Intervention effects in Mandarin-speaking children's comprehension of passives

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Roadmap

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- Intervention Hypothesis
- Which features are relevant for intervention?
- Why Mandarin:
  - Mandarin passives
  - Mandarin classifiers

Experiment

- Design and materials
- Procedure
- Subjects
- Results

Summary and discussion

Intervention Effects in child languages

Intervention Hypothesis: Children are subject to a stricter version of (featural) Relativized Minimality (Rizzi, 1990, 2004) (e.g., Hyams & Snyder 2005, Friedmann et al. 2009, Adani et al. 2010, Orfitelli 2012, Snyder & Hyams 2015).

- Intervention Effect: A dependency between a moved element X and its gap Y is harder for children to comprehend if it crosses another element Z, an *intervener*, which (i) c-commands Y and (ii) shares certain morphosyntactic features with X.

- The degree of intervention is a function of featural distinctness between X and Z. A mismatch in crucial morphosyntactic features between X and Z mitigates the Intervention difficulty.

What *features* are relevant?

Previous studies in other languages have shown that children's difficulty with intervention is lessened when the two arguments mismatch in…

- Number: Italian (Adani et al. 2010), English (Adani et al. 2014), Spanish (Mateu, 2022)
- Gender: Hebrew (Belletti et al. 2012)
- Animacy: Italian (Arosio et al., 2011), French (Bentea et al. 2016), English (Mateu & Hyams 2021)
- NP type: Hebrew (Friedmann et al. 2009), English (Choe 2013)

Language-specific

e.g., Belletti et al. (2012): only features functioning as attractors for syntactic movement (e.g., Starke 2001, Rizzi 2004) enter into the computation of intervention

	Hebrew Obj RC	Italian Obj RC
Number mismatch	improvement	improvement
Gender mismatch	improvement	no improvement

Why Mandarin passives

Two types of passive structures:

(1) a. Long passives

laoshu	*bei*	*mao*	*yao*	*le*
mouse	BEI	cat	bite	PERF

'The mouse was bitten by the cat.'

b. Short passives

laoshu	*bei*	*yao*	*le*
mouse	BEI	bite	PERF

'The mouse was bitten.'

- In long passives, the external argument is an embedded subject, while in short passives the EA is **structurally absent** (e.g., Huang 1999, Bruening and Tran 2015, Chen and Li 2021).
- There are no verbal/adjectival passive homophones in Mandarin
  → Thus children cannot resort to an "adjectival strategy" to interpret short passives. (cf. Borer and Wexler 1987, 1992)
- No morphological agreement on the verb
  raising the question of what features - if any - might be relevant for intervention in a language like Mandarin

Why Mandarin passives

(2) a. **Dependency in Mandarin LongPass:**

The mouse BEI$_{PASS}$ [$_{IP}$ *the cat* [$_{vP}$ *bite*-PERF __]]

intervener

'The mouse was bitten by the cat.'

b. **Dependency in Mandarin ShortPass:**

The mouse BEI$_{PASS}$ [$_{VP}$ *bite*-PERF __]

'The mouse was bitten.'

1st prediction of the Intervention Hypothesis:

Long passives will be harder for children to comprehend than short passives and active sentences

Why Mandarin passives

What is relevant for the computation of Intervention in child Mandarin?

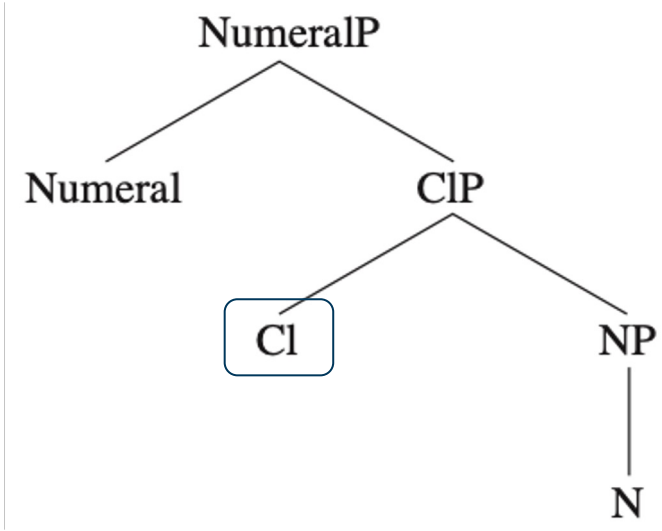
The current study in Mandarin manipulates two different features:

- **Number**, canonically a phi-feature that has been found to modulate intervention in other languages (e.g., Italian, Hebrew, Spanish)
- **Shape**, an inherent lexical feature that has not been previously tested with regards to intervention

Neither Number nor Shape is marked on the verb nor triggers movement in Mandarin.

