

Experimental Pragmatics

UCL Linguistics Short Courses 25/26

Negation Processing II

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Recap

- Some empirical evidence of the difficulty of negation processing.
- The presence of the activation of the positive argument of negation.

Questions

Q1: why negation (especially when presenting alone) is hard to process?

Q2: what role does the positive argument play in negation processing?



An Incremental-Dynamic Perspective

Tian, Breheny & Ferguson (2010)

- Incremental processes probabilistically establish QUDs/Source of Relevance (SoR) for utterance.
- Without any further contextual information, the most likely question for a negative sentence is the positive polar question.





Negation Processing Without Context

Tian, Breheny & Ferguson (2010)

	Match	Mismatch
Clefted: <i>It was Jane who didn't cook the spaghetti</i>		
Non-clefted: <i>Jane didn't cook the spaghetti</i>		

Negation Processing Without Context

Tian, Breheny & Ferguson (2010)

	Match	Mismatch
Clefted: <i>It was Jane who didn't cook the spaghetti</i>		
Non-cleft: <i>Jane didn't cook the spaghetti</i>		

- Clefts are known to be presupposition triggers (Levinson, 1983).
- The simple and cleft sentences have the same content and truth conditions.
 - For clefted items, presupposition is ‘Someone didn’t cook the spaghetti’, assume the intended context is ‘Which person/who didn’t cook the spaghetti?’
- Assume cleft items lead to the inference of a negative context question.
- Predictions at short SOA (250ms):
 - Kaup et al: $RT_{mismatch} < RT_{match}$ for both conditions
 - Tian et al: Interaction. $RT_{mismatch} > RT_{match}$ for cleft condition

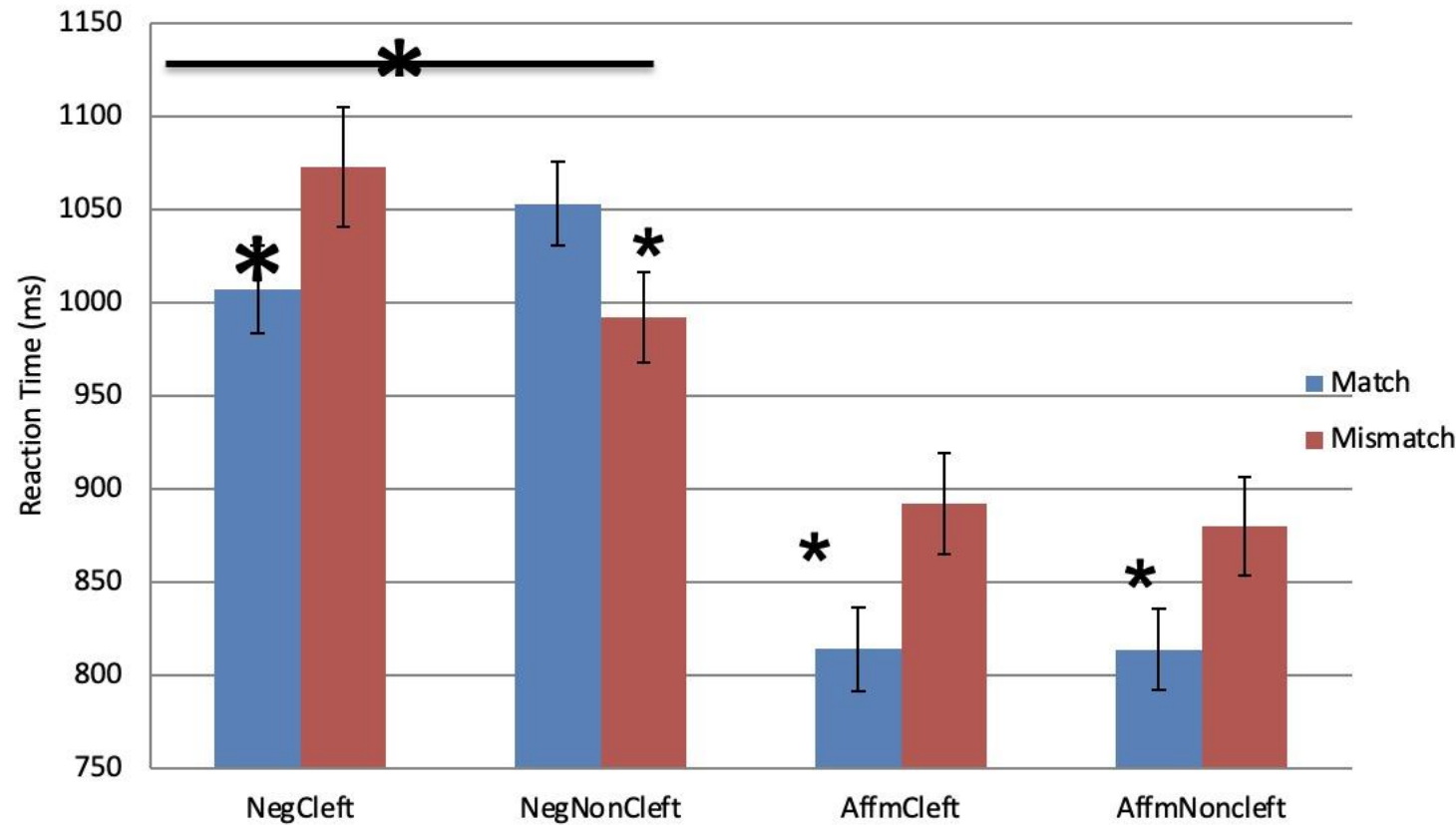
John didn't iron the shirt.



It was John who didn't iron the shirt.



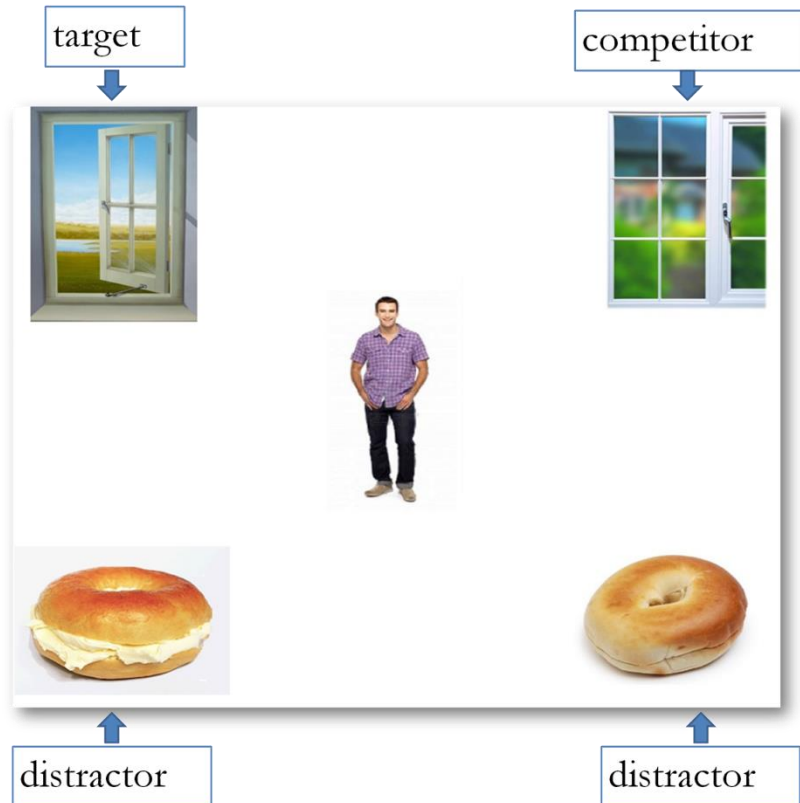
Tian, Breheny & Ferguson (2010)




- The results suggest that the representation of the positive counterpart is not a mandatory first step of negation processing.
- It is probably due to the process of context inference.
- Without further contextual information, the structure of a simple negative sentence draws participants' attention to the positive counterpart that is at issue.

