Presupposition filtering in disjunction – Does exclusive interpretation play a role?

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Overall structure

- Background
- Motivations
- Design
- Predictions
- Stimuli
- Results
- Discussions
- Conclusions

Background notions

Research question

Theoretical analyses to show it is a solid question

Mandarin experiment investigating that research question

Theoretical analysis of a limitation of this experiment

Conclusion

Presupposition: one type of inference

As we all know…

Two traditional diagnostics:

Context: We don't know whether John has a violin.

(1) # John's violin is expensive. ⇝ **John has a violin.**

(2) # John's violin is not expensive. ⇝ **John has a violin.**

(3) # Is John's violin expensive? ⇝ **John has a violin.**

(4) # If John's violin is expensive, he will be happy. ⇝ **John has a violin.**

- **Survived the family of sentences test: not at issue!**

(5) John has a violin. John's violin is expensive.

- **Can be backgrounded: treated as old information!**

Projection and filtering: two sides of the same coin

- (1) John's violin is expensive. ⇝ **John has a violin.**
- Context: We don't know whether John has a violin.
- Conjunction:
- (2) # John's violin is expensive **and** John has a violin. ⇝ **John has a violin.**
  - **Presupposition of the left conjunct projects = no right to left (R-to-L) filtering**
- (3) John has a violin **and** John's violin is expensive. ⇝ **no presupposition**
  - **Presupposition of the right conjunct doesn't project = have left to right (L-to-R) filtering**
- Disjunction:
- (4) Either John's violin is expensive **or** John doesn't have a violin. ⇝ **no presupposition**
  - **Presupposition of the left disjunct doesn't project = have R-to-L filtering**
- (5) Either John doesn't have a violin **or** John's violin is expensive. ⇝ **no presupposition**
  - **Presupposition of the right disjunct doesn't project = have L-to-R filtering**

Presupposition filtering in disjunction

- (1) Either John doesn't have a violin, or John's violin is expensive.
- (2) Either this floor has no bathroom, or the bathroom is in a weird place.
- Bathroom disjunction: Negation of one disjunct = the presupposition of the other disjunct

- Different possibilities for bathroom disjunctions:

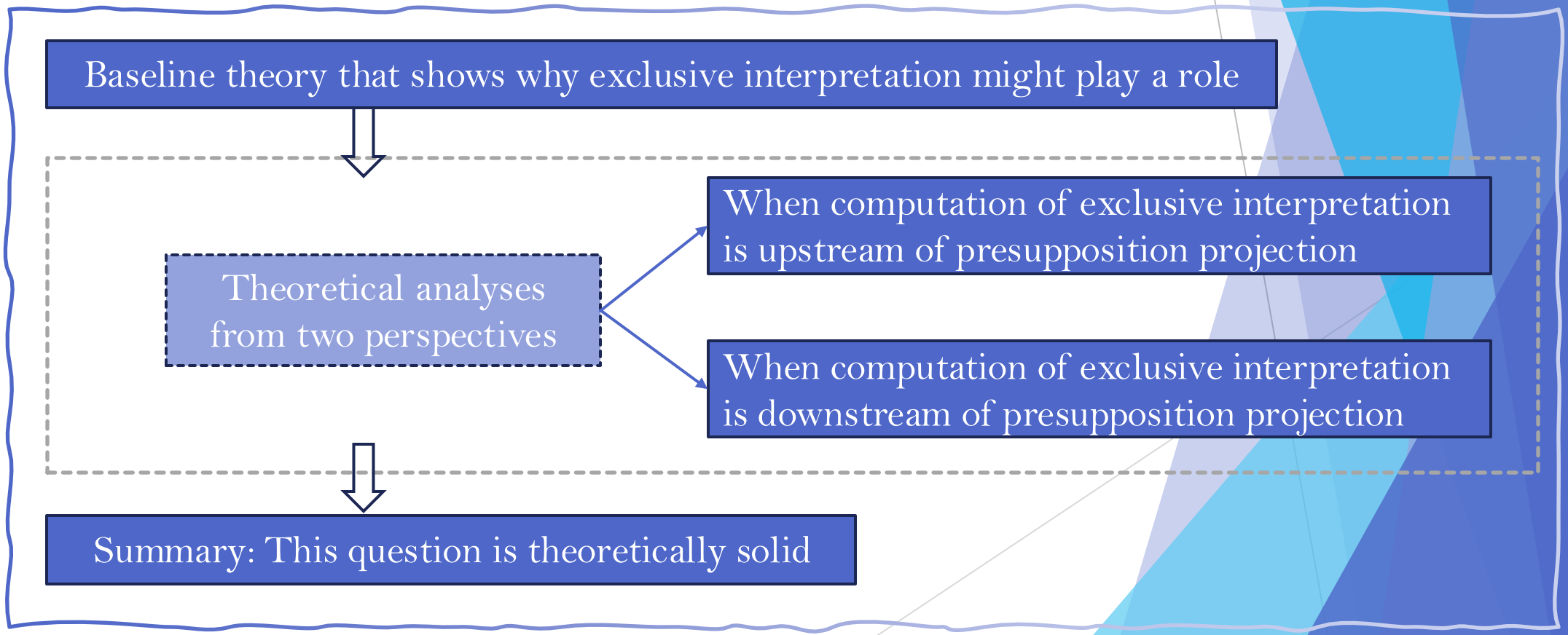
Projection	Filtering
Presupposition in *either* disjunct projects	**No filtering**
Presupposition in the left disjunct (sometimes) projects but presupposition in the right disjunct doesn't	**Asymmetric filtering** R-to-L filtering weaker than L-to-R filtering
Presupposition in *neither* disjunct projects	**Uniform filtering** (R-to-L and L-to-R filtering both at ceiling)

