Lexical Effects on Processing Doubly Quantified Sentences in Chinese

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JWLLP-23

15 December 2017

Quantifier Scope Ambiguity?

(1) ***Every kid*** climbed **a tree**.

(2) a. Surface scope: (*every* > *a*)

For every kid x, there is a tree y, such that x climbed y.

b. Inverse scope: (*a* > *every*)

There is a tree y, such that for every kid x, x climbed y.

(Entailment? The inverse scope reading entails the surface scope; i.e., if there is a single tree that every kid climbed, it is necessarily the case that every kid climbed a tree, albeit the same one cf. Reinhart 1978, Lyons 1999).

(pictures from Raffray & Pickering 2010)

Quantifier Scope Ambiguity?

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For every kid x, there is a tree y, such that x climbed y.

b. Inverse scope: (*a* > *every*)

There is a tree y, such that for every kid x, x climbed y.

(3) *每個* *孩子* (都) 爬-了 一棵 樹.
every-CL kid all climb-PERF one-CL tree
'***Every kid*** climbed **a tree**.' ➔ Only (2a)?

(4) *每個* *學生* (都) 怕 一個 老師.
every-CL student all afraid.of one-CL teacher
'Every student is afraid of a teacher.' ➔(2b) !

(5) *每個* *人* 都 被 一個 女人 抓走.
every-CL man all PASSIVE one-CL woman arrest
'Every man is arrested by a woman.' ➔ ambiguous?

Questions

How sentences with double quantifiers in Chinese are interpreted?

1. Is the inverse scope available in Chinese?
2. What factors are involved in interpreting the scope of quantifiers?
3. Can the scopal interpretation be primed?

➔ Lexical effects on scope processing

The selection of items

- Universal quantifier: ***mei (yi) ge* N** 'every N'
- Existential quantifier: ____ 'a N' or 'some N'
  - ***someone***

    ➔Aoun and Li 1989: Chinese does not have an equivalent expression like *someone*.
  - ***you (yi) ge* N** 'a N' is always specific indefinite.

    ➔ Specific and D-link phrases take wide scope (Fordor and sag 1982, Kuno et al. 1999)
  - Bare noun can be indefinite singular or plural, or generic

✓***yi ge* N** 'a N'

The selection of items

- 4 verb types were manipulated to test **the thematic information**:

  a. Action verb (e.g., *shiyong* 'use', *zhui* 'chase')
  b. Psychology-obj. verbs (e.g., *qifu* 'bully', *konghe* 'threaten')
  c. Perception verbs (e.g., *wen* 'scent', *kanshou* 'watch')
  d. Locative verbs (e.g., *canguan* 'visit', *pa* 'climb')

  ❖ Preprocessing:

  Action verbs: only those that are cognitively possible in surface and inverse interpretations were included.

  Psychology verbs: only those allow passivization were used (those with experiencer object).

- 3 aspect types:
  (a) the zero form (bare verbs), (b) *le*: perfective aspect,
  (c) *guo*: an event has been experienced and no longer exists at the speech time

- Experiment 1
  2 sentence structures (active vs. passive); 4 verb types

- Experiment 2
  3 types of aspecuality (perfective *le*, experienced *guo*, and the zero form); 2 verb types (action, perception)

- Experiment 3
  2 quantifier orders (*Every* … *a* …. vs. *A*… *every*….) in conditional SVO sentences marked by *yaoshi* 'if'

- Experiment 4
  Sentence priming of active SVO sentences

The format of stimuli

- **Active**

  Context: 朋友|在家裡|養了|三隻|波斯貓。

  Sentence: **每隻|貓|都|在追|一隻|老鼠。**

  'Every cat is chasing a mouse.'

  -- 這隻$_{-CL}$|老鼠$_{-N}$|看起來$_{-N+1}$|十分|迷你。 [inverse]

  -- 這些$_{-CL}$|老鼠$_{-N}$|看起來$_{-N+1}$|十分|迷你。 [surface]

- **Passive**

  Context: 朋友|在公園|看到|三隻|老鼠，

  Sentence: **每隻|老鼠|都被|一隻|貓|追著。**

  'Every mouse is being chased by a cat.'