Both Number and Shape are realized on classifiers.

Background: Mandarin classifiers



- The classifier (Cl^0) has the individualizing function of D^0 and Number locates on Cl^0 (e.g., Cheng & Sybesma 1999, 2012, Borer 2005)

- Numerals require the presence of classifiers

(3) *yi-*(ge) pingguo*
one-CL apple
'one apple'

Background: Mandarin classifiers

Plural classifier *-xie* combines with the numeral *one* and marks the DP as plural:

(4) *yi-**xie** pingguo*
one-CL apple
'some apples'

Specific classifiers mark *the inherent lexical properties* of the noun, such as the shape or size of the denoted entity. E.g., ***-tiao*** s(emantically)-selects for some entities that are thin and long, such as *snake* and *street* in (5a), but not entities of other shapes in (5b).

(5) *a. yi-**tiao** she / jiedao*
one-CL snake / street
'a snake/street'

b. *yi-**tiao** *houzi / *qiche*
one-CL monkey / car
Intended: 'a monkey/car'

Background: classifiers in child Mandarin

-ge (e.g., Loke 1991, Hu, 1993, Tse et al. 2007)

- Most frequent in Mandarin
- Acquired first; functions as a place-holder before children produce specific classifiers

-xie 'plural'

- Occurs early in child spontaneous speech

-tiao 'shape' (e.g., Erbaugh 1986)

- Occurs early in child spontaneous speech

(6) *hai you yi-ge jiuhuche* (2;2)
still exist one-CL ambulance
'There is still an ambulance.'

(7) *yi-xie xiaoqiche* (2;9)
one-CL car
'some cars'

(8) *zhebian yi-tiao xian* (2;4)
here one-CL line
'Here is a line.'

2nd prediction of the Intervention Hypothesis

Possible outcomes	What is relevant for intervention?
Number Mismatch = Shape Mismatch > Match	Morphologically overt features • Both Number and Shape are morphologically realized on classifiers in Mandarin
Number Mismatch > Shape Mismatch = Match	Candidate for phi-feature cross-linguistically • Number but not Shape is cross-linguistically a candidate for phi-features
Number Mismatch = Shape Mismatch = Match	Features that trigger syntactic processes (movement or agreement) • In Mandarin, neither number or shape is marked on the verb nor triggers movement

Design and materials

A two-choice sentence-picture matching task

- Manipulations:
  - Sentence type: **Actives, Long Passives, Short Passives**
  - Featural condition: **Match, Number Mismatch, Shape Mismatch**
- 54 trials, six per condition crossing four actional verbs:
  - *yao-zhu* ‘bite’, *zhua-dao* ‘grab’, *zhuang-dao* ‘bump’, *ya-zhu* ‘pin down’
- A semi-random order
  - Trials of the same sentence types were never adjacent
  - Only two adjacent trials contained the same verb

Design and materials

(12) Actives

a. Match (no Number or Shape differences)

[yi-**ge**	xiaoniu]	yaozhu-le	[yi-**ge**	xiaogou]
one-CL	cow	bite-PERF	one-CL	dog

'A cow bit a dog.'

b. Number Mismatch (classifier distribution is balanced)

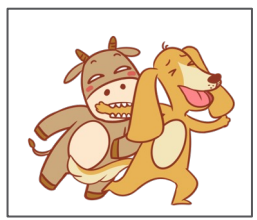
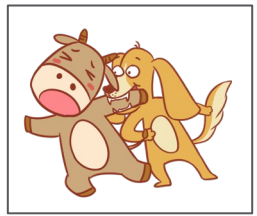
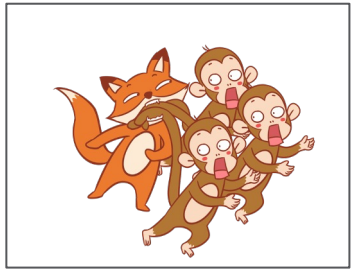
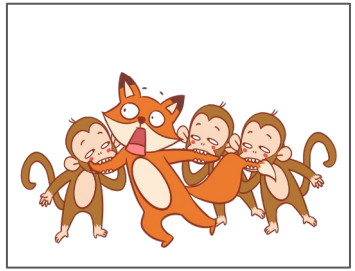
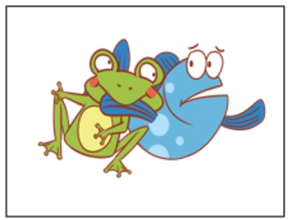
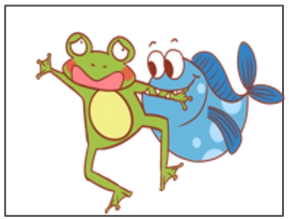
[yi-**xie**	houzi]	yaozhu-le	[yi-**ge**	huli]
one-CL[+PL]	monkey	bite-PERF	one-CL	fox