- A recent experimental study by Kalomoiros & Schwarz (2024): uniform filtering

Does exclusive interpretation play a role in filtering?

- Kalomoiros & Schwarz (2024): "either … or … "
- "either or" sounds more exclusive than "or"
  - **Does exclusive interpretation play a role in presupposition filtering in disjunction?**

Roadmap to the "Motivations" section



Baseline theory: trivalent semantics

- Why exclusive interpretation of a disjunction might play a role in presupposition filtering:

p or q	q=1	q=0	q=#
p=1	1	1	1
p=0	1	0	#
p=#	1	#	#

p xor q	q=1	q=0	q=#
p=1	0	1	#
p=0	1	0	#
p=#	#	#	#

Baseline theory: trivalent semantics

- Why exclusive interpretation of a disjunction might play a role in presupposition filtering:

p or q	q=1	q=0	q=#
p=1			1
p=0	1	0	
p=#			

p xor q	q=1	q=0	q=#
p=1			#
p=0	1	0	
p=#			

- Either p or q: (1) Either this floor has no bathroom, or the bathroom is in a weird place.
  - p = this floor doesn't have a bathroom
  - q = the bathroom is in a weird place
  - $\neg p = Ps(q)$
  - $p = 1 \Rightarrow q = \#$
  - $p = 0 \Rightarrow q \neq \#$
  - $p \neq \#$

Presupposition of the right disjunct is filtered

Presupposition of the right disjunct is NOT filtered

Vice versa when presupposition is in the left disjunct

Vice versa when presupposition is in the left disjunct

Uniform filtering for inclusive disjunction

NO filtering for exclusive disjunction

If exclusive interpretation is considered when computing presupposition projection: no filtering

Exclusive interpretation

Computation of Presupposition projection

- **Trivalent logic**: Strong Kleene semantics (noted by Mayr & Romoli, 2016b):

⩛	1	0	#
1	0	1	#
0	1	0	#
#	#	#	#

No filtering

- **Local context theory** of Schlenker 2009 (noted by Mayr & Romoli, 2016a)
  - Local context for exclusive disjunction is the global context

No filtering

- **Traditional dynamic semantics** of Heim 1983 (novel observation): $C[\alpha \; xor \; \beta] =$

$(a)\, C[\alpha][\neg\beta] \cup C[\beta][\neg\alpha]$	$(e)\, C - C[\alpha][\beta] - C[\neg\beta][\neg\alpha]$
$(b)\, C[\neg\alpha][\beta] \cup C[\neg\beta][\alpha]$	$(f)\, C - C[\neg\alpha][\neg\beta] - C[\beta][\alpha]$
$(c)\, C[\alpha][\neg\beta] \cup C[\neg\alpha][\beta]$	$(g)\, C - C[\alpha][\beta] - C[\neg\alpha][\neg\beta]$
$(d)\, C[\beta][\neg\alpha] \cup C[\neg\beta][\alpha]$	$(h)\, C - C[\beta][\alpha] - C[\neg\beta][\neg\alpha]$

No filtering

If presupposition is considered when computing exclusive interpretations: no filtering

Presupposition

Computation of Exclusive interpretation

- ***Exh* in trivalent semantics** of Spector & Sudo 2017

  (we extended to the case of disjunction)