Move to Visual World

Context inference on-line (Tian et al. 2016)



	Simple	Cleft
Affm	Matt has shut his dad's window.	It is Matt who has shut his dad's window.
Neg	Matt hasn't shut his dad's window.	It is Matt who hasn't shut his dad's window.

Context inference on-line (Tian et al. 2016)

QUDs, Negation and Clefting

	Simple	Cleft
Affm	Matt has shut his dad's window.	It is Matt who has shut his dad's window.
QUD	<i>Has Matt shut his dad's window?</i>	<i>Who has shut their dad's window?</i>
Neg	Matt hasn't shut his dad's window.	It is Matt who hasn't shut his dad's window.
QUD	<i>Has Matt shut his dad's window?</i>	<i>Who hasn't shut their dad's window?</i>

Context inference on-line (Tian et al. 2016)

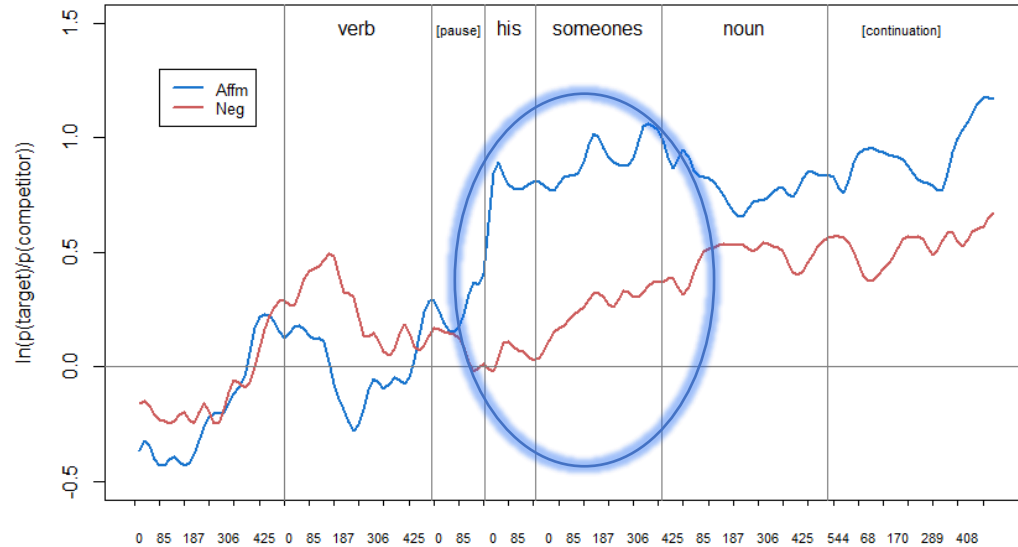
	Simple	Cleft
Affm	Positive sentence	Positive sentence
QUD	Positive QUD	Positive QUD
Neg	Negative sentence	Negative sentence
QUD	Positive QUD	Negative QUD

Predictions

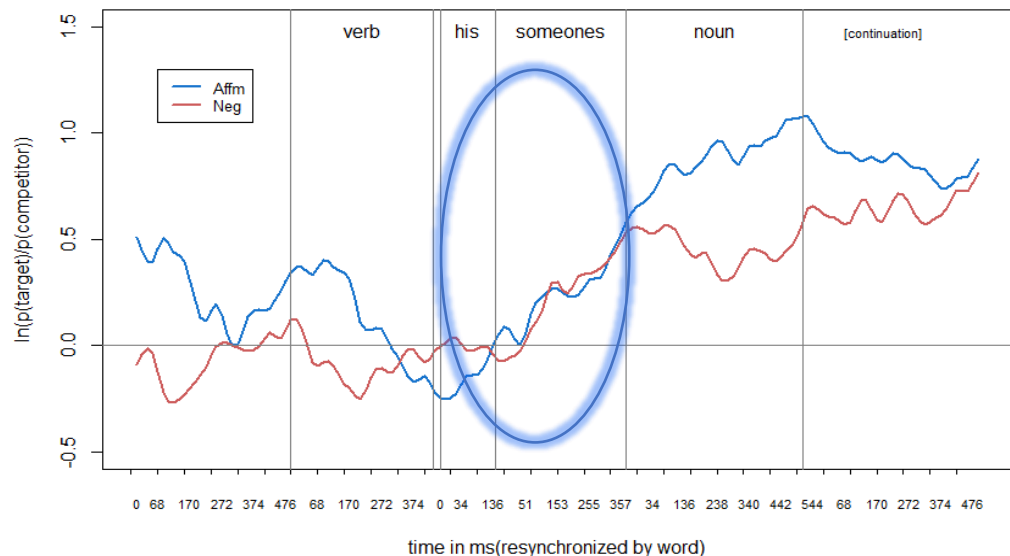
- For simple sentences, more interference from the competitor for negative compared to positive sentences.
 - Due to the inference of the default context.
- For cleft sentences, no more interference for negatives than positive sentences.
 - Negation is incorporated incrementally: more looks to the target before onset of noun, at least in the cleft case.

Context inference on-line (Tian et al. 2016)

Simple



Cleft



- For simple sentences, there is a difference in log ratios between positive and negative from the offset of verb to the offset of noun.
- For cleft sentences, there is no difference between positives and negatives shortly after the verb.

Interim Summary

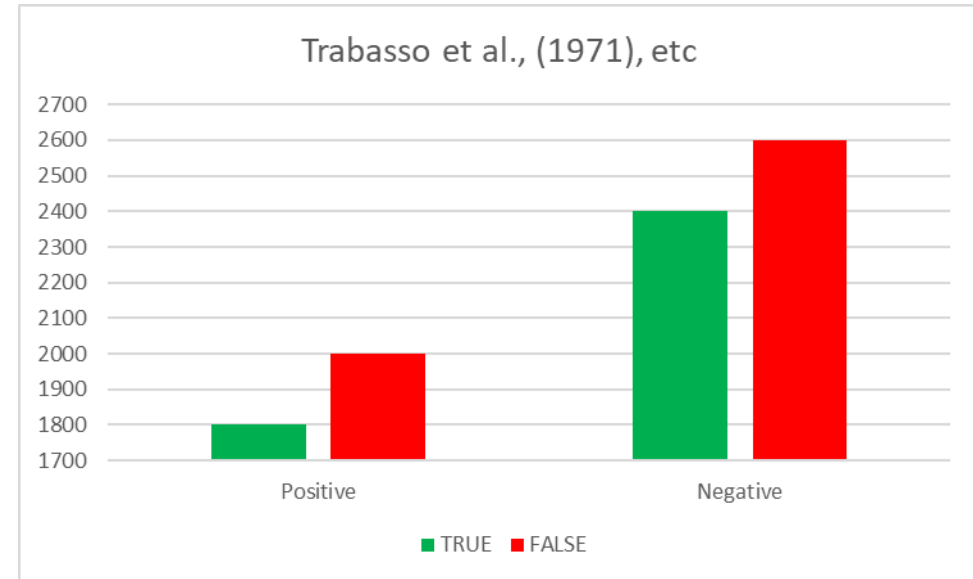
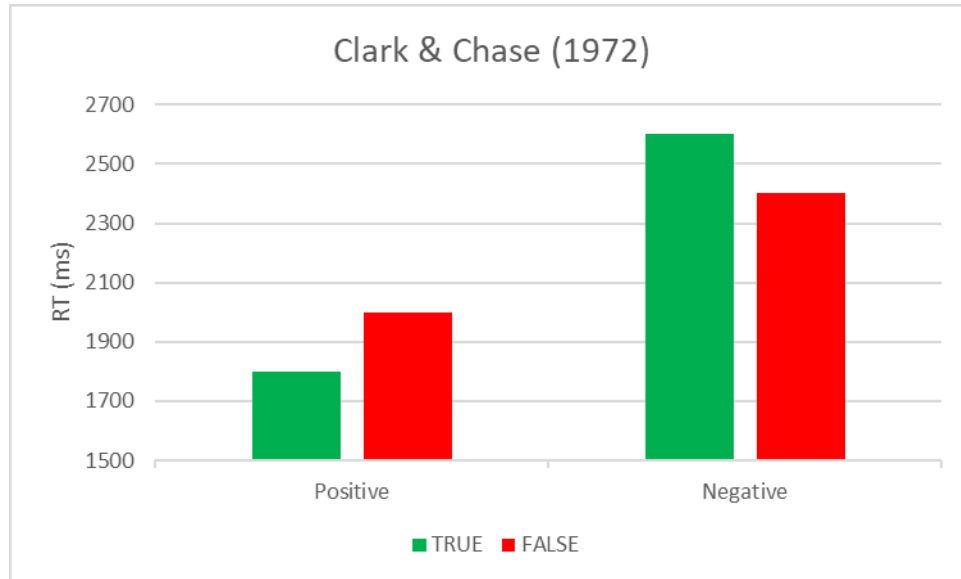
- We have some evidence that participants spontaneously infer the intended context even in the absence of contextual support.
- Cleft condition shows that when the intended context is consistent, the time course for processing negatives is the same as positives.
- Simple negatives take longer to process than their positive counterparts due to the interference with inferring context.
- Our results show that the process of context inference is incorporated incrementally.