  --這隻$_{-CL}$|貓$_{-N}$|是$_{-N+1}$|他的|寵物。[inverse]

  --這些$_{-CL}$|貓$_{-N}$|是$_{-N+1}$|他的|寵物。[surface]

- **Control--baseline** (with preceding contexts)

  每隻|貓|都|在追|同一隻|老鼠。

  每隻|貓|都|在追|不同隻|老鼠。

Stimuli are followed by a comprehension question.

Experiment 1: Self-Paced Reading

- Native Chinese speakers from Taiwan (N=36)
- Action verb (e.g., *qiaoda* 'knock', *zhui* 'chase'),
  Perception verbs (e.g., *wen* 'scent', *kanshou* 'watch'),
  Psychology-obj. verbs (e.g., *qifu* 'bully', *konghe* 'threaten'),
  Locative verbs (e.g., *canguan* 'visit', *pa* 'climb')
- 2 sentence structures: **Active** vs. **Passive** (with preceding contexts)

(6) a. Active

每個 *搶匪* 都 搶 了 一家 銀行.
every-CL robber all rob PERF one-CL bank
'Every robber robbed a bank.'

b. Passive

每家 *銀行* 都 被 一個 搶匪 搶 了.
every-CL bank all PASSIVE one-CL robber rob PERF
'Every bank was robbed by a robber.'

Experiment 1: Self-Paced Reading

1. Significant different scopal preferences (.02)

- Active sentences with action verbs preferred inverse scope

  張先生養了三隻狼犬，前天他們到公園去玩，一不小心，
  每隻 狼犬 都 攻擊-了 一個 男孩，
  every shepherd ALL attack-PERF a boy
  這個男孩傷勢相當嚴重。

- **Passive** showed strong preference on the surface scope.

  張先生照顧三個男孩，前天他們到公園去玩，一不小心，
  每個 男孩 都 被 一隻 狼犬 攻擊了，
  every boy ALL PASSIVE a shepherd attack-PERF
  這些男孩傷勢相當嚴重。

2. Significant sentence type effect at regions CL and N+1
3. Marginal significant effects of sentence type on scope readings at the CL (.07) and the N+1(.06)

Experiment 1: Self-Paced Reading

A tendency similar to results of action verbs was found with perception verbs

- Active sentences prefer **inverse scope (*a>every*)**

  每個 探員 都 注意到 一條 線索。
  every-CL agent ALL notice one-CL clue
  'Every agent has noticed a clue.'

- Passive sentences prefer surface scope (*every>a*)

  每條 線索 都 被 一個 探員 注意到-了。
  every-CL clue ALL passive one-CL agent notice-PERF
  'Every clue has been noticed by an agent.'

Experiment 1: Self-Paced Reading

Psychology-object verbs with experience objects show significant interaction with scopes (.039)

每個 流氓 都 恐嚇-過 一個 警察。
every-CL gangster ALL threaten-EXP one-CL police
'Every gangster has threatened a police.'

➔Strong preference on the inverse scope reading in active sentences, contra the standard view in linguistics literature.

Cf. Pafel (2005)

➔Theta roles and the event structure influenced the scopal interpretation

Inverse scope reading is available in active SVO sentences, but different types of verb show different preferences.

Experiment 1: Self-Paced Reading

- Sentences with locative verbs show a strong preference to the surface scope reading (*every* > *a*) (.01)

  每個 學生 都 參觀-了 一家 工廠。
  every-CL student ALL visit-PERF one-CL factory
  'Every student has visited a factory.'

Unlike active SVO sentences,

- Passive sentences show a dominant surface scope reading (*every* > *a*) across three verb types (i.e., action, perception, psychology verbs).

