Language Shapes Cognition: Mandarin Speaker's Conception of Different Duration of Time

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ABSTRACT

Does language shape thought? We use an experiment about Mandarin speaker's temporal cognition to answer this question in this study. Mandarin has four temporal prepositions that have spatiotemporal metaphors: two of them are horizontal (qian "front" and hou "back"), and the other two are vertical (shang "up" and xia "down"). In Mandarin, the horizontal terms are more frequent in a shorter duration of time, such as second and day (e. g. qian yi tian "front a day" which means the last day, and qian yi miao "front a second" which means the last second), whereas the vertical terms are more frequent in longer duration of time, such as week, month, year, and century (e. g. shang ge yue "up [quantifier] month" which means the last month). In this study, Mandarin native speakers are asked to answer a question about a short or long duration of time prime questions. In answering a prime question, the participants are shown a picture with a horizontal or vertical feature (for instance, a horizontal prime picture shows two dogs running from the left to the right), and we ask a yes-or-no question about the picture. We record the reaction time of each target question about time expression. The result is "short (horizontal – vertical)" < "long (horizontal – vertical)", which indicates that Mandarin native speakers tend to use the horizontal way to think of a shorter duration of time and use the vertical way to think of a longer duration of time. Since in Mandarin, shorter stretches of time are more frequently expressed in horizontal terms, and longer stretches of time are more frequently expressed in vertical terms, this cognitive pattern of perceiving short or long time as horizontal or vertical concepts resembles the pattern in the Mandarin language. The language matches shorter stretches of time with horizontal terms, and this lets the speakers adapt the horizontal thinking mode for shorter stretches of time. The same process happens in vertical terms and longer stretches of time. We conclude that language affects Mandarin native speakers' temporal cognition.

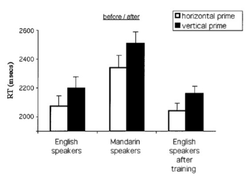
INTRODUCTION

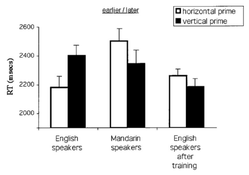
Boroditsky(2001):

Mandarin: vertical & horizontal spatiotemporal metaphor

English: only horizontal

Conclusion: Mandarin speakers think of time horizontally and vertically, but English speakers think of time horizontally → language shapes thought (weak Worfian hypothesis)





My observation:

Different durations of time is associated with different spatiotemporal metaphors. (supported by data in CCL corpus)

Short duration of time (day, seconds): horizontal >> vertical

Longer duration of time (week, month, century): vertical >> horizontal

EXPERIMENT DESIGN

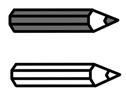
Experiment Principle: The experiment uses the priming effect. The priming effect occurs when the participants are exposed to a certain stimulus that would influence the participants' behavior subconsciously. In this experiment, we use pictures as primes. The pictures show either a horizontal or vertical relationship between two objects.

Participants: 30 Mandarin native speakers aged from 17 to 56. They are all students or teachers at a high school in Beijing. Most of them has English as their second language.

Preparation: There are 2 practice questions and 12 experimental trials, 6 of which are horizontal primes and the others are vertical primes. In each practice question, 1 prime question and 1 target question are needed. In each experimental trial, 2 prime questions and 1 target question are needed. There are also 2 filler questions. We create 14 horizontal prime pictures, 14 vertical prime pictures, and 16 questions. All the questions in the study are yes-or-no questions.

Experiment Procedure: The Mandarin speakers are asked to look at a horizontal or vertical priming picture that shows a horizontal or vertical relationship between two objects. The researchers would ask a priming question about the picture. All languages used in this experiment are Mandarin.

The figure above is an example of horizontal prime, with the priming question "TRUE/FALSE: The black dog won."



This figure is a vertical prime, with the priming question "TRUE/FALSE: The white pencil is below the black pencil."