Extend to Sentence Verification Task

Clark & Chase (1972)

‘The star is not above the plus.’

Some other studies find *Main Effect* of both polarity and truth value.



No significant difference in truth value for negative sentences (TN=FN).

Multiple Strategies

- Two-Step

- Evaluate the prejacnet and then reverse response

$$RT_{TA} < RT_{FA} \quad \longrightarrow \quad RT_{FN} < RT_{TN}$$

- One-step /Interpretive

- Infer what a truth-maker looks like and check it against the image

RT for False > RT for True

Two Views of Negative Sentence Comprehension

- Composite approach: preadjacent represented separately by comprehension processes.
- Clark & Chase (1972); Carpenter & Just (1975); Hasson & Glucksberg (2006); Kaup et al. (2006; 2007), etc.
- Interpretive approach: represent content on the assumption that the sentence is true.
- Tanenhaus, Carroll & Bever (1976).

An Interpretivist Approach and the Role for the Source of Relevance



- Language processing has two simultaneous aims: to compute the content of the utterance and the intended Source of Relevance.
 - Information drawn from the linguistic stimulus itself.
- Without contextual support, sentential negation acts as a strong cue to a SoR where the positive argument is a live possibility, which the speaker intends to exclude.
 - The default context is one in which a positive state of affairs is at issue.
- The presence of other cues (e.g. information structure, prosodic information) can override this (Tian et al., 2010; 2016).

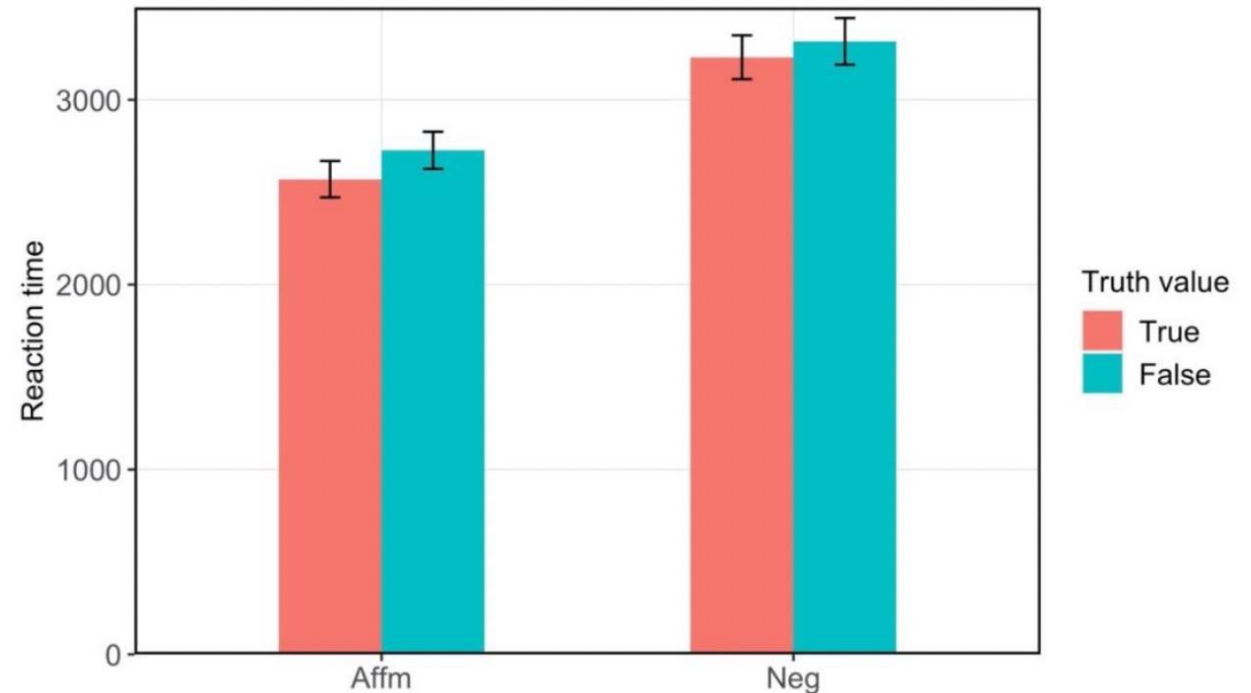
The Context Effects on Negation Processing in Sentence Verification Tasks

Wang et al. (2021)

Experiment 1a Baseline Sentence-Picture Verification Task

- There were only main effects of polarity ($p < .001$) and truth value ($p = .01$).









Polarity	Truth Value	Sentence	Display
Affm	True	The apple is peeled.	
Neg	False	The apple isn't peeled.	



Experiment 1b Sentence-Picture Verification Task (Context Manipulation)

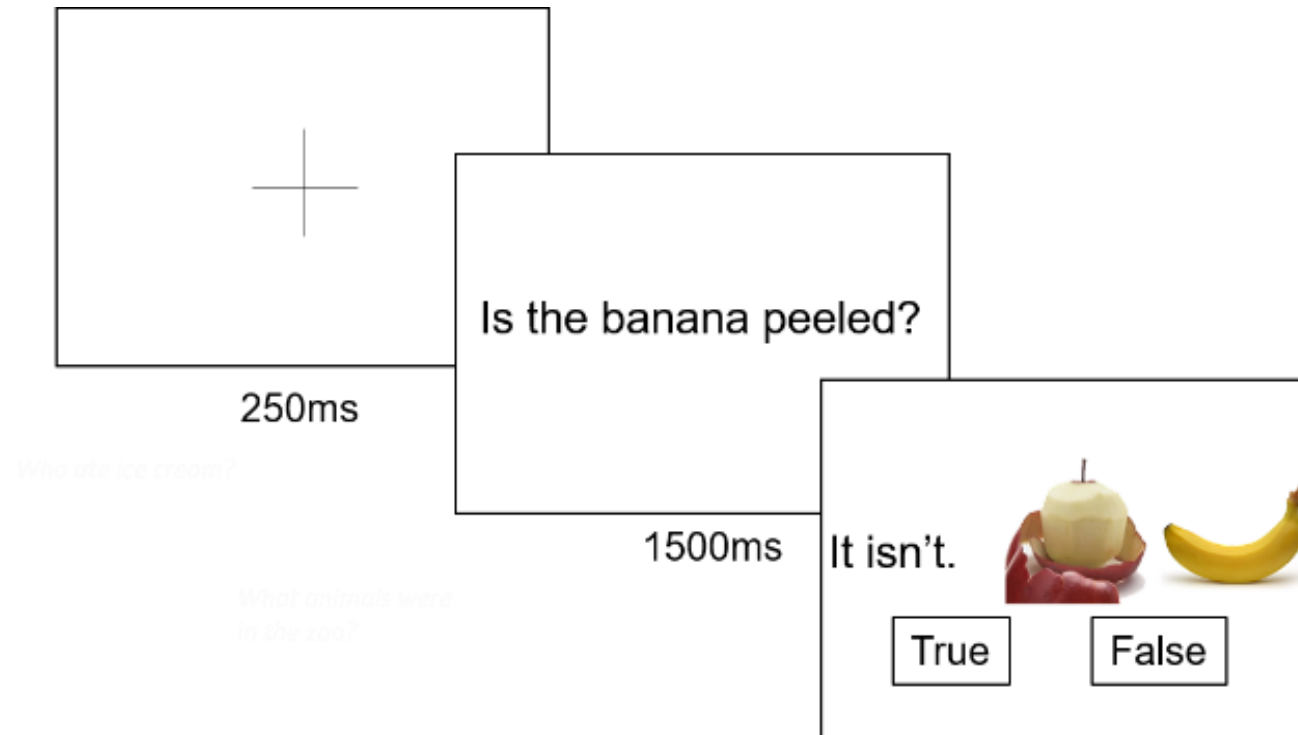
- Two types of question were used to manipulate the context.
- Prediction: greater bias to an interactive RT pattern in Default context (TA < FA; TN > FN).

