

... and related phenomena

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Structure of today's talk

- The basic meanings of logical words have proven elusive, due to extraneous factors such as scope and pragmatic inferences. However, linguists have developed tests that remove the effects of these factors.
- We illustrate some of the tests using the English indefinite **some**, which is a **Positive Polarity Item** and an informationally **weak scalar term**.
- Then we apply the same tests to disjunction. This not only reveals the basic meaning of disjunction, but also several putative linguistic universals.

Tests

- VP ellipsis (Klima 1964)
- The antecedent clause of conditional statements, but not the consequent clause (Chierchia, among others)
- The restrictor (internal argument) of the universal quantifier, but not the scope (external argument) (Partee et al.)
- When negation appears in a higher clause than the one that contains the PPI (Baker, Szabolcsi)
- When the PPI appears in the predicate phrase of sentences with focus operators

English **any** versus **some**

English **some** and **any** are licensed in different linguistic contexts.

At first glance, **any** seems to require a licensor with a negative cast:

Ted ate **any* cookies, but Bill didn't eat *any*.

In such linguistic contexts, **some** and **any** are assigned different interpretations:

Ted didn't eat **some** cookies.

Bill didn't eat **any** cookies.

Properties of PPIs: English *some*

English **some** takes scope over negation at Logical Form.

Julia didn't eat **some** of the kangaroo.

some of the kangaroo Julia didn't eat ~~some of the kangaroo~~

Julia didn't eat **any** of the kangaroo

Negated Disjunctions in Mandarin

Negated disjunctions fail to generate a conjunctive entailment.

(Wo cai) Yuehan **meiyou** dai piji **huozhe** hongjiu.
(I guess) John **not** bring beer **or** wine
'It's either beer or wine that John did not bring.'

Positive Polarity Items



In Mandarin, disjunction is a Positive Polarity Item. PPIs take scope over negation at logical form:

Adults:

Surface syntax: NOT ... *huozhe*

Logical Form: *huozhe* > NOT

Children:

Surface syntax: NOT ... *huozhe*

Logical Form: NOT > *huozhe*

Some and any are allomorphs

(Klima 1964)



*Ted ordered **some** sushi but Max didn't.*

Meaning 1: Ted ordered **some** sushi but Max didn't order **some** sushi

Meaning 2: Ted ordered **some** sushi but Max didn't order **any** sushi

Suppose VP ellipsis is deletion under identity. If so, the underlying VP yields the wrong interpretation

a) Ted ordered some sushi but Max didn't < order **some** sushi >

b) Ted ordered some sushi but Max didn't < order **any** sushi >

Some and any are allomorphs

(Klima 1964)



*Fred didn't order **any** pasta but Jon did.*

Meaning 1: Fred didn't order **any** pasta but Jon did order **any** sushi

Meaning 2: Fred didn't order **any** pasta but Jon did order **some** sushi

Suppose VP ellipsis is deletion under identity. If so, the underlying VP is ungrammatical

a) Fred didn't order **any** pasta but Jon did < order **any** pasta >

b) Fred didn't order **any** pasta but Jon did < order **some** pasta >

Some and any are allomorphs

(Klima 1964)



VP ellipsis: **some** and **any** are variants of the same abstract morpheme, $\exists$

Step 1: the contents of both clauses contain the abstract morpheme $\exists$

Step 2: the VP of the second clause is elided under identity with the first Step

3: the abstract morpheme $\exists$ is made overt <**some**, **any**>:

$\exists$ is phonetically realized as **some**, because the first clause is positive:

*Ted ordered **some** sushi but Max didn't.*

Step 1: Ted ordered $\exists$ sushi but Max didn't order $\exists$ sushi

Step 2: Ted ordered $\exists$ sushi but Max didn't < order $\exists$ sushi >

Step 3: Ted ordered **some** sushi but Max didn't < order $\exists$ sushi >

Some and any are allomorphs

(Klima 1964)



VP ellipsis: **some** and **any** are variants of the same abstract morpheme, $\exists$

Step 1: the contents of both clauses contain the abstract morpheme $\exists$

Step 2: the VP of the second clause is elided under identity with the first

Step 3: the abstract morpheme $\exists$ is made overt <**some**, **any**>

$\exists$ is phonetically realized as **any**, because the first clause is negative:

*Fred didn't order **any** pasta but Jon did.*

Step 1: Fred didn't order $\exists$ pasta but Jon did order $\exists$ pasta

Step 2: Fred didn't order $\exists$ pasta but Jon did < order $\exists$ pasta >

Step 3: Fred didn't order **any** pasta but Jon did < order $\exists$ pasta >

Disjunction/conjunction in VP ellipsis



*Ted ordered **some** sushi but Max didn't.*

Analysis: Ted ordered **some** sushi but Max didn't < order $\exists$ sushi >

NB: There is no overt PPI (**some**) in the elided VP. The existential $\exists$ is interpreted *in situ*.