Experiment 2: Forced-choice questionnaire

- Native Chinese speakers from HK (N=96) studying in HK PolyU
- 3 types of aspectuality with 6 action verbs and 6 perception verbs

(7)	*每個*	*學生*	都	敲打	了	一個	玻璃瓶。
	every-CL	student	all	knock	PERF	one-CL	glass-bottle
(8)	*每個*	*學生*	都	敲打	過	一個	玻璃瓶。
	every-CL	student	all	climb	EXP	one-CL	glass-bottle
(9)	*每個*	*學生*	都	敲打		一個	玻璃瓶。
	every-CL	student	all	climb		one-CL	glass-bottle

a. 這些玻璃瓶 'These bottles……' (surface scope)

b. 這個玻璃瓶 'This bottle……' (inverse scope)

Results:

- The zero form of aspect was compatible with both verb types
- Action verbs preferred the surface scope with *le* and *guo*.
- Perception verbs with *le* and *guo* preferred the inverse scope.

Experiment 3

Two quantifier orders, e.g., ***Every kid*** climbed **a tree**. Vs.
A kid climbed **every tree**.

a. Surface scope: (*a* > *every*)

b. Inverse scope: (*every* > *a*)

This study used Chinese materials:

Conditional SVO sentences marked by 要是 *yaoshi* 'if' containing an action verb in the bare form.

Experiment 3: Forced-choice questionnaire

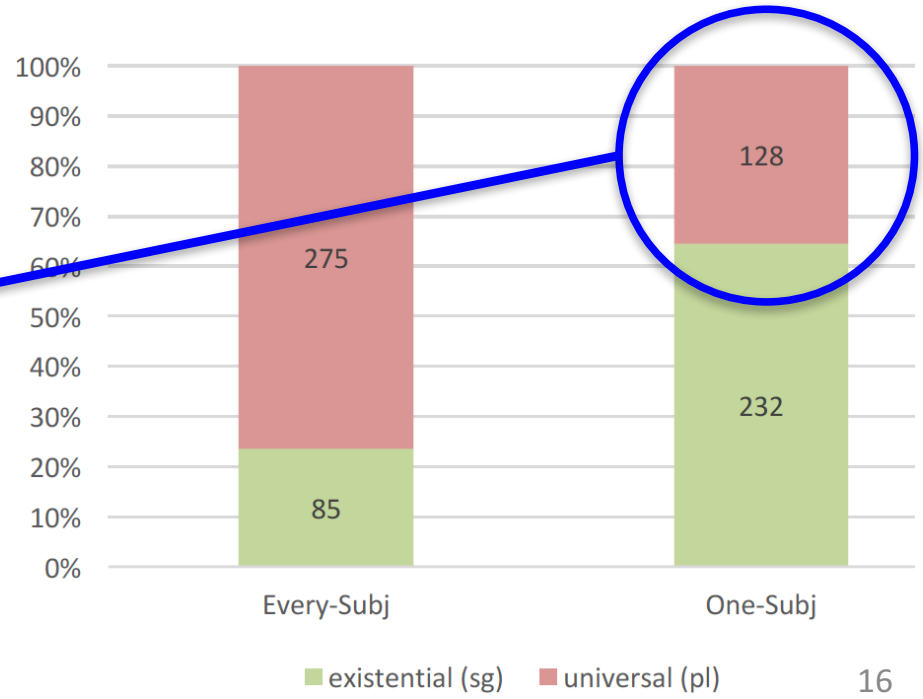
- Native Chinese speakers from HK (N=60) studying in HK PolyU

(10) 要是 *每個* *警察* 追 一個 小偷， **(Every > a)**
if every-CL police chase one-CL thief

'If every police chases a thief,' ➔ a. 這個小偷 'this thief'…
b. 這些小偷 'these thieves'…

(11) 要是 一個 警察 追 *每個* *小偷*， **(A> every)**
if one-CL police chase every-CL thief

'If a police chases every thief,'
➔ a. 這個警察……
'This police officer' …
b. 這些警察……
'These police officers' …



($X^2(1) = 120.14$, $p < .01$)

Experiment 4:
Self-Paced Reading + Sentence-Picture Verification

- Native Chinese speakers from HK (N=48) studying in HK PolyU
- **Sentence-priming: 2 scope readings (12 action verbs)**

Prime a: 所有 工人 敲打 那塊 石頭. (Existential-W)
all worker **knock** that rock

'All workers knocked that rock.'

Prime b: 所有 工人 敲打 不同 石頭. (Universal-W)
all worker **knock** different rock

'All workers knocked different rocks.'