(63) $\left[\!\left[\text{EXH}^2_{Alt(\phi)}\ \phi\right]\!\right](w)$

$$= \begin{cases} \# & \text{iff } [\![\phi]\!](w) = \# \text{ or for some } \psi \in IE^2(\phi, Alt(\phi)), [\![\psi]\!](w) = \# \\ 1 & \text{iff } [\![\phi]\!](w) = 1 \text{ and for all } \psi \in IE^2(\phi, Alt(\phi)), [\![\psi]\!](w) = 0 \\ 0 & \text{iff } [\![\phi]\!](w) = 0 \text{ or for some } \psi \in IE^2(\phi, Alt(\phi)), [\![\psi]\!](w) = 1 \\ & \quad \text{and for no } \psi \in IE^2(\phi, Alt(\phi)), [\![\psi]\!](w) = \# \end{cases}$$

(64) $\text{EXH}^2_{Alt(\phi)}\ \phi$

a. asserts ϕ and the strong negation of all alternatives $\psi \in IE^2(\phi, Alt(\phi))$;
b. presupposes whatever ϕ presupposes and the negated alternatives ψ presuppose.

Spector & Sudo, 2017, p.498

If presupposition is considered when computing exclusive interpretations: no filtering

Presupposition

Computation of Exclusive interpretation

- ***Exh* in trivalent semantics** of Spector & Sudo 2017
  - $Exh^2(\alpha \text{ or } \beta)$ (1) (we extended to the case of disjunction)

(64) $\text{EXH}^2_{Alt(\phi)}\ \phi$

a. asserts ϕ and the strong negation of all alternatives $\psi \in IE^2(\phi, Alt(\phi))$;

b. presupposes whatever ϕ presupposes and the negated alternatives ψ presuppose.

$$ps(Exh^2(\alpha \vee \beta)) = ps(\alpha \vee \beta) \wedge ps(\neg(\alpha \wedge \beta)) = ps(\alpha \vee \beta) \wedge ps(\alpha \wedge \beta) \quad (2)$$

- Suppose α is presupposition-less but β has a presupposition:
  - if there is projection from the 2^{nd} disjunct or 2^{nd} conjunct, we already have projection from β:

$$ps(Exh^2(\alpha \vee \beta)) = ps(\beta) \quad (3)$$

  - if there is L-to-R filtering for both disjunction and conjunction:

$$ps(Exh^2(\alpha \vee \beta)) = (\neg\alpha \rightarrow ps(\beta)) \wedge (\alpha \rightarrow ps(\beta)) = (\neg\alpha \vee \alpha) \rightarrow ps(\beta) = ps(\beta) \quad (4)$$

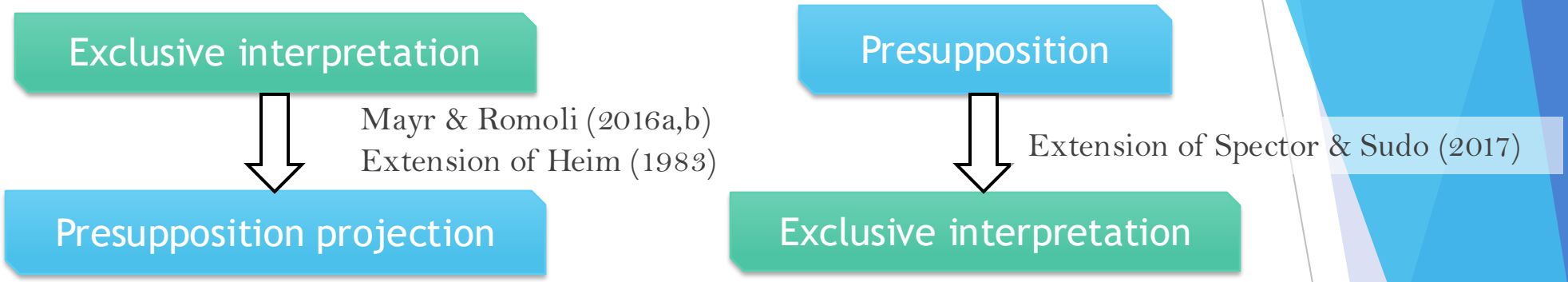
- Suppose β is presupposition-less but α has a presupposition: Similar reasoning goes through:

$$ps(Exh^2(\alpha \vee \beta)) = ps(\alpha) \quad (5)$$

- Thus, presupposition from either disjunct projects for $Exh^2(\alpha \vee \beta)$

No filtering

Summary of theoretical analyses



- Theoretical predictions for disjunction:
  - When exclusive interpretation is **not** considered: **uniform or asymmetric filtering**
  - When exclusive interpretation **is** considered (upstream or downstream): **no filtering**
- We have reasons to expect exclusive interpretation to play a role in presupposition filtering!