'Some monkeys bit a fox.'

c. Shape Mismatch (classifier distribution is balanced)

[yi-**tiao**	xiaoyu]	yaozhu-le	[yi-**ge**	qingwa]
one-CL$_{specific}$	fish	bite-PERF	one-CL	frog

'A fish bit a frog.'

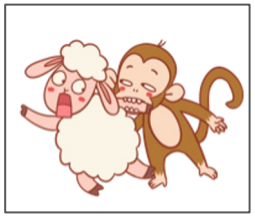
Design and materials

(13) Long Passives

a. Match (no Number or Shape differences)

[yi-ge	xiaoyang]	bei	[yi-ge	houzi]	yaozhu-le
one-CL	sheep	BEI	one-CL	monkey	bite-PERF

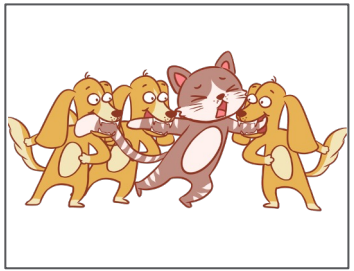
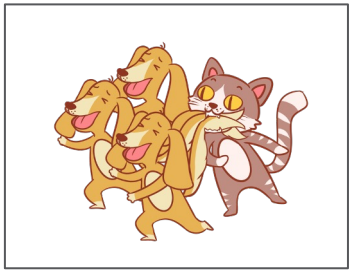
'A sheep was bitten by a monkey.'

b. Number Mismatch (classifier distribution is balanced)

[yi-ge	xiaomao]	bei	[yi-xie	xiaogou]	yaozhu-le
one-CL	cat	BEI	one-CL[+PL]	dog	bite-PERF

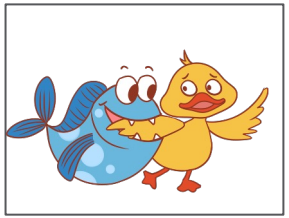
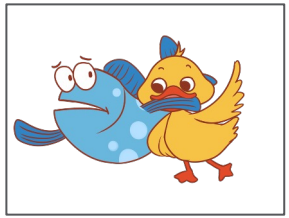
'A cat was bitten by some dogs.'

c. Shape Mismatch (classifier distribution is balanced)

[yi-ge	yazi]	bei	[yi-tiao	xiaoyu]	yaozhu-le
one-CL	duck	BEI	one-CL$_{specific}$	fish	bite-PERF

'A duck was bitten by a fish.'

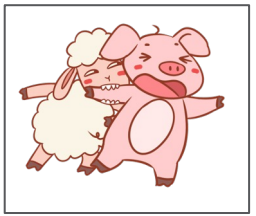
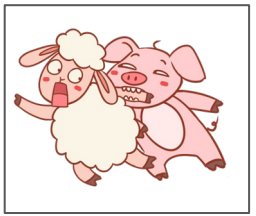



Design and materials

(14) Short Passives

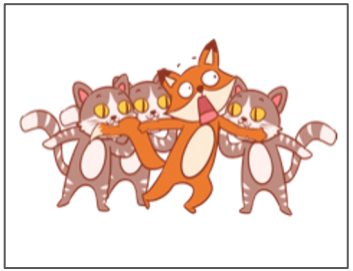
a. "Match"

[yi-**ge** xiaoyang] bei yaozhu-le
one-CL sheep BEI bite-PERF
'A sheep was bitten.'

b. "Number Mismatch" (classifier distribution is balanced)

[yi-**xie** xiaomao] bei yaozhu-le
one-$CL_{[+PL]}$ cat BEI bite-PERF
'Some cats were bitten.'