Table 2 Experimental design and example items for Experiment 1b

Context	Polarity	Truth value	Question	Elided answer	Display
Default	Affm	True	Is the apple peeled?	It is.	
Congruent	Affm	True	Which one is peeled?	The apple.	
Default	Neg	False	Is the apple peeled?	It isn't.	
Congruent	Neg	False	Which one isn't peeled?	The apple.	
Default	Affm	False	Is the apple peeled?	It is.	
Congruent	Affm	False	Which one is peeled?	The apple.	
Default	Neg	True	Is the apple peeled?	It isn't.	
Congruent	Neg	True	Which one isn't peeled?	The apple.	

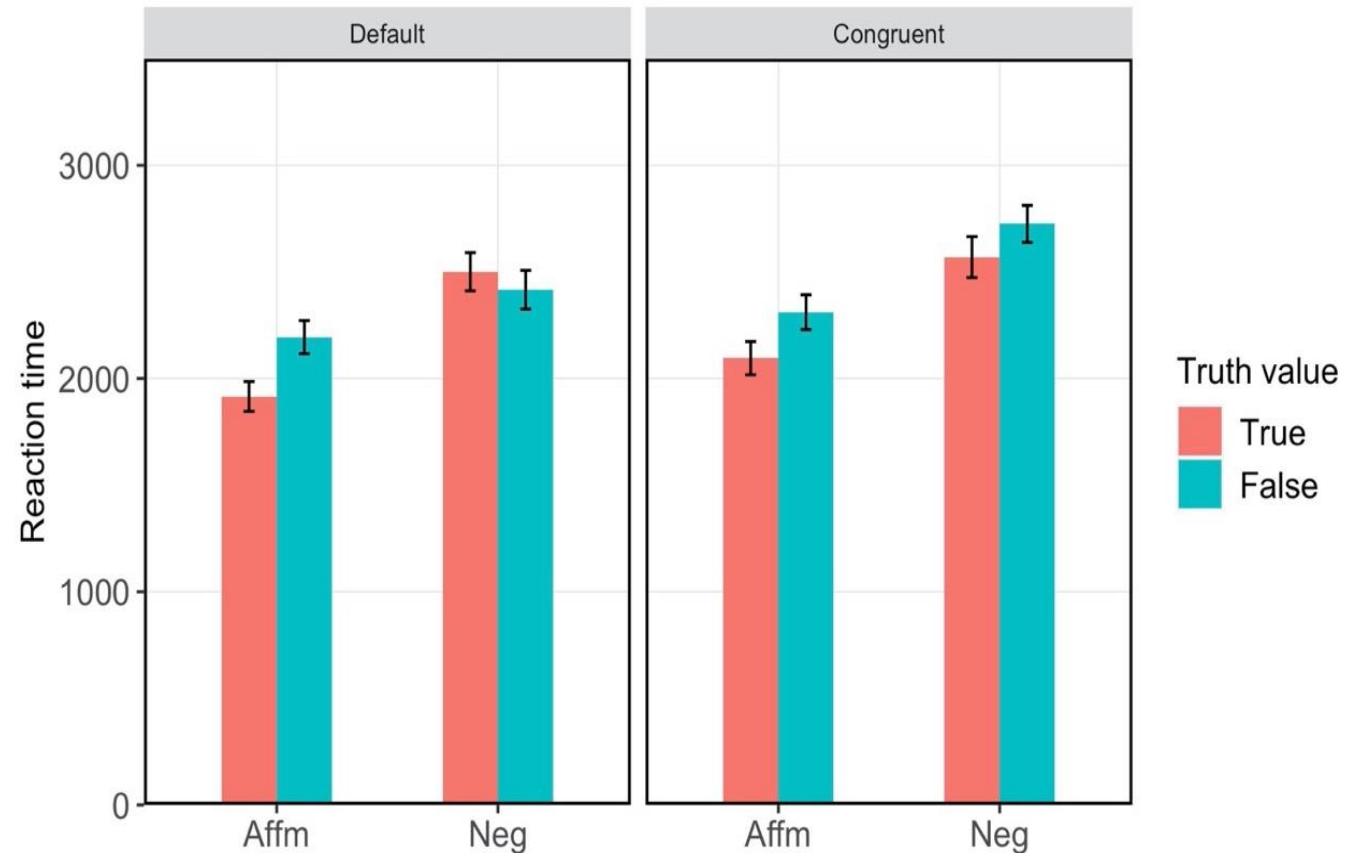
Procedure

- Within-subject design: Context (default vs. congruent) * Polarity (affm vs. neg) * Truth value (true vs. false)