Roadmap to the "Design" section

Goal and the basic design of the experiment

2 norming studies

- Norming study 1: Confirm the added manipulations would work
- Norming study 2: Select grammatically sound combinations

Detailed introduction of the experimental design with example sentences

Experiment in Mandarin

- **Goal:**
- **Test whether exclusive interpretation of disjunction affects its presupposition filtering**

Upward entailing (UE): unembedded

Downward entailing (DE): embedded in antecedent of conditional

- Adopt the within-subject design from K&S 2024
- Add two cross-subject manipulations: (1) form of disjunction; (2) monotonicity of environment

One particle disjunction: …huozhe…

Two particle disjunction: yaome…yaome…

- (Intuitions about) rate of exclusive interpretation:
  - *yaome yaome* > *huozhe*
  - Disjunctions in UE environment > disjunctions in DE environment
- Why cross-subject:
  - Avoid highlighting the contrast; if difference is observed, it will be very convincing
- Why use Mandarin:
  - Sample of convenience
  - Don't expect cross-linguistic differences in this domain
    - Check whether K&S 2024's results can be replicated in the *yaome yaome* conditions using stimuli of similar structures

Norming study 1: Rate of exclusive interpretation

- Norming study on rate of exclusive interpretation for different **disjunction forms** in different **environmental monotonicity**

(1) (Translation of) A trial (from **the norming task**) of "huozhe" in a UE environment:

> Li said: "I believe Zhang will come or (*huozhe*) Wang will come."
> In fact, both Zhang and Wang came.
> Do you consider Li's prediction correct or incorrect?

[Choosing "incorrect" will be analyzed as an "exclusive reading" of disjunction]

  - UE environment: "I believe …"
  - DE environment: "I don't believe …"
- Results confirm our intuition about disjunction forms and environmental monotonicity:

Table 1 Percentage of exclusive reading of disjunction across participants in the norming task

	DE environment <	UE environment
…huozhe…	0%	23.3%
Yaome…yaome…	36.7%	53.3%

- Similar results in terms of disjunction form was found by Nicolae et al. (2024)

Norming study 2: Naturalness of disjunctions in different environments

- The grammatical constructions should sound natural
- Stimuli:
  - Almost identical with the non-presuppositional stimuli in the experiment
  - **UE** environment: Disjunction **unembedded**
  - **DE** environment: Disjunction embedded in **the antecedent of conditional**
- Results: *yaome…yaome…* in DE environment is very bad. It might be a positive polarity item.

Table 2 Mean naturalness judgment of disjunction across participants on a 7-point scale

	DE environment	UE environment
…huozhe…	4.7	5.6
Yaome…yaome…	2.4	6.0

- Select 3 combinations of disjunction form and environmental monotonicity

Group A: *yaome…yaome…* in UE environment → Intended as a replicate of K&S 2024 in Mandarin

Group B: *huozhe* in UE environment

Group C: *huozhe* in DE environment

Experimental design in more details

- 4 Variables

Table 2 Variables in the experiments

Variable	Value	Value
DisjunctionType	huozhe	yaome…yaome…
MonotonicityType	UE	DE
PredicateType	Presuppositional (Ps)	Non-presuppositional (NoPs)
OrderType	First	Second

between-subject variables

within-subject variables

Table 3 The 6 within-subject conditions

Abbr.	Context	PredicateType	OrderType	Sentence form
PsFirst	EI	Presuppositional	First	S_p *or* $\neg p$
PsSecond	EI	Presuppositional	Second	$\neg p$ *or* S_p
NoPsFirst	EI	Non-presuppositional	First	S *or* $\neg p$
NoPsSecond	EI	Non-presuppositional	Second	$\neg p$ *or* S

Condition labels are adopted from K&S 2024

EI (Explicit Ignorance): I don't know whether John has smoked.
S (Support): I know John has smoked.

PsFirst: Either John **stopped** smoking, or John has never smoked.
PsSecond: Either John has never smoked, or John **stopped** smoking.
NoPsFirst: Either John **frowned upon** smoking, or John has never smoked.
NoPsSecond: Either John has never smoked, or John **frowned upon** smoking.
SimplePs: If John **stopped** smoking, then the cigarettes in the dustbin are not his.

