Asymmetries in Pragmatics?

[Schlenker 2009]

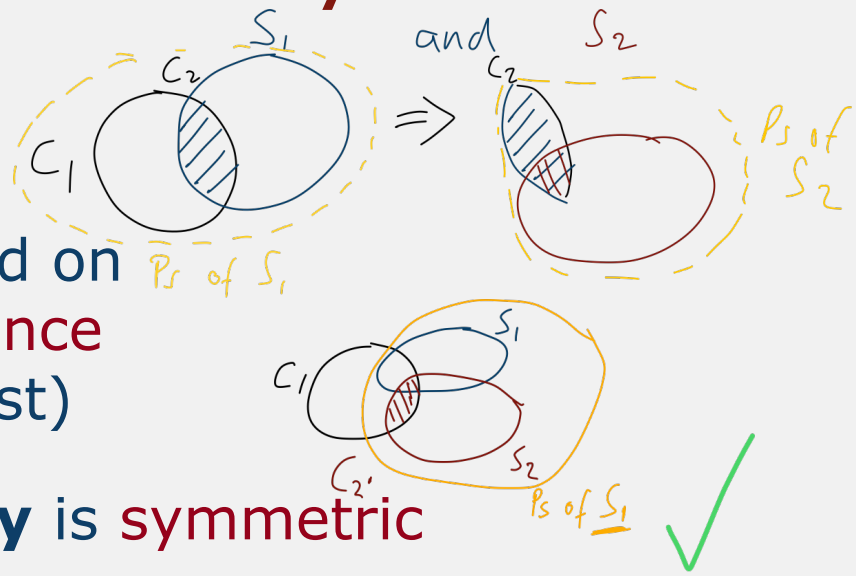
- Stalnaker-Schlenker: **Pragmatic** projection approach
- Maintain **coverage** of semantic approach within a classical semantics (including fully symmetric conjunction)
- **Explain asymmetry** with left-to-right order:



Step 1 **Step 2**

Penn
University of Pennsylvania

Status of Asymmetry



- Schlenker 2009:
  - **Asymmetry is a default** based on Left-to-right processing preference that can be overridden (at a cost)
  - **Core of projection machinery** is symmetric
- Chemla & Schlenker 2012:
  Experimental data on disjunction and conditionals
- Is conjunction symmetric after all?
- Removing redundancy helps (Rothschild 2011):

  (?) Mary **stopped doing yoga**
  and she used to do Jivamukti yoga

Penn
University of Pennsylvania

Conjunctions in Conditionals

- Crucial variation: (cf. Rothschild 2008)

  If Mary **stopped doing yoga**
  and she used to do Jivamukti yoga,
  then Matt will interview her for his story.

  ?—> Mary used to do yoga

  Asymmetric prediction: **Yes**

  Symmetric prediction: **No**

Penn
University of Pennsylvania

An Experimental Approach

[Mandelkern et al. 2019]

- **Subtle judgments** call for experimental assessment
- **Prior experimental work** not on conjunction
- But conjunction is the **poster-child** for asymmetry

- Our question:

  Is **projection from conjunction** ever symmetric?

Penn
University of Pennsylvania

Design

- Initial studies using inference task (ask in discussion!)
- Here: **acceptability** task with 4 different triggers
- Main Factors:
  - Ps in **First** vs. **Second** conjunct
  - **Context** manipulation:
    - **Support** vs.
    - '**Explicit ignorance'** contexts (incompatible with projection)
- Only symmetric **Right-to-left** filtering could remedy infelicity in key condition

Penn
University of Pennsylvania

Task Illustration

Mary always was involved in a lot of sports, but I don't know whether she ever did any yoga. If Mary used to do Jivamukti yoga and she stopped doing yoga, then Matthew will interview her for his story.

Completely unnatural ○ ○ ○ ○ ○ ○ ○ Completely natural

Penn
University of Pennsylvania

Materials

Context: Mary always was involved in a lot of sports

Expl Ignorance:
… but I don't know whether she ever did any yoga.
Support:
… and she used to do yoga, too.

Target:

If Mary **stopped** doing yoga
and she used to do Jivamukti yoga, …

ConjFirst

If Mary used to do Jivamukti yoga
and she **stopped** doing yoga, …

ConjSecond

Penn
University of Pennsylvania

Controls

- If Mary {**frowns on** doing yoga
  and she used to do Jivamukti yoga}, …

NoPs

If Mary **stopped** doing yoga, …

SimplePs

…then Matthew will interview her for his story.