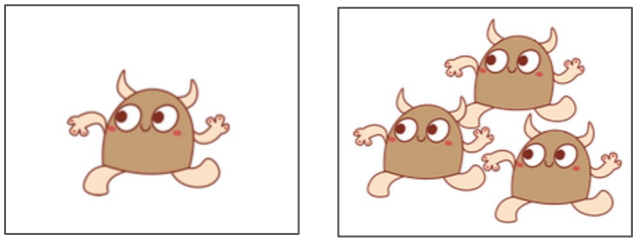



c. "Shape Mismatch" (classifier distribution is balanced)

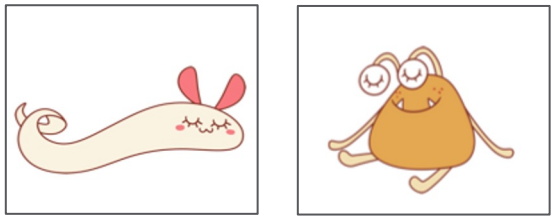
[yi-**tiao** xiaolong] bei yaozhu-le
one-$CL_{specific}$ dragon BEI bite-PERF
'A dragon was bitten.'


Procedure

- Online experiment with the assistance of parents/teachers/care-takers
- Two training sessions
  - One familiarizes children with the task and the nouns used in the experiment
  - One tests children's knowledge of the 3 target classifiers with novel nouns



"one-*xie* milas are running"



"one-*tiao* buna is sleeping"

- A break after half of the trials

Subjects

- 80 monolingual Mandarin-speaking children aged 3;01-6;08 (*M* = 4;11), recruited from Changsha, Hunan, China
    - 3yos (3;01-3;11, *M* = 3;08, *N* = 19)
    - 4yos (4;01-4;11, *M* = 4;05, *N* = 22)
    - 5yos (5;00-5;11, *M* = 5;05, *N* = 19)
    - 6yos (6;00-6;08, *M* = 6;04, *N* = 20)
- All showed above-chance performance with control trials, i.e., >13/18 in Actives

Results

- Mixed-effects logistic regression
- Full model:

  Correct Response ~ Sentence Type × Featural Condition × Age (in months)

  + (1 | Child) + (1 | Verb)

- Stepwise model comparison:
  - **Age** is not a significant predictor *($X^2(7) = 8.5264$, $p = 0.2885$)*

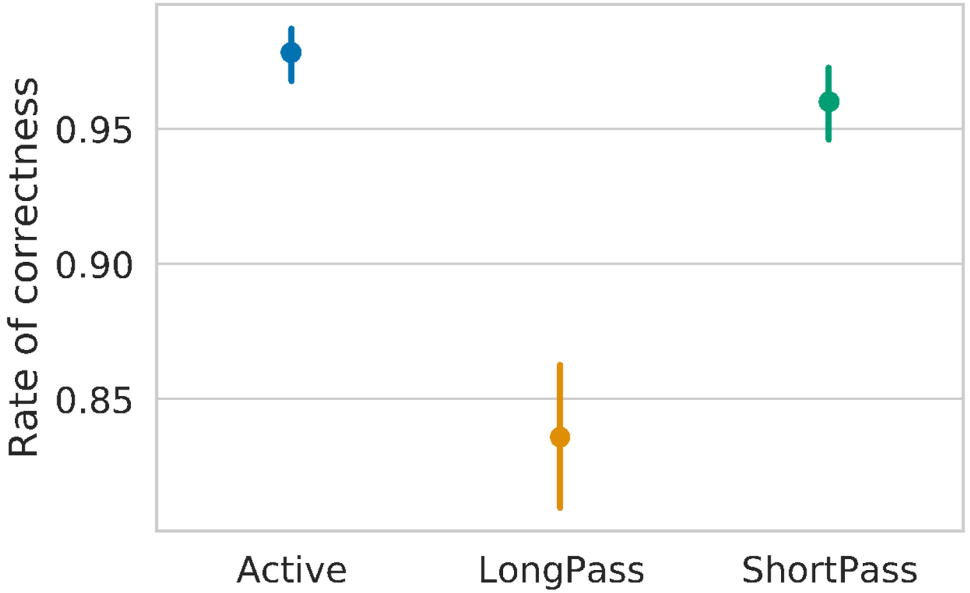
Results

The effect of **Sentence Type** is significant *($X^2(6) = 188.86, p < 0.001$)*

Short passives = Actives
(z-value = -1.888, p = 0.059)