Variable	Value	Value
DisjunctionType	huozhe	yaome…yaome…
MonotonicityType	UE	DE
PredicateType	Presuppositional (Ps)	Non-presuppositional (NoPs)
OrderType	First	Second

between-subject variables

within-subject variables

- 6 within-subject conditions (4 + 2)

Prevent global accommodation

Table 3 The 6 within-subject conditions

Abbr.	Context	PredicateType	OrderType	Sentence form
PsFirst	EI	Presuppositional	First	S_p *or* $\neg p$
PsSecond	EI	Presuppositional	Second	$\neg p$ *or* S_p
NoPsFirst	EI	Non-presuppositional	First	S *or* $\neg p$
NoPsSecond	EI	Non-presuppositional	Second	$\neg p$ *or* S

Latin square design

Their difference: Reduction in rating with no filtering

Condition labels are adopted from K&S 2024

		Exclusive interpretation: semantics	Exclusive interpretation: pragmatics
Presupposition projection	semantics	I	II
	pragmatics	III	IV

- **Question: Does exclusive interpretation affect presupposition filtering?**
- Assumption:
  - the exclusive interpretations caused by both disjunction form and environmental monotonicity are implicatures
- **Hypothesis 1 (H1)**: Exclusive interpretation **does** affect presupposition filtering
  - Mayr & Romoli (2016a,b), our observation of Heim (1983) and Spector & Sudo (2017)
  - **Prediction: disjunction form and environmental monotonicity should have the same effect on presupposition filtering**
    - **Significant two-way interactions among PredicateType * DisjunctionType and among PredicateType * MonotonicityType in the same direction**
- **Hypothesis 2 (H2)**: Exclusive interpretation **doesn't** affect presupposition filtering
  - **Prediction: environmental monotonicity will not affect presupposition filtering**
    - **No significant two-way or three-way interactions involving PredicateType * MonotonicityType**
    - disjunction form **may or may not** affect presupposition filtering

Triggers and items

- 2 triggers, 2 items each trigger → 4 items

Table 4 Ps triggers, their NoPs counterparts, and items

Ps Trigger (presuppositional predicate)	Item	Presupposition	Non-presuppositional predicate
戒 "jie" quit	戒酒 quit drinking 戒烟 quit smoking	曾经喝过酒 have drunk 曾经抽过烟 have smoked	不喜欢 "buxihuan" dislike
知道 "zhidao" know	不知道某人泄密 don't know sb. has leaked secrets 不知道某人挪用公款 don't know sb. has embezzled funds	某人确实泄密了 sb. has indeed leaked secrets 某人确实挪用公款了 sb. has indeed embezzled funds	觉得 "juede" think

- Each participant completes 15 trials:
  - 8 critical trials (2 conditions per item, Latin square design)
  - + 2 catch trials + 2 good conditionals + 2 bad conditionals + 1 inference task

An example trial

- Ps trigger: **jie ("quit")**
- Within-subject condition: **PsFirst**
- Cross-subject condition: **huozhe-in-DE**

我之前完全不认识小李，不知道他有没有喝过酒。在今晚的饭局上，大多数人都喝酒了，但小李滴酒不沾，于是我想：
如果小李已经戒酒了或者从来不喝酒，那么他今晚的行为很合理。
请给划线句子在语境中的自然程度打分：
I didn't know Li at all before, and I didn't know if he ever drank. At tonight's dinner party, most people drank, but Li didn't drink a drop, so I thought:
If Li has quit drinking or (*huozhe*) never drank, then his behaviour tonight makes sense.
Please rate how natural the underlined sentence is in the context:
[7-point scale; ends of scale: completely unnatural 1 – completely natural 7]

Overall results

Does exclusivity of disjunction affect its presupposition filtering?

- We analyzed 197 responses after exclusions based on catch trials.
- Significant three-way interaction among:
  - Predicate.Type*Disjunction.Type*Order.Type (β=1.20, SE=0.59, p=0.043)
  - This shows disjunction form does affect presupposition filtering
- No significant three-way or two-way interaction including Monotonicity.Type*Predicate.Type
  - No significant three-way interaction among: Predicate.Type*Monotonicity.Type*Order.Type
  - No significant two-way interaction among: Predicate.Type*Monotonicity.Type
  - This shows environmental monotonicity doesn't affect presupposition filtering at all
- It is NOT the case that disjunction form and environmental monotonicity affect presupposition filtering in the same way → **incompatible with H1**
- Environmental monotonicity has no effect + disjunction form has an effect → **compatible with H2**

Treatment coding
ref level: NoPs, huozhe, Second

Unpack the three-way interaction

Treatment coding
ref level: NoPs, huozhe, Second

- **Significant three-way interactions among:**
  - **Predicate.Type*Disjunction.Type*Order.Type** (β=1.20, SE=0.59, p=0.043)