Penn
University of Pennsylvania

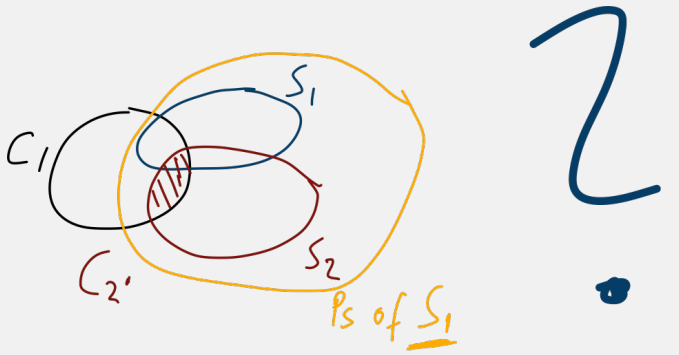
Predictions

- Unacceptability should only arise for
  - Explicit Ignorance paired with
  - Ps with **no option** for filtering

—> **Simple Ps**
I don't know whether Mary ever did any yoga.
If she stopped doing yoga, then…

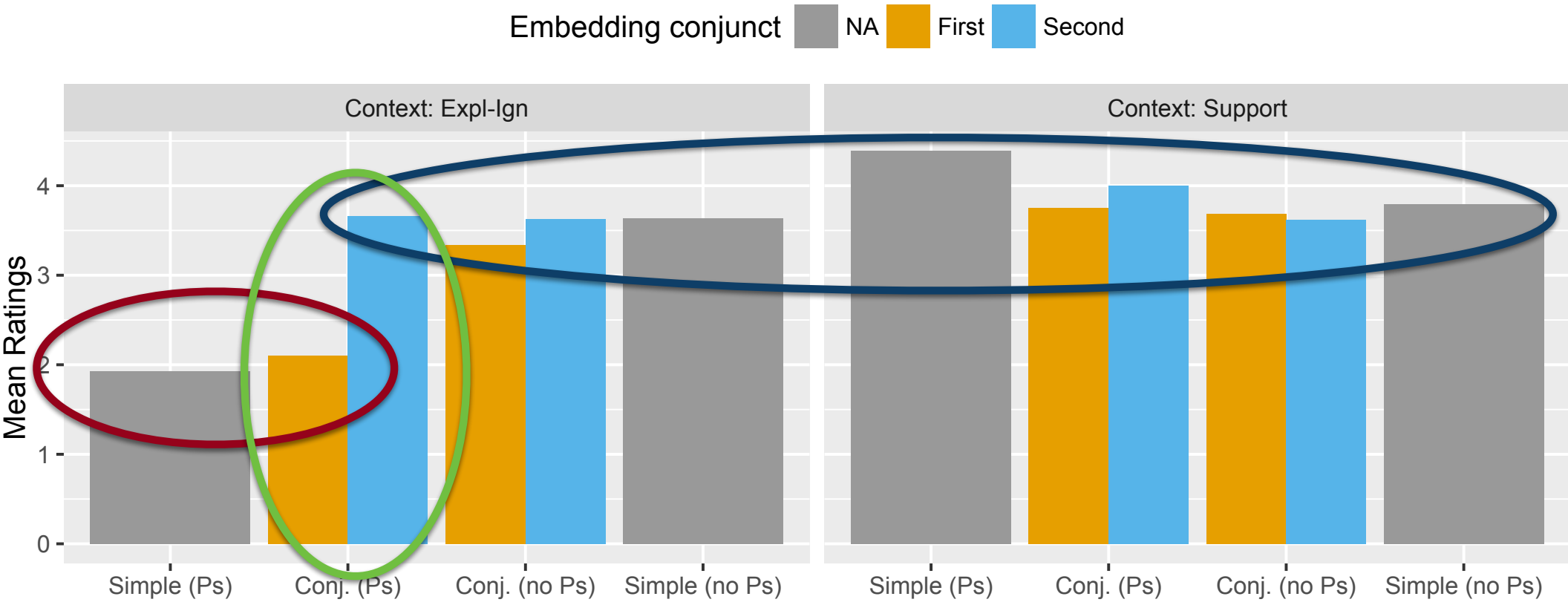
What will happen in **Conj-Ps-First?**

(Right-to-Left Filtering?
—> 2nd conjunct support Ps in 1st?)