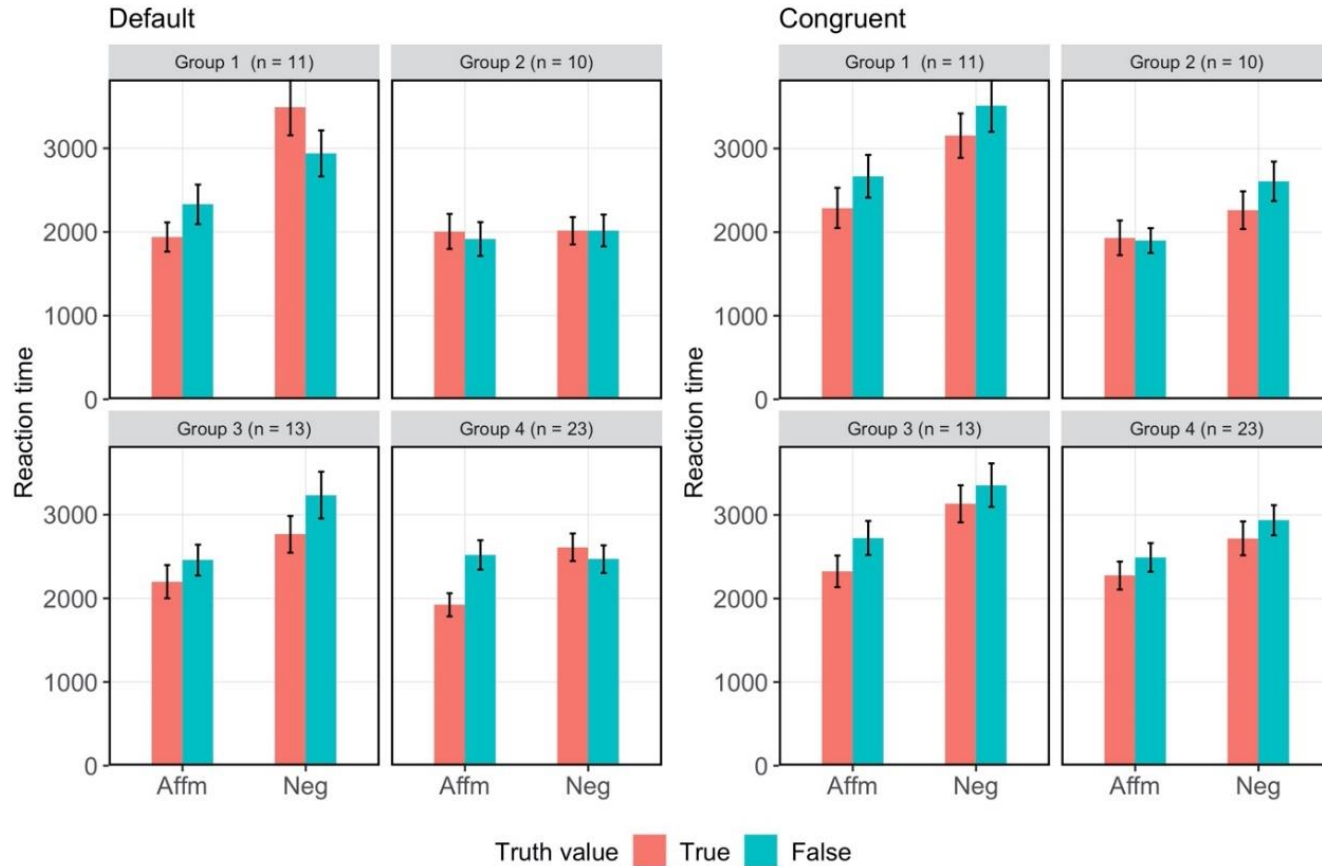


Results

- There was a significant three-way interaction.
- The **Default context** showed an interaction between polarity and truth value; there was a significant difference only for affirmatives between true and false (TA < FA; TN = FN).
- The **Congruent context** showed only main effects (TA < FA; TN < FN).



Results-Cluster Analysis



- Group 1 and 4 (N=34) showed an interaction pattern in Default context (TA < FA, FN < TN); but only main effects in the congruent context (TA < FA; TN < FN);
- Group 3 (N=13) showed only significant main effects in both contexts.
- Group 2 (N=10) showed less clear pattern though this group did show a delay for FN than TN in congruent context.

Discussion

The same group of participants switch their processing strategy according to the question context.

→ It is the context that is responsible for the use of two-step strategy.

What factors determine strategy

- **Individual abilities/preferences of participant**

--Greater visual-spatial ability: adoption of the interpretive strategy (Macleod et al.,1978; Matthews et al.,1980).

--Applying one or the other strategy throughout the course of SPV task (Clark, 1974; Carpenter & Just, 1975).

- **Type of predicates**

Bipolar predicate:

The banana is/is not peeled.



Unipolar predicate:

The dots are/are not red.





Interpretive strategy will be discouraged without bipolar predicates (Kroll & Corrigan,1981; Mayo et al., 2004; Orenes et al., 2014)

- **Manner of presentation**

--On the same display (FN<TN, Clark&Chase, 1972) or at a delay (TN<FN, Tversky,1975)

A Wrinkle in Sentence Verification Design

- $[S]$ = The banana is peeled / The banana isn't peeled.
- Task question: what is the truth value of $[S]$?

- Verification tasks stimuli may be construed as declarative polar questions.
 - The banana is peeled. The banana is peeled?
 - The banana isn't peeled.  The banana isn't peeled?
 - 

- Could this be a separate factor, biasing participants to adopt a two-step strategy in SPV task?

Question-Answering Systems

The banana is peeled?

English

- **Yes**, it is.
- **No**, it isn't.

Mandarin

- **Yes (shì)**, it is.
- **No (bù)**, it isn't.

English speakers use a '**polarity-based**' strategy to respond to questions (Pope, 1973).

The banana isn't peeled?

English

- **Yes**, it is.
- **No**, it isn't.

Mandarin

- **No (bù)**, it is.
- **Yes (shì)**, it isn't.

Mandarin speakers use a '**truth-based**' strategy to respond to questions (Jones, 1999).

Question-Answering Systems



The banana isn't peeled?

- | | | | |
|-------------------------|--------------------------|---|-----------------|
| • Yes , it is. | • No , it is. | ← | Confirmation |
| • No , it isn't. | • Yes , it isn't. | ← | Disconfirmation |

- Zhang & Vanek (2021) show that for both English and Mandarin speakers, confirmation strategy is 100% adhered to; disconfirmation leads to more mixed strategies.
- It is expected to find more evidence of a *two-step strategy* pattern if English participants follow the polarity-based question-answering strategy.