Figure 1: 'yaome yaome' Mean ratings per condition

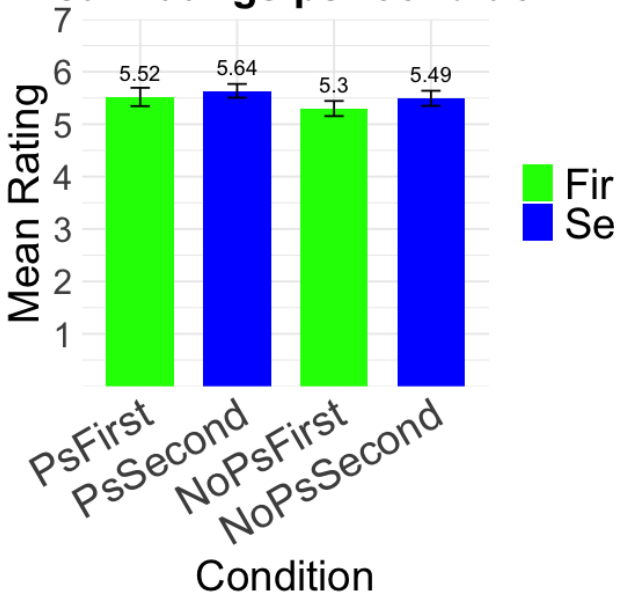
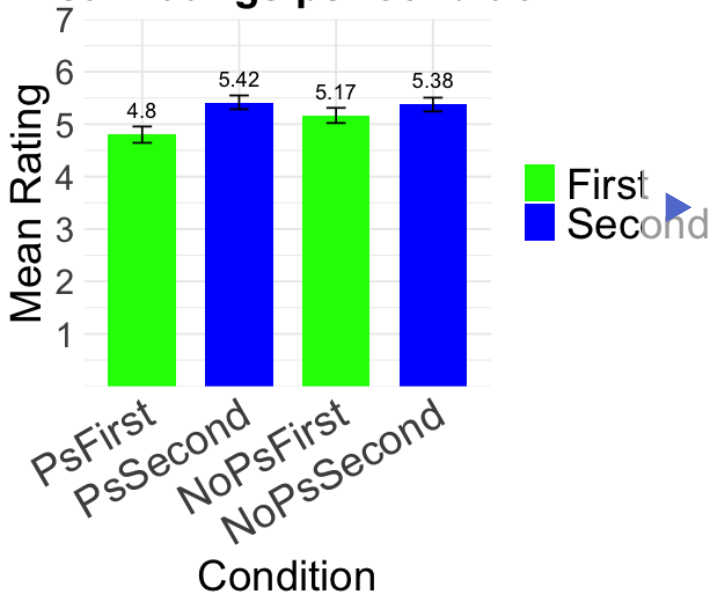
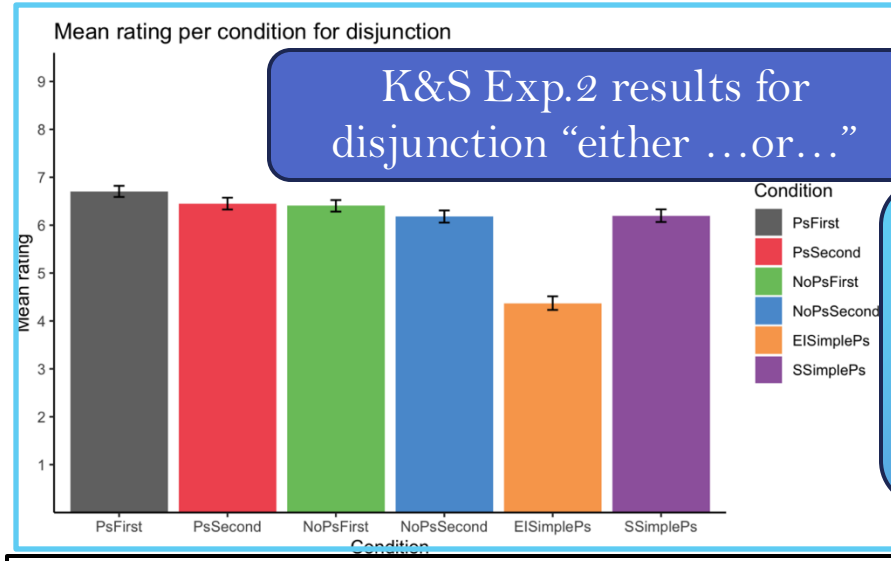