Penn
University of Pennsylvania

Results

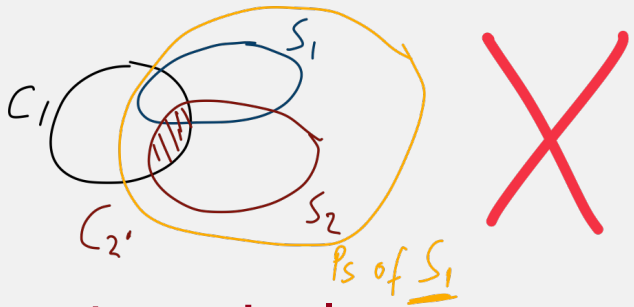


- **Context effects only** for Simple-Ps & Cont-Ps-First

Penn
University of Pennsylvania

Discussion

- We set up **contexts** where there was pressure to use Right-to-left / symmetric filtering to ensure felicity
- We find **no evidence** of its existence



- **Theoretical implication**:

  asymmetry in conjunction seems to be categorical,

  not just an overridable left-to-right processing default

Penn
University of Pennsylvania

Where does that leave us?

- Can we **maintain explanatory advantage** of pragmatic account?

  —> Maybe Left-to-Right **processing pressure** is so strong it can't be overridden?

- **Prediction**:

  Left-to-Right pattern should be

  uniform across connectives

Penn
University of Pennsylvania

Partee's Bathroom Sentences

- Disjunction DOES seem to exhibit symmetry:
  - Either **the bathroom in this house** is well hidden, or there is no bathroom.
  - Either John **stopped doing yoga** or he never was a yoga practitioner.
- Part of **Schlenker's motivation** to allow symmetry
- **Alternative** (Hirsch & Hackl 2014):
  Local Accommodation
  (triggered by pragmatic constraints on disjunction)
- **Both** predict processing costs for **PsFirst**!

Penn
University of Pennsylvania

Kalomoiros & Schwarz (2021)

- Adapting Mandelkern et al. to Disjunctions:

- […] **I don't know if John has ever had research interests in Tolkien's work**, so I thought:

  Either John {**has** / **continues** having}
  research interests in Tolkien, or
  he **has never had an interest** in Tolkien and the book is unrelated to his research.

  (**No**-)**Ps-First**

- Comparison with (**No**-)**Ps-Second** and **SimplePs**

Penn
University of Pennsylvania

Disjunction Results

- **No effects** of linear order
- **Ps** and **No-Ps** have comparable acceptability
- Support in **PsFirst** and **PsSecond** seems to have parallel effects

—> Symmetry

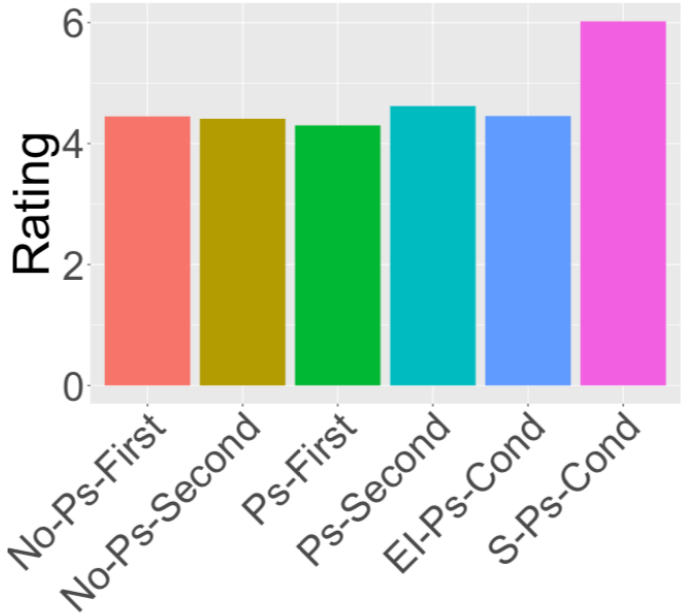
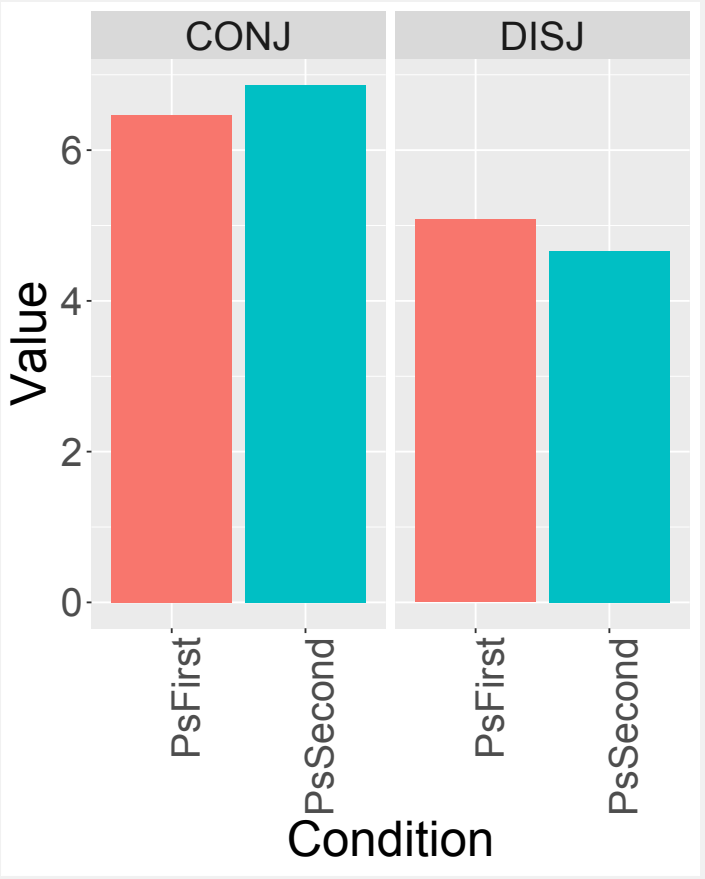