Conclusion: The inverse scope reading (otherwise associated with the PPI **some**) is cancelled in VP ellipsis.

Prediction: If **disjunction/conjunction** are PPIs in human languages, these expressions should be interpreted *in situ* in VP ellipsis.

Disjunction in VP ellipsis



Ted ordered sushi or pasta but Max didn't.

Analysis: Ted ordered sushi or pasta but Max didn't < order sushi or pasta >

- Disjunction is covert in the elided VP, so it is interpreted *in situ*.

Conclusion: The inverse scope reading (associated with PPI *or*) is cancelled in VP ellipsis.

Prediction: Disjunction words are PPIs in human languages, but they are interpreted *in situ* in VP ellipsis structures.

Thus: Disjunction words should be assigned the same interpretation in all human languages, for children -- and for adults!

English *any* versus *some* Mandarin *renhe* versus *yixie*



Words like English *any* and Mandarin *renhe* are perfect in **negative** linguistic environments

*There are **not any** cookies left.*

*Mei you liuxia **renhe** binggan.*
Not have leave any cookie
没有留下任何饼干

English *any* versus *some* Mandarin *renhe* versus *yixie*



Words like *some* and *yixie* are perfect in the **consequent clause** of a conditional statement

If you are wondering what to munch on, *there are **some** cookies left.*

*Ruguo ni xiang jiao dian shenme, you **yixie** binggan liuxia.*
if you want munch CL what have **some** cookie leave
如果你想嚼点什么，有一些饼干留下了。

English *any* versus *some* Mandarin *renhe* versus *yixie*



Words like *any* and *renhe* are not tolerated in the **consequent** clause of conditionals

If you are wondering what to munch on, *there are ***any** cookies left.*

*Ruguo ni xiang jiao dian shenme, you ***renhe** binggan liuxia le.*
if you want munch CL what have **any** cookie leave Asp
如果你想嚼点什么，有任何饼干留下了。

English *any* versus *some* Mandarin *renhe* versus *yixie*



The deviant sentences are repaired by **negation**

If you are wondering what to munch on, *we **do not have any** cookies left.*

*Ruguo ni xiang jiao dian shenme, women **mei** you liuxia **renhe** binggan*
if you want munch CL what we **not have leave any** cookie
如果你想嚼点什么，我们没有留下任何饼干。

English *any* versus *some* Mandarin *renhe* versus *yixie*



Recall the original **deviant** sentences ... and the contrast

*There are ***any** cookies left*

*There are **some** cookies left*

*Liuxia le ***renhe** binggan*
leave Asp **any** cookie
留下了任何饼干

*Liuxia le **yixie** binggan.*
leave Asp **some** cookie
留下了一些饼干

The Antecedent is Downward Entailing



There are ***any** cookies left

Liuxiale ***renhe** binggan
leave Asp any cookie
留下了任何饼干

The deviant sentences become perfect in the **antecedent** clause of a conditional statement, **without negation!**

If there are **any** cookies left, we'll have something to munch on.

Ruguo you **renhe** binggan liuxia le, women jiu keyi you dongxi jiao le
if have **any** cookie leave Asp we then can have something munch Asp
如果有任何饼干留下了, 我们就可以有东西嚼了

Any/renhe in Antecedent of Conditionals



Any and **some** have similar truth conditions in the **antecedent** clause of a conditional statement

If there are **any** cookies left, we'll have something to munch on.

If there are **some** cookies left, we'll have something to munch on.

Renhe/yixie in Antecedent of Conditionals



Renhe and **yixie** have similar truth conditions in the **antecedent** clause of a conditional statement

Ruguo you **renhe** binggan liuxia le, women jiu keyi you dongxi jiao le
if have **any** cookie leave Asp we then can have something munch Asp
如果有任何饼干留下了, 我们就可以有东西嚼了

Ruguo you **yixie** binggan liuxia le, women jiu keyi you dongxi jiao le
if have **some** cookie leave Asp we then can have something munch Asp
如果有一些饼干留下了, 我们就可以有东西嚼了

The Antecedent is Downward Entailing



In classical logic, conditionals are logically equivalent to negated disjunctions

$$A \rightarrow C \Leftrightarrow \neg A \vee C$$

Conclusions:

- The antecedent of a conditional is inherently **negative** in human languages.
- There is no difference in meaning between **some/yixie** versus **any/renhe**.
- They are allomorphs, starting life as an existential indefinite, $\exists$.