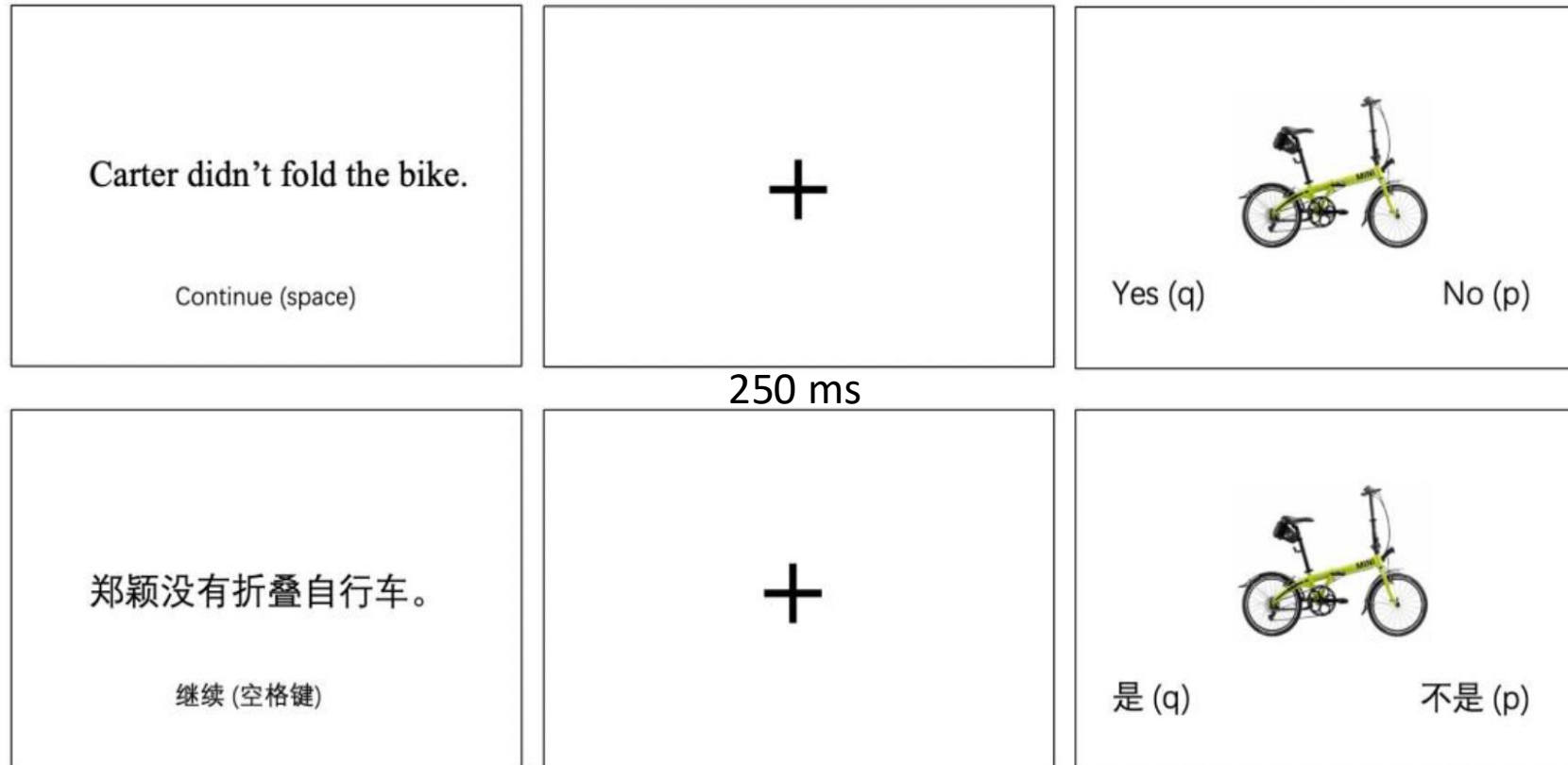
Experiments

- Baseline task: Visual Probe Recognition Task
- Main task: Sentence Verification Task
- 2 (Polarity: affirmative/negative) x 2 (Congruence: true-match / false-mismatch) x 2 (Language: English/Mandarin) x 2 (Task: VPT/SPVT) mixed factorial design
- Each task recruits 48 native speakers

Polarity	TV	Language	Sentence	Display
Affm	True	English	Carter folded the bike.	
		Mandarin	郑颖折叠了自行车。 Zhèng Yǐng zhé dié le zìxíngchē	
Neg	False	English	Carter didn't fold the bike.	
		Mandarin	郑颖没折叠自行车。 Zhèng Yǐng méizhé dié zìxíngchē	
Affm	False	English	Carter folded the bike.	
		Mandarin	郑颖折叠了自行车。 Zhèng Yǐng zhé dié le zìxíngchē	
Neg	True	English	Carter didn't fold the bike.	
		Mandarin	郑颖没折叠自行车。 Zhèng Yǐng méizhé dié zìxíngchē	

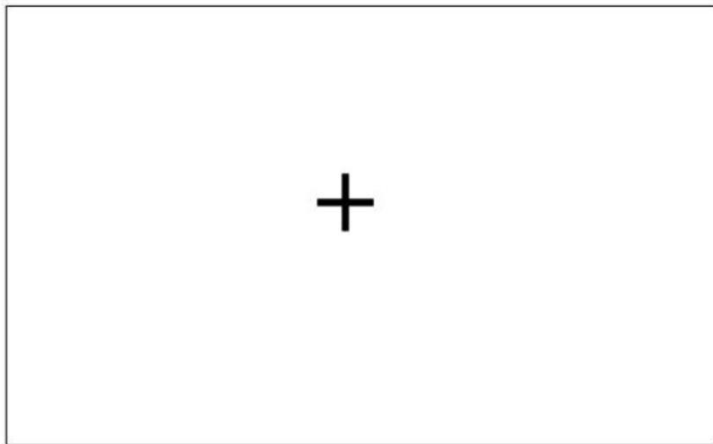
Visual Probe Recognition Tasks

- Example trials of a Neg-Match sentence.

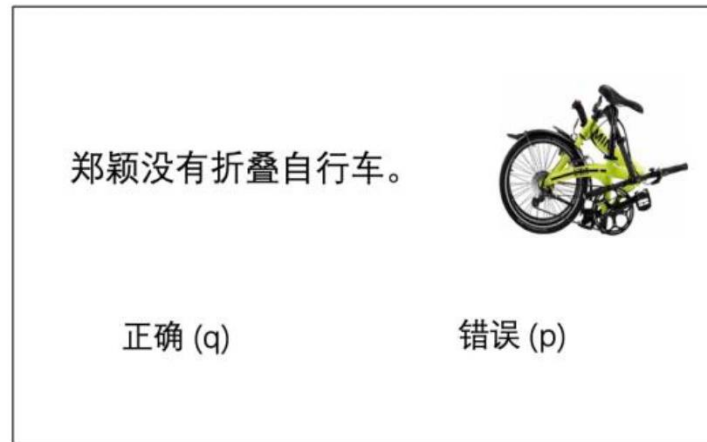
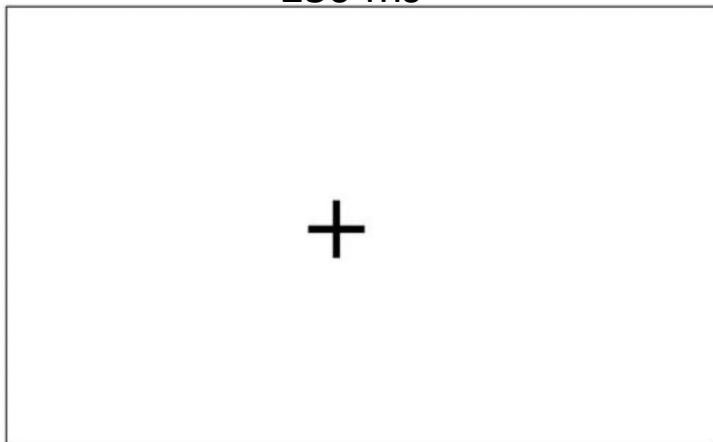
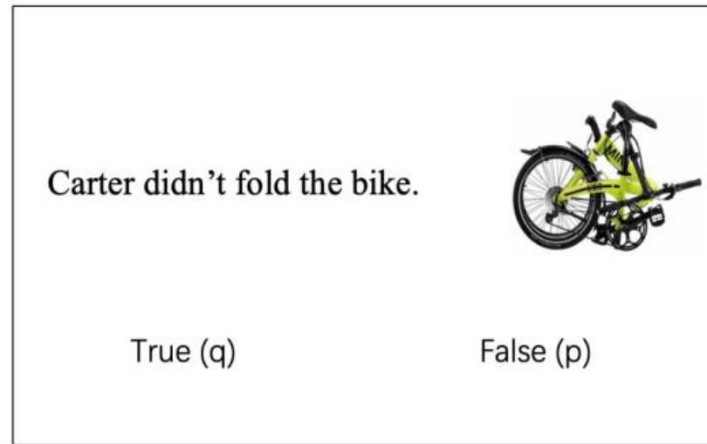


Sentence-Picture Verification Tasks

- Example trials of a Neg-False sentence.



250 ms



Accuracy

- Overall a four-way interaction ($p=.03$).

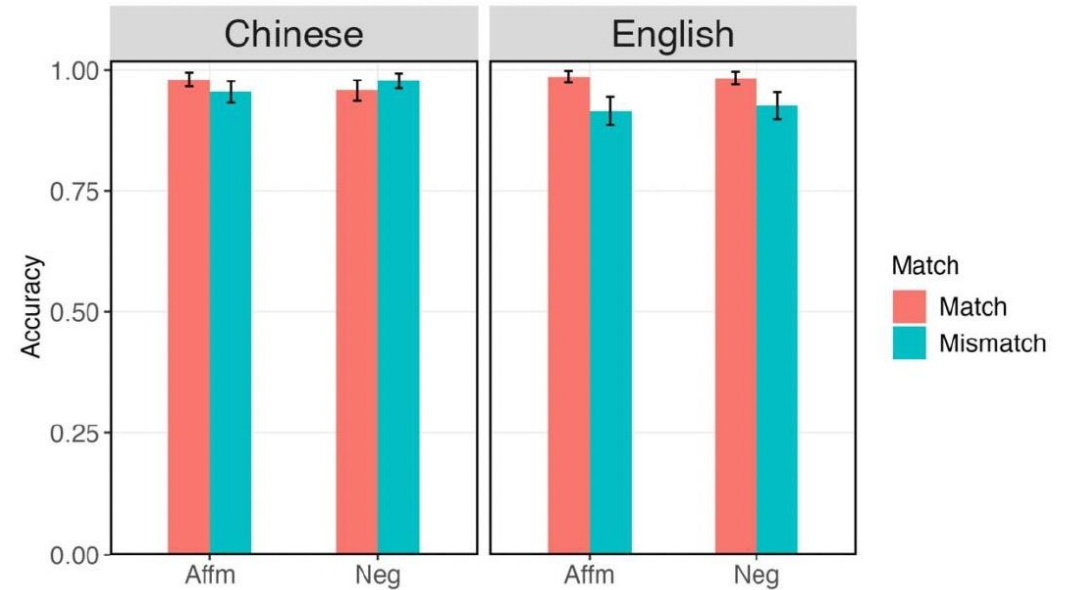
Visual Probe Tasks:

- Main effect of match ($p=.01$);
- The three-way interaction didn't reach the significance:
 - Mandarin group: only an interaction between polarity and match ($p=.02$).
 - English group: only a significant main effect of match ($p=.002$).