Fig. 1. Mean acceptability rating by condition

Penn
University of Pennsylvania

Kalomoiros & Schwarz (in progress)

- Limitation: No **direct comparison** with conjunction
- Other Differences (e.g., embedding)
- New study:
  - Minimally varied stimuli
  - Same contexts
  - Embedding under **could**
- First analysis of results:



Opposite order effects across connectives!

Penn
University of Pennsylvania

Summary & Discussion

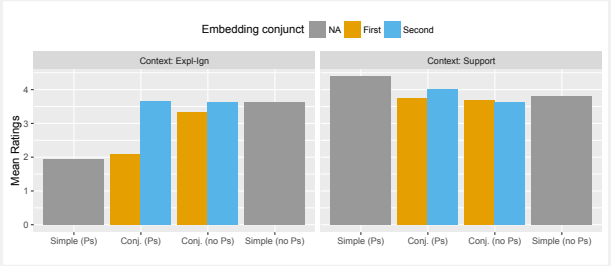
- Projection from **conjunction**: Categorical asymmetry
- **Disjunction**: No Left-to-Right preference
- ~~**Pragmatic theories** predicting uniform order effects across connectives~~
- Theoretical Avenues:
  - **Encode** projection properties lexically (~~Explanatory Adequacy~~?)
  - Pragmatic theory variant with **order effects** that vary across connectives

    (How? Alex has ideas…)

Penn
University of Pennsylvania

Key Role of Experiments

- **Crucial judgments** are subtle
- Accounts posit **different processes** of deriving same interpretation (e.g., local accommodation vs. Right-to-Left Filtering)
- **Complex patterns** needed for key theoretical points (to control for confounds etc.) - —> **beyond** what our intuitions can access



- More **fine-grained processing measures** can inform what cognitive representations are involved

Penn
University of Pennsylvania

The Role of Experimenting in Semantics & Pragmatics

Penn
University of Pennsylvania

Should everyone do experiments?

- Well, in a sense everyone does anyway:

  Experiments are the **continuation of minimal pairs** with other means

  (Clausewitz for linguists!)

- Both aspects matter:
  - **continuation** - nothing fundamentally different from other empirical data
  - **other means** - broader range of empirical tools expands what we can do

- **Upshot**: Let's **not** think of this as a binary division!

Penn
University of Pennsylvania

Linguistic Training

- Reasonable minimum **goal**:
  Basic experimental literacy
    - Know when an experiment would help
    - Understand design logic and data discussion
- **Foster collaboration**
  (befriend some experimentalists!)
- Again: **Leave behind** binary thinking:

  No need to become a (full-blown) psycho-linguist
  just because some **targeted experiments**
  might supplement one of your projects

Penn
University of Pennsylvania

Access

- **Experimenting** has become so much easier
  - **Online tools**
    - PCIbex - https://www.pcibex.net/ (and many others)
  - **Recruitment** platforms
    - Prolific
    - Mechanical Turk
    - University Subject Pools
- **No need** for a **'lab' and lots of money** to get experimental data

Conclusion

- **Greater range of empirical data** can be key for refining our theories
- Integration with **more full-fledged models** of cognitive representations
- **Increased accessibility** makes it easier for more people to utilize these tools
- Also **opens up the door** to more cross-linguistic work and where possible even integration with field-work

Penn
University of Pennsylvania

Thank you!

Acknowledgments:

- **Collaborators**:
  - Matt Mandelkern
  - Jacopo Romoli
  - Jeremy Zehr
  - Sonja Tiemann
  - Alexandros Kalomoiros

- **RA's**:
  - Nikhil Lakhani
  - Hansoo Chang
  - Carissa Redfield

- **Financial Support**:

BCS-1349009

Penn
University of Pennsylvania