Target sentences followed one of the prime sentences, or was processed without a prime sentence:

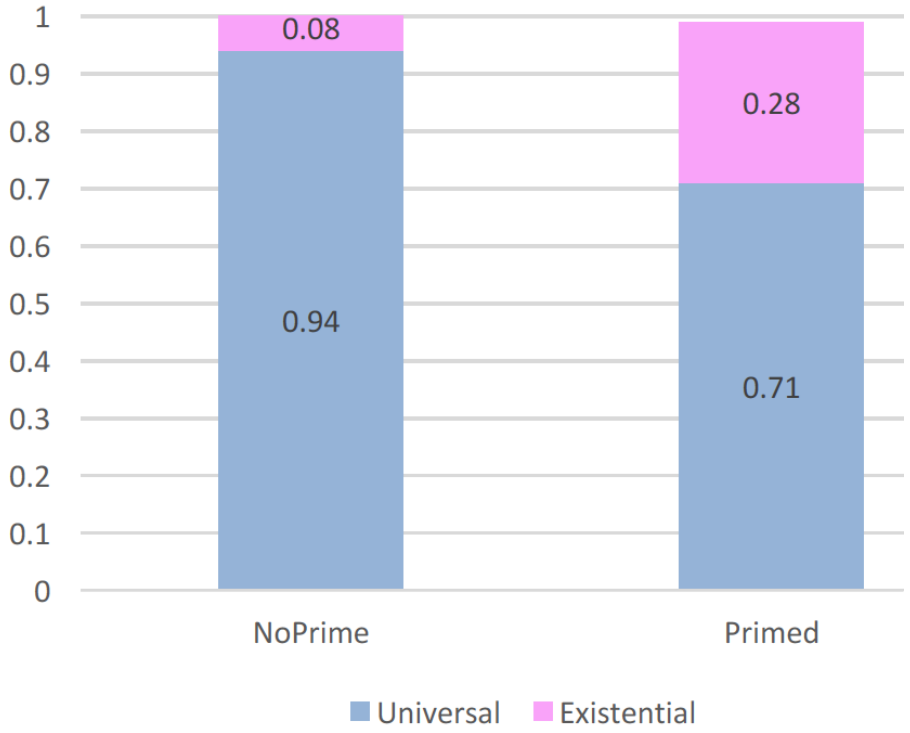
每個 學生 敲打 一個 玻璃瓶.
every-CL student **knock** one-CL glass-bottle

'Every student knocked one bottle.'

Experiment 4:
Self-Paced Reading + Sentence-Picture Verification

- 每個$_{CL1}$ 學生$_{N1}$ 敲打$_{V}$ 一個$_{CL2}$ 玻璃瓶$_{N2}$·
  every student knock one glass-bottle
  'Every student knocked one bottle.'

- Interaction of PrimeScope and TargetScope (p=.04) at N1
- Universal-wide prime had sig. higher priming accuracy
- Target showed Longer RT when being primed as existential-wide scope



Summary

1. **Different sentence structures**
   - Active sentences could prefer the inverse scope (*a>every*) with contexts (; different verb types showed different preferences).
   - **Passive** sentences show dominant preference on the surface scope (*every>a*).

2. **Different types of aspectuality influenced the preference**
   -- The zero form of aspect was compatible with 2 verb types
   -- Action verbs preferred the surface scope with *le* and *guo*.
   -- Perception verbs with *le* and *guo* preferred the inverse scope.

3. **Both order of quantifiers (*Every>a, A>every*) allowed the inverse scope reading**

4. **Priming effects were observed**
   Different scope interpretations could be primed

Concluding Remarks

Inverse scope is available in Chinese doubly quantified sentences.

Doubly quantified sentences have been used in studies of sentence processing, but what contributed to the interpretation of scopes is more complicated, e.g.,

- **The type of quantified elements**
- **The position of quantified elements**
- **The type of verbs used in a sentence**
- **The aspectuality of an event described by a sentence**

Lexical effects, in addition to the linear word order, play a role in deciding the scopal preference of doubly quantified sentences in Chinese.

Thank you!