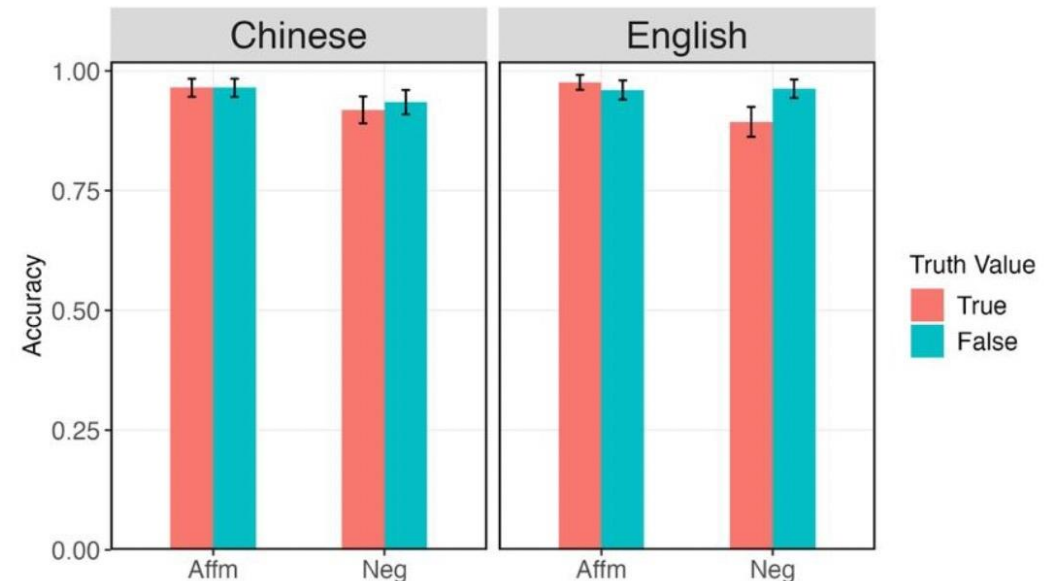
Sentence Verification Tasks:

- Main effects of polarity and truth value ($ps<.01$);
- A three-way interaction between polarity, truth value and language ($p=.05$).
- Mandarin group: a main effect of polarity ($p=.01$) and a marginal main effect of truth value ($p=.06$).
- English group: only an interaction between polarity and truth value ($p=.003$).

Visual Probe Recognition Tasks



Sentence Picture verification Tasks



Reaction Time

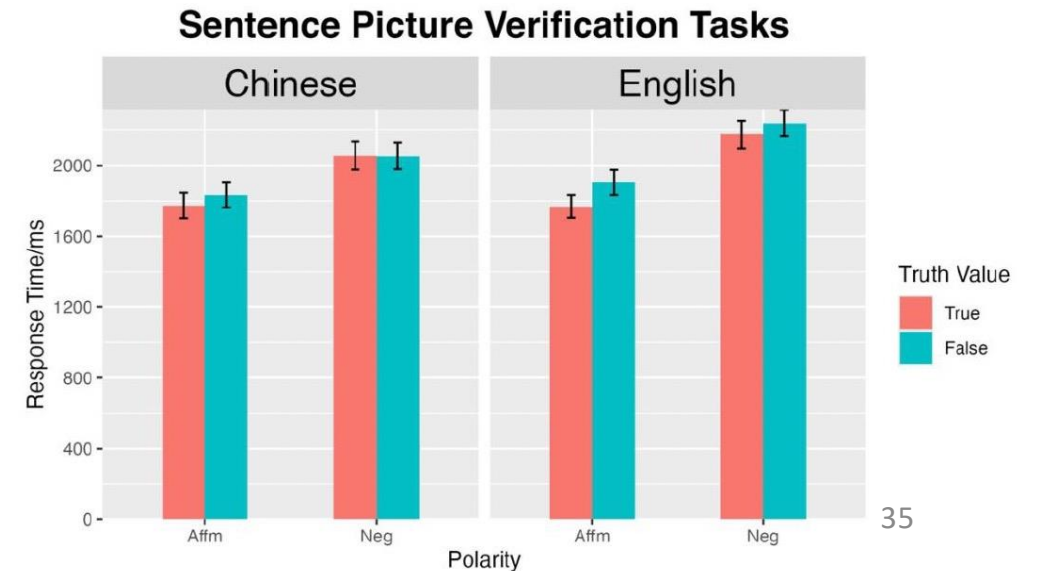
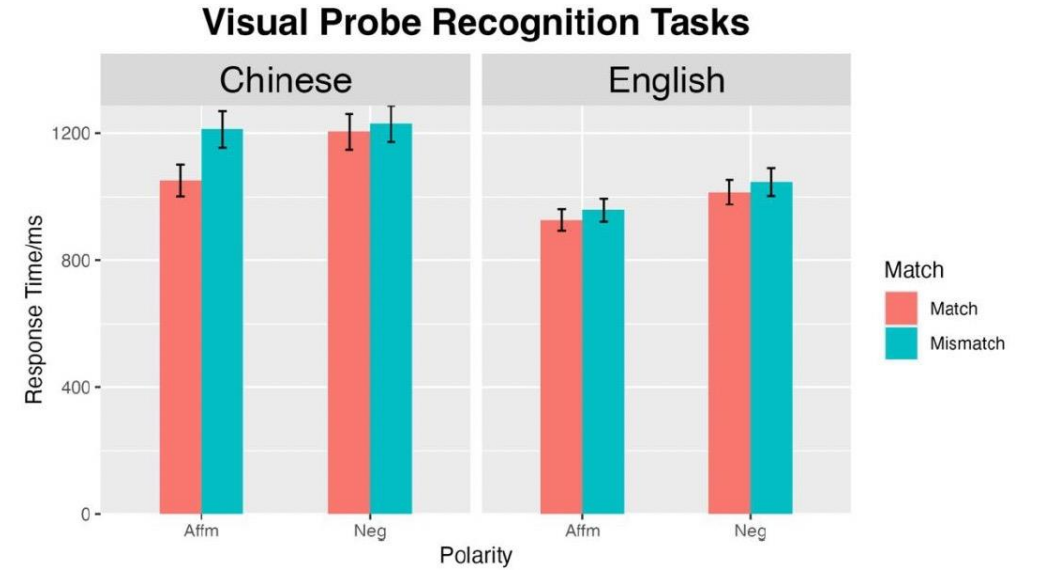
- The four-way interaction missed the significance ($p=0.10$).

