



Spatial Metaphors for Time in Language Foster Non-Linguistic Representations of Time in Thinking: Evidence from Chinese-English Bilinguals

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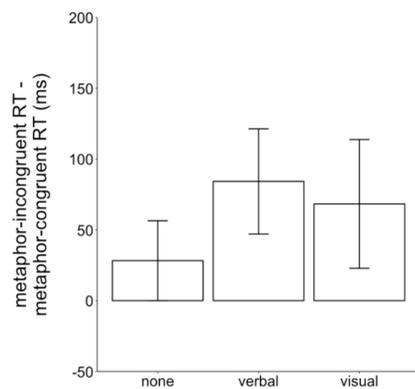
Previous work

Can learning new linguistic metaphors for time shape the way people think about it?

English speakers learned new vertical metaphors for time (i.e., *breakfast is above dinner* or *breakfast is below dinner*)

They made time judgments when the task was congruent and incongruent with their newly learned metaphors → showed mental representations of time consistent with new metaphors

Representations persisted under verbal interference, suggesting they are **non-linguistic** in nature



Hendricks & Boroditsky, 2015.

Current Work

Are representations acquired by learning new metaphors **similar in nature** to those acquired through natural language experience (for example, speaking Chinese, which uses vertical metaphors for talking about time)?

Chinese metaphors: earlier events above later

Ex: shàng = up; xià = down

shàng ge yuè = last month; xià ge yuè = next month

Exp 1: Examined Chinese-English bilinguals' vertical mental timelines under verbal and visual interference

Exp 2: Compared Chinese-English bilinguals' natural language and newly learned representations by **training** participants to use metaphors consistent or inconsistent with those in Chinese

Methods

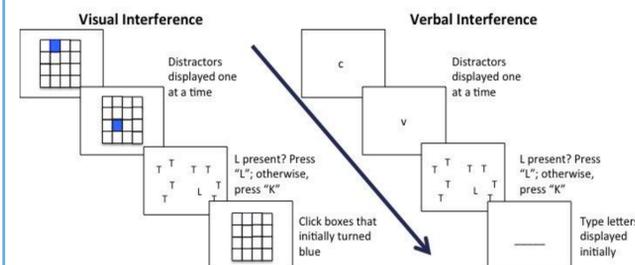
Experiment 1

110 UCSD undergraduates who spoke Mandarin Chinese

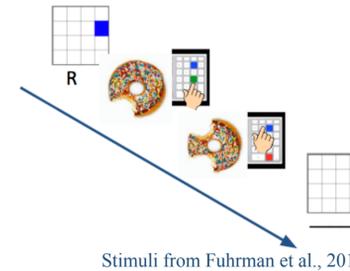
Average English proficiency of 4.06/5 (SD=.87);
Mandarin proficiency of 4.88/5 (SD=.39)

Participants instructed in Mandarin by a native Mandarin speaker

1) Interference Calibration: to account for individual differences in ability



2) Time Judgment Task + Interference



Experiment 2

48 UCSD undergraduates; self-identified as native English speakers

All were Chinese-English bilinguals

Average English proficiency of 4.72 (SD=.26);
Mandarin proficiency of 3.16 (SD=1.18)

Participants learned a new way to talk about time

In April. February is [above/below] us.

Black & white movies were invented [higher/lower] than color movies.

Adapted from Homke et al., 2013

The rest was identical to the procedure in Experiment 1

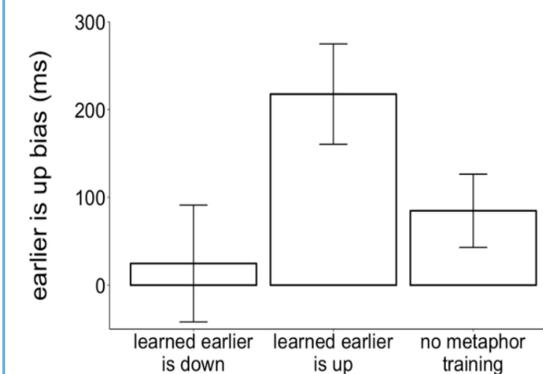
Entire experiment conducted in English

Results

Experiment 1

People were faster when the keys were congruent with **Chinese language metaphors** (1868 ms) than incongruent (1952 ms)

Congruency effects persisted under interference



Congruency effect (Earlier is up bias) for Exp 1 (far right) and Exp 2.

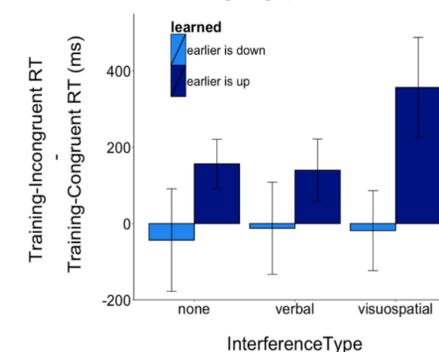
Experiment 2

People were faster when the keys were congruent with **newly-learned metaphors** (1563 ms) than incongruent (1660 ms)

Congruency effects persisted under interference

People were ALSO faster when keys were congruent with **Chinese language metaphors** (1551 ms) than incongruent (1672 ms)

No difference in size of congruency effects consistent with new metaphors and with natural language)



Conclusions

Experiment 1

Natural language-consistent biases (placing earlier events above later ones) persisted under interference

Representations from long-term language experience are non-linguistic, like those that arose from newly-learned metaphors (Hendricks & Boroditsky, 2015)

Experiment 2

Mental representations consistent with **long-term** and **newly-learned** metaphors are comparable in size

Both persist under interference

Comparing Exp. 1 and 2

When Chinese-English participants learned metaphors in the lab (Exp 2) that...

- reinforced Chinese natural language metaphors (earlier is up) → stronger earlier-is-up bias...
- Contradicted Chinese natural language metaphors (earlier is down) → weaker earlier-is-up bias...

...than learning nothing in the lab (Exp. 1)

Linguistic metaphors, whether newly-learned or acquired through long-term language experience, can create non-linguistic representations for thinking about time.

References

- Fuhrman & Boroditsky, 2010. Cross-Cultural Differences in Mental Representations of Time: Evidence From an Implicit Nonlinguistic Task. *Cognitive Science*.
- Hendricks & Boroditsky, 2015. Spatial metaphors for time in language foster non-linguistic representations of time in Thinking: Evidence from Chinese-English bilinguals. *CogSci 2017*.
- Homke, Majid, & Boroditsky, 2013. Reversing the direction of time: Does the visibility of spatial representations of time shape temporal focus?

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