The Antecedent is Downward Entailing



In classical logic, conditionals are logically equivalent to negated disjunctions

$$A \rightarrow C \Leftrightarrow \neg A \vee C$$

- The antecedent of a conditional is inherently **negative**.
- In sentences with overt negation, disjunction is forced to take scope over negation if it is +PPI in a language.

Prediction: In the antecedent of conditionals, negation takes scope over disjunction.

Negated Disjunctions in Mandarin



Yiwannuo **meiyou** dai quqi **huozhe** shutiao,
fouze women jiu you dongxi xiangyong le.
Ivano not bring cookies **or** chips,
otherwise we then have something munch on-Asp.
伊瓦诺 没有带曲奇或者薯条, 否则我们就有东西享用了。
'Its cookies or chips that Ivano didn't bring, or we would have had something to munch on.'

- Surface form matters. In sentences with overt negation, disjunction is forced to take scope over negation if it is +PPI in a language.

Conditionals and Disjunctions



Ruguo Yiwannuo dian le quqi huozhe shutiao, name women jiu you dongxi xiangyong le.
 if Ivano bring-ASP. cookies or chips,
 then we will have something munch on-asp.
 如果伊万诺带了曲奇或者薯条, 那么我们就有东西享用了。
 'If Ivano brought cookies or chips, then we will have something to munch on.'

Conditionals and Disjunctions



CHILD LANGUAGE EXPERIMENT

If Ivano brings cookies **or** chips, then I get a coin.'

- If Ivano brings cookies, but not chips, then I get a coin
- If Ivano brings cookies and chips, then I get a coin

If Ivano brings cookies **and** chips, then I get a coin.'

- # If Ivano brings cookies, but not chips, then I get a coin
- If Ivano brings cookies and chips, then I get a coin

Cancelling +PPI



Polarity Sensitivity is cancelled when negation is in a higher clause than the one that contains **some**.

Tony didn't say that Julia ate **some** of the kangaroo

Tony didn't say that Julia ate **any** of the kangaroo

some and **any** have same truth conditions

The Interpretation of Disjunction: English



Every student who speaks French or Spanish passed the exam.

Entails: Every student who speaks French passed the exam
 Every student who speaks Spanish passed the exam

So, every student who speaks French passed the exam
 and every student who speaks Spanish passed the exam

Every student who passed the exam speaks French or Spanish.

- # Every student who passed the exam speaks French
- # Every student who passed the exam speaks Spanish

The Interpretation of Disjunction: Mandarin



Mei-ge hui shuo fayu huozhe xibanyayu de xuesheng dou tongguo-le kaoshi.
 Every-CL can speak French or Spanish DE student DOU pass-ASP exam
 每个会说法语或者西班牙语的学生都通过了考试。
 'Every student who speaks French or Spanish passed the exam'

Entails: Every student who speaks French passed the exam
 Every student who speaks Spanish passed the exam

So, every student who speaks French passed the exam
 and every student who speaks Spanish passed the exam

Child language studies...

The Interpretation of Disjunction: Japanese



Furansugo ka supeingo-wo hanasu dono gakusei-mo goukakushi-ta
 French or Spanish-ACC speak every student pass-exam-PAST
 'Every student who speaks French or Spanish passed the exam'

Entails: Every student who speaks French passed the exam
 Every student who speaks Spanish passed the exam

So, every student who speaks French passed the exam
 and every student who speaks Spanish passed the exam

Focus Operators



Polarity Sensitivity is cancelled when a PPI appears in the predicate phrase of a **focus operator**

Only Julia ate some of the kangaroo

Only Julia ate any of the kangaroo

some and **any** have similar truth conditions

Disjunction and Focus



Focus operators introduce **covert negation**

Only John took the car **or** the train to the concert.

Presupposition:

John took the car **or** the train to the concert.

Entailment:

Everyone else didn't take the car **or** the train to the concert.

NB: In the entailment, **disjunction** is in the scope of **negation**.

Disjunction and Focus



Focus operators introduce **negation** in the entailment

Zhiyou Yuehan zuo-le qiche **huozhe** huoche qu ting yinyuehui.
Only John take-ASP car **or** train go listen concert.
'Only John took the car or the train to the concert.'

Presupposition:

Yuehan zuo-le qiche **huozhe** huoche qu ting yinyuehui.
John take-ASP car **or** train go listen concert.
'John took the car or the train to the concert.'