Long passives < Actives
*(z-value = -7.243, p < 0.001 ***)*

Long passives < Short passives
*(z-value = -10.198, p < 0.001 ***)*



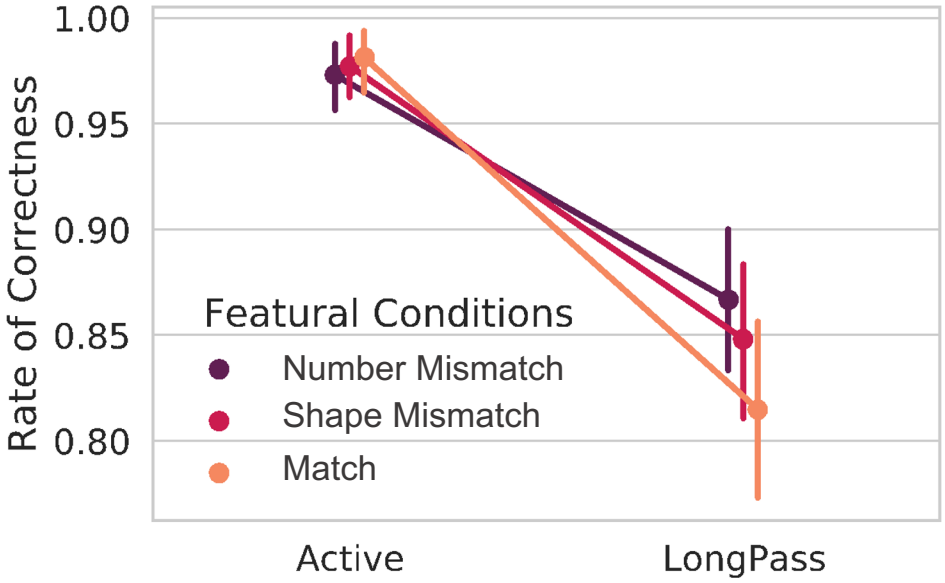
Results

Featural Condition is not a significant predictor *($X^2(8) = 7.2351$, $p = 0.5115$)*, nor is the **interaction** between Sentence Type and Featural Condition *($X^2(2) = 3.395$, $p = 0.1831$)*

Number Mismatch = Match
(z-value = -1.236, p = 0.216)

Shape Mismatch = Match
(z-value = -0.951, p = 0.341)

Number Mismatch = Shape Mismatch
(z-value = 0.283, p = 0.7772)



Summary and Discussion

Result 1: Long passives < Short passives and Actives

Consistent with the Intervention Hypothesis, we found that in Mandarin long passives are harder for children to comprehend than short passives and active sentences.

(2) a. **Dependency in Mandarin LongPass:**

The mouse BEI$_{PASS}$ [$_{IP}$ *the cat* [$_{vP}$ *bite*-PERF __]]

intervener

'The mouse was bitten by the cat.'

b. **Dependency in Mandarin ShortPass:**

The mouse BEI$_{PASS}$ [$_{VP}$ *bite*-PERF __]

'The mouse was bitten.'

Summary and Discussion

Result 2: on featural manipulation

Possible outcomes	What is relevant for intervention?
Number Mismatch = Shape Mismatch > Match	Morphologically overt features • Both Number and Shape are morphologically realized on classifiers in Mandarin
Number Mismatch > Shape Mismatch = Match	Candidate for phi-feature cross-linguistically • Number but not Shape is cross-linguistically a candidate for phi-features
Number Mismatch = Shape Mismatch = Match	Features that trigger syntactic processes (movement or agreement) • In Mandarin, neither number or shape is marked on the verb nor triggers movement

Summary and Discussion

Our results suggest:

- ❖ Intervention effects are grammatical in nature.
  - If the results from previous studies were due to general cognitive principles and processing strategies, e.g., similarity-based interference (e.g., Gordon et al. 2001), Number (and Shape) should also play a role in Mandarin intervening structures. However, that is not what we find.

  - There is a formal, grammatical characterization of what may count as a relevant feature for intervention – only a feature with the specific morphosyntactic function of triggering movement counts for intervention (e.g., Belletti et al. 2012).

→ The importance of comparative acquisition studies

Thank you!

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