Figure 2: 'huozhe' Mean ratings per condition



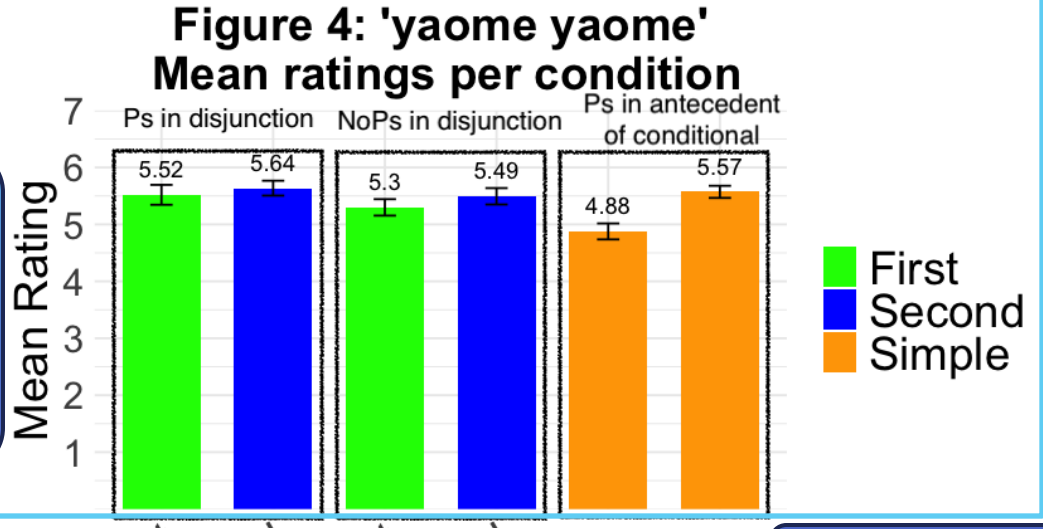
- Bonferroni corrected simple-interaction tests (Predicate.Type × Order.Type | Disjunction.Type):
- "yaome yaome": not significant
- "huozhe": significant
  - β = -0.82, p=0.046
  - R-to-L filtering weaker
- This three-way interaction is driven by uniform filtering for "yaome yaome" as opposed to asymmetric filtering for "huozhe"

Comparison with Kalomoiros & Schwarz (2024)



K&S Exp.2 results for disjunction "either …or…"

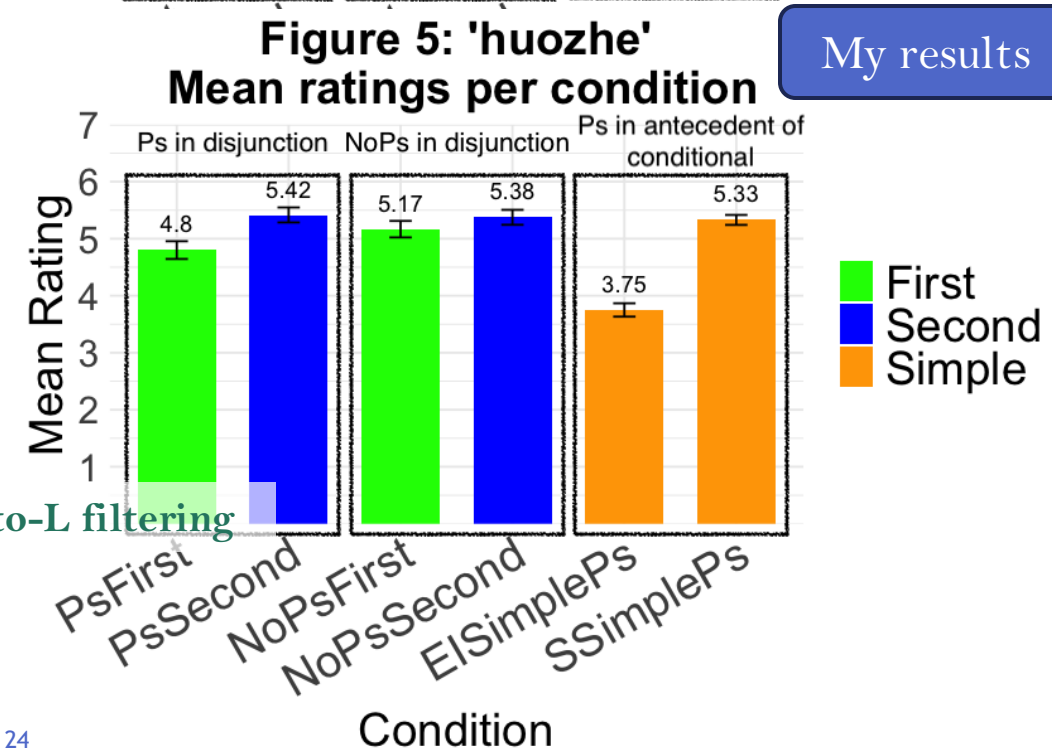
replicated K&S's results in Mandarin



		Language	
		English	Mandarin
Disjunction form	Two particle	Uniform filtering	Uniform filtering
	One particle		Asymmetric filtering

Not categorical!