After every priming question, the participants are asked a question related to time. The duration of time in the question is either of the following: day, week, month, year and century. Example target questions are listed below:

Day

四月一号比四月四号早。*April the first comes earlier than April the fourth.*

Week

第五周比第一周晚。*The fifth week comes later than the first week.*

Month

三月比四月早。*March comes earlier than April.*

Year

二零一三年比二零零八年晚。*2013 comes later than 2008.*

Century

十三世纪晚于十世纪。*The 13th century comes later than the 10th century.*

Each participant is asked 2 practice questions and 12 experimental trials. Each experimental trial consists of two priming questions (both horizontal or both vertical) and one target question. In each trial, the researcher records the answers to the target questions and use the spectrogram to calculate the response time (the time when the sound of the question ended minus the time when the participant first makes a sound).

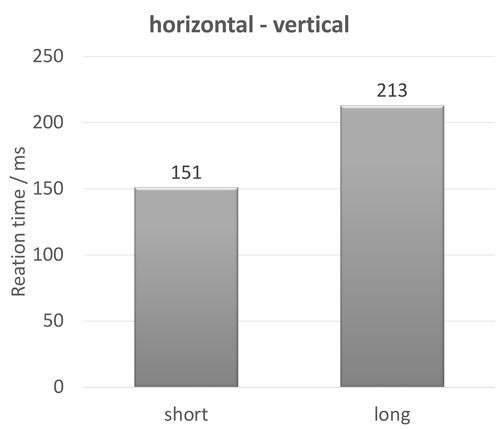
RESULTS

The reaction time of time type versus prime type (in milliseconds)

Time / prime type	Horizontal	Vertical
Long time	792.9	580.1
Short time	843.3	692.4

We construct a Chi-square test for independence with a null hypothesis that different prime types produce similar reaction times for different stretches of time. An alternative hypothesis of different prime types affects the reaction time. $p=0.12 > 0.01$. We fail to reject H0. We could not say that the reaction time of different time types is necessarily associated with prime types.

However, if we look at the difference between reaction times of prime types, there is a difference. The average difference in reaction time for answering short time questions is significantly smaller than the difference in reaction time for answering long time questions (horizontal minus vertical). This shows that after viewing a horizontal prime, answering short time questions takes a shorter time and that after viewing a vertical prime, answering long time questions takes a shorter time.



This shows that Mandarin does influence people's cognition over the different duration of time. Mandarin native speakers tend to think of shorter duration of time (such as days) in horizontal ways and think of longer duration of time (such as weeks, months, years, and centuries) in vertical ways because Mandarin assigns different spatiotemporal metaphors to the different duration of time.

We could not conclude with a relationship between time type and prime type because we do not have enough sample size to show the significance. The difference between reaction times of different prime types indicates a tendency that questions about short duration are easier to answer after a horizontal prime, whereas questions about long duration are easier to answer after a vertical prime.

CONCLUSIONS

Mandarin native speakers' temporal cognition of different duration of time resembles the pattern in temporal terms in Mandarin: they use the horizontal way to think of shorter time units such as second and day and use the vertical way to think of longer time units such as week, month, year, and century. This resembles the pattern in Mandarin because, in the context of a shorter duration of time, horizontal spatiotemporal metaphors (*qian* "front" and *hou* "back") are more frequent than vertical spatiotemporal metaphors (*shang* "up" and *xia* "down). On the other hand, vertical spatiotemporal metaphors are more frequent than horizontal spatiotemporal metaphors in the context of a longer duration of time. These are proved by the data in the CCL corpus.

Our experiment shows that the reaction time of answering questions about a shorter duration of time after answering horizontal and vertical prime questions (horizontal – vertical) is shorter than the reaction time of answering questions about a longer duration of time. This means that the Mandarin native speakers tend to use the horizontal way to think of a shorter duration of time (such as second and day), and they tend to use the vertical way to think of a longer duration of time (such as week, month, year, and century).

This study proves the Whorfian hypothesis: language shapes thought. Language is an important factor that influences our cognition, even though this factor is often neglected.

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