Disjunction and Focus



Focus operators introduce **negation** in the entailment

Zhiyou Yuehan zuo-le qiche **huozhe** huoche qu ting yinyuehui.
Only John take-ASP car **or** train go listen concert.
'Only John took the car or the train to the concert.'

Entailment:

Qita-ren **meiyou** zuo qiche **huozhe** huoche qu ting yinyuehui.
Other-people **not** take car **or** train go listen concert.
'Everyone else didn't take the car or the train to the concert.'

NB: In the entailment, **disjunction** is in the scope of **negation**

Disjunction Generates a Conjunctive Entailment



Only John took the car or the train to the concert.

Entailment:

Everyone else didn't take the car **or** the train to the concert.

Zhiyou Yuehan zuo-le qiche **huozhe** huoche qu ting yinyuehui.
Only John take-ASP car **or** train go listen concert.
'Only John took the car or the train to the concert.'

Entailment:

Qita-ren meiyou zuo qiche huozhe huoche qu ting yinyuehui.

With and Without Focus



Without **zhiyou**:

Yuehan **meiyou** zuo qiche **huozhe** huoche qu ting yinyuehui.
John not take car **or** train go listen concert.
'John didn't take the car or the train to the concert.'

qiche huozhe huoche Yuehan **meiyou** zuo qiche huozhe huoche qu ting yinyuehui.

With **zhiyou**:

Zhiyou Yuehan zuo-le qiche **huozhe** huoche qu ting yinyuehui.
Only John take-ASP car **or** train go listen concert.
'Only John took the car or the train to the concert.'

Entailment: Qita-ren **meiyou** zuo qiche huozhe huoche qu ting yinyuehui

With and Without Focus



Entailment:

Qita-ren **meiyou** zuo qiche **huozhe** huoche qu ting yingyuehui.
Other-people **not** take car **or** train go listen concert.
'Everyone else didn't take the car or the train to the concert.'

Logical Form:

Qita-ren **meiyou** zuo qiche huozhe huoche qu ting yingyuehui.

Spoken Version:

qiche **huozhe** huoche Qita-ren **meiyou** zuo qiche huozhe huoche qu ting yingyuehui.

Child Language



We have seen that, across languages, disjunction words are subject to parametric variation. These words are PPIs in some languages, but not in others.

Learnability theory leads us to predict that children will initially favour parameter values that make sentences true in the narrowest range of circumstances. This ensures that there will be positive evidence if the local language favours the alternative parameter value.

The Disjunction Parameter: Mandarin-speaking children favour the -PPI setting of the Disjunction Parameter, so they speak a fragment of English.

Disjunction and Focus in Child English and Mandarin



Participants:

18 monolingual English-speaking children (mean age 4;3, range 3;5 to 5;1), 20 monolingual Mandarin-speaking children (mean age 4;7, range 4;5 to 4;10)

13 English-speaking adults and 20 Mandarin-speaking adults

Procedure



Truth Value Judgment Task (Crain & Thornton, 1998)



Here is what happened.



Is Kermit right or wrong?

Adult-true Scenario



Only Bunny Rabbit ate a carrot **or** a pepper.



Adult-true Scenario



Only Bunny Rabbit ate a carrot **or** a pepper.



Acceptance rates:

Mandarin-speaking adults: 100%
Mandarin-speaking children: 100%
English-speaking adults: 100%
English-speaking children: 93%

Adult-false Scenario



Only Bunny Rabbit ate a carrot **or** a pepper.



Adult-false Scenario



Only Bunny Rabbit ate a carrot **or** a pepper.



Rejection rates:

Mandarin-speaking adults: 100%
Mandarin-speaking children: 70%
English-speaking adults: 100%
English-speaking children: 90%

A Universal of Logic



Both English and Mandarin Chinese, including child language, adhere to the laws of classical logic once the polarity sensitivity of disjunction is cancelled by focus operators

$$\neg(A \vee B) \rightarrow \neg A \wedge \neg B$$

Conclusions



Diagnostic tests for PPIs reveal that when polarity sensitivity is cancelled, both children and adults interpret **disjunction** as in first-order logic. Exactly the same arguments apply for **conjunction**, as I will show in Saturday's talk.

Two main conclusions:

First, the theory of UG (Principles and Parameters) is supported by both cross-linguistic research and by research on child language.

Second, human languages and classical logic are similar in important respects.

Conclusions



Across human languages, certain kinds of linguistic expressions have similar patterns of distribution.

These patterns are predicted by the theory of Universal Grammar.

These patterns reveal logical structures of the human mind.