Visual Probe Tasks:

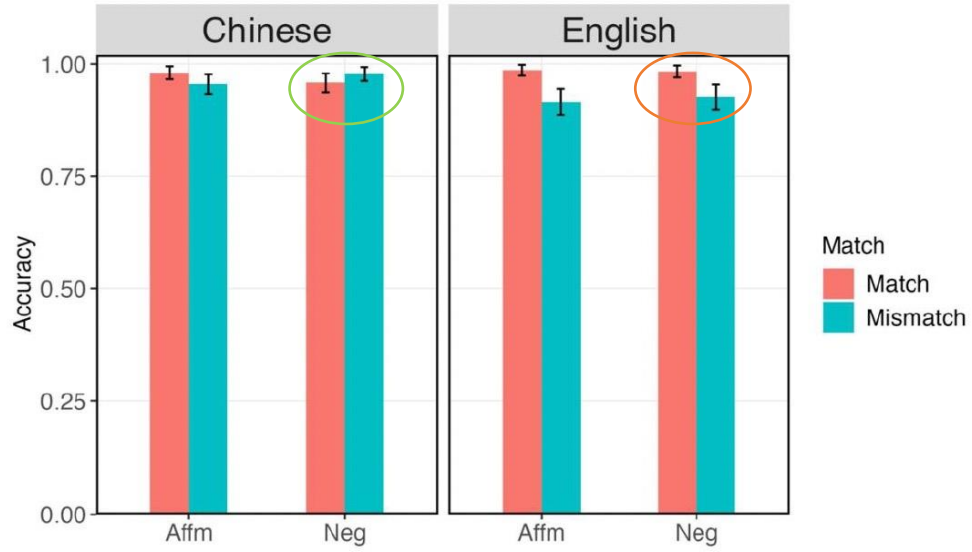
- A significant three-way interaction ($p=.02$).
- Mandarin group: Main effects of polarity and match ($ps=.001$); a significant interaction ($p=.002$).
- English group: only main effects of polarity ($p<.001$) and match ($p=.01$).

Sentence Verification Tasks:

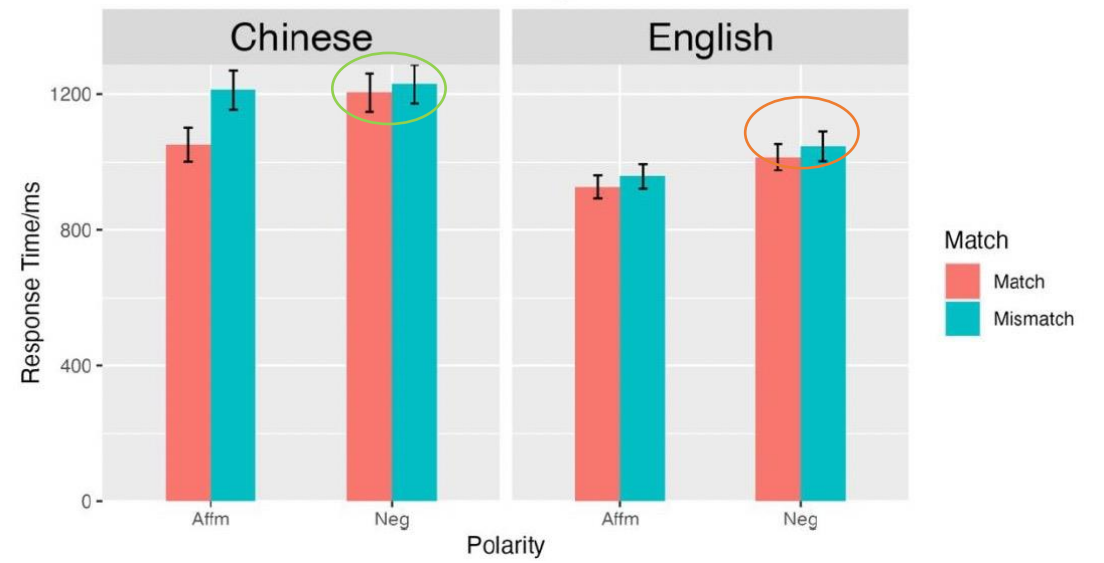
- Main effects of polarity and truth value ($ps<.001$).
- Interaction between language and polarity ($p=.004$).



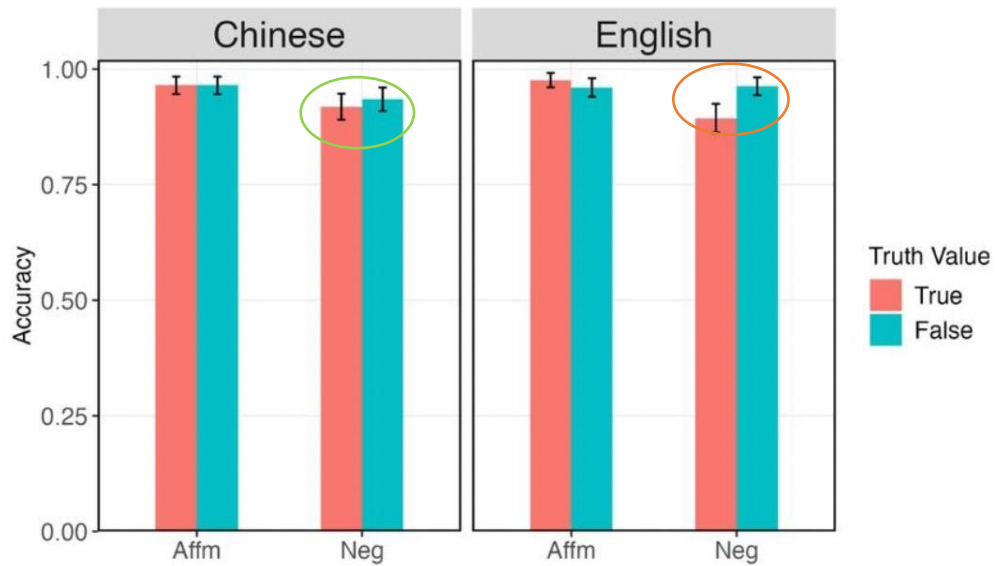
Visual Probe Recognition Tasks



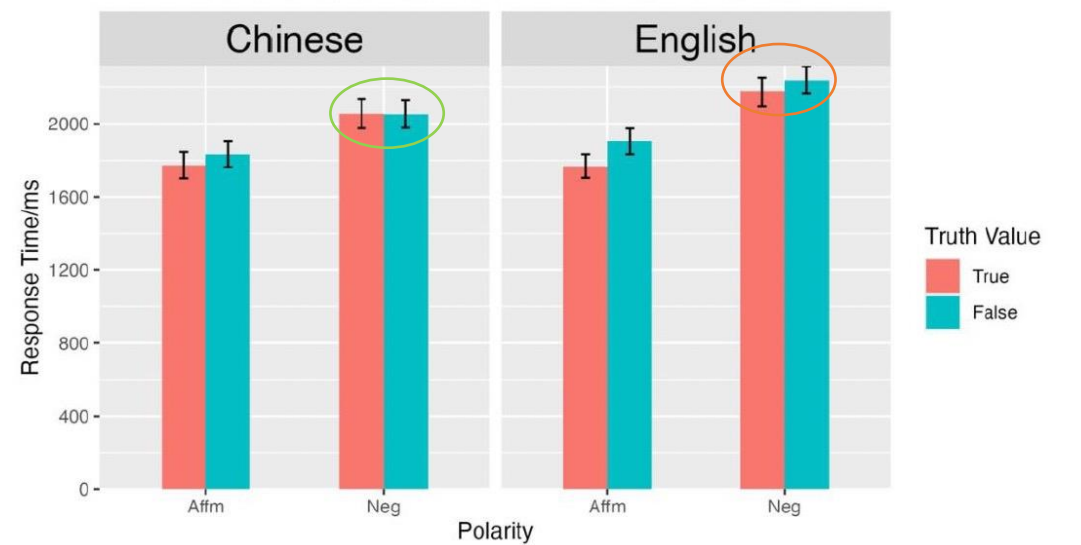
Visual Probe Recognition Tasks



Sentence Picture verification Tasks



Sentence Picture Verification Tasks



Conclusion

- Our results point to that language-specific factor may lead individuals to adopt two-step procedure in the verification tasks.

Thank you :)

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