My results



NoPsFirst – PsFirst < SSimplePs – ElSimplePs: there is R-to-L filtering

- Two-particle disjunction (iterated or not) signals the sentence is a disjunction at the beginning
- One-particle disjunction lacks such full signal

Back to bathroom disjunctions

- Kalomoiros & Schwarz (2024) and our study both used bathroom disjunctions.
- Can bathroom disjunctions be interpreted exclusively, in the first place?
- Either p or q: (1) Either this floor has no bathroom, or the bathroom is in a weird place.
  - p = this floor doesn't have a bathroom
  - q = the bathroom is in a weird place

p or q	q=1	q=0	q=#
p=1			1
p=0	1	0	
p=#			

p xor q	q=1	q=0	q=#
p=1			#
p=0	1	0	
p=#			

  - p = 1: It is true that this floor doesn't have a bathroom
    - q = #
    - In such case, it seems that we often judge the disjunction to be true!
    - ❑ → Bathroom disjunctions may favor inclusive interpretations

- ❑ Thus, I plan to carry out a follow-up study involving asymmetric entailment $\neg p \subsetneq Ps(q)$ to test this question more rigorously

What asymmetric entailment buys us

- $\neg p = Ps(q)$

p or q	q=1	q=0	q=#
p=1			1
p=0	1	0	
p=#			

p xor q	q=1	q=0	q=#
p=1			#
p=0	1	0	
p=#			

- $\neg p \subsetneq Ps(q)$

p or q	q=1	q=0	q=#
p=1	1	1	1
p=0	1	0	
p=#			

p xor q	q=1	q=0	q=#
p=1	0	1	#
p=0	1	0	
p=#			

- (2) Either [this *floor* has no bathroom], or [the bathroom in this *building* is in a weird place].
  p q
- When this entire building doesn't have a bathroom: p = 1, q = #
  - Our intuitions are compatible with the exclusive interpretation

Our theoretical predictions may be better reflected when $\neg p \subsetneq Ps(q)$ for "(either) p or q"

- **Trivalent logic**: Strong Kleene semantics (noted by Mayr & Romoli, 2016b):

- **Local context theory** of Schlenker 2009 (noted by Mayr & Romoli, 2016a)
  - Local context for exclusive disjunction is the global context
- **Traditional dynamic semantics** of Heim 1983 (novel observation): $C[\alpha \; xor \; \beta] =$

$(a)\, C[\alpha][\neg\beta] \cup C[\beta][\neg\alpha]$	$(e)\, C - C[\alpha][\beta] - C[\neg\beta][\neg\alpha]$
$(b)\, C[\neg\alpha][\beta] \cup C[\neg\beta][\alpha]$	$(f)\, C - C[\neg\alpha][\neg\beta] - C[\beta][\alpha]$
$(c)\, C[\alpha][\neg\beta] \cup C[\neg\alpha][\beta]$	$(g)\, C - C[\alpha][\beta] - C[\neg\alpha][\neg\beta]$
$(d)\, C[\beta][\neg\alpha] \cup C[\neg\beta][\alpha]$	$(h)\, C - C[\beta][\alpha] - C[\neg\beta][\neg\alpha]$

Exclusive interpretation

Presupposition projection

- ***Exh* in trivalent semantics**, with strong negation of alternatives (Spector & Sudo, 2017)
  - $Exh^2(\phi \; or \; \psi)$

- **No filtering** (as long as exclusive interpretation is taken into account)

Conclusions

- Question: Does exclusive interpretation affect presupposition filtering?
  - Results:
    - Disjunction form does affect presupposition filtering
    - Environmental monotonicity doesn't affect presupposition filtering
  - Implication:
    - Assuming exclusive interpretation caused by both disjunction form and environmental monotonicity are implicatures
    - **Exclusive interpretation doesn't affect presupposition filtering**
- Speculative: How does disjunction form affect presupposition filtering?
  - Results:
    - Two particle disjunction: Uniform filtering (Evidence from Mandarin and English)
    - One particle disjunction: (slightly) Asymmetric filtering (Evidence from Mandarin)
  - One explanation: one-particle disjunction lacks a preview of the disjunction, leading to slightly weaker R-to-L filtering
- Future direction: a step forward from the theoretical & experimental tradition of inspecting bathroom disjunctions → use disjunctions with asymmetric entailment ($\neg p \subsetneq Ps(q)$)

Thank you!

Selected references

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