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# Which is in front of Chinese people: Past or Future?

## A study on Chinese people's space-time mapping

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### Abstract

Recent research shows that Chinese, when they gesture about time, tend to put the past “ahead” and the future “behind”. Do they think of time in the way as suggested by their gestures? In this study we investigate whether Chinese people explicitly have such past-in-front mappings. In experiment 1 we show that when time conceptions are constructed with neutral wording (without spatial metaphors), Chinese people are more likely to have a past-in-front-mapping than Spaniards. This could be due to cultural differences in temporal focus of attention, in that Chinese people are more past-oriented than Europeans. However, additional experiments (2 & 3) show that, independent of culture, Chinese people's past-in-front mapping is sensitive to the wording of sagittal spatial metaphors. In comparison to a neutral condition, they have more past-in-front mappings when time conceptions are constructed with past-in-front spatial metaphors (“front day”, means the day before yesterday), whereas fewer past-in-front mappings are constructed with future-in-front metaphors. There thus appear to be both long-term effects of cultural attitudes on the spatialization of time, and also immediate effects of the space-time metaphors used to probe people's mental representations.

**Keywords:** cross-cultural differences; space and time; conceptual metaphor; Chinese; Temporal Focus Hypothesis

### Introduction

Across cultures people use space to represent time. The conceptions of future and past are often linguistically expressed by the use of spatial metaphors. For instance, in English, we look *forward* to the bright future lying *ahead*, or look *back* to the hard times *behind* (e.g., Clark, 1973; Lakoff & Johnson, 1980). Interestingly, studies have shown that people not only talk about time using a front-back axis, but also tend to think about time this way, i.e., the future is mentally “ahead” of the speaker, and the past is “behind” (Boroditsky, 2000; Miles, Nind & Macrae, 2010; Ulrich et al., 2012). This seems to be consistent with the bodily experience of walking in a certain direction, so that the path that we have passed by is the past and the place that we are heading towards is the future (e.g., Clark, 1973).

However, speakers of some languages exhibit the opposite space-time mapping in the sagittal axis. For example, in Aymara, the spatial words for front and back literally mean past and future (e.g., “front year” means last year, “back year” means next year). This past-in-front

mapping is also apparent from Aymara speakers' spontaneous temporal gestures (Núñez & Sweetser, 2006).

Additionally, cultures may vary about the degree to which they associate space to time. A recent study showed that different spatial-temporal mappings between Moroccans and Spaniards could be related to cross-culture differences in temporal focus (*Temporal Focus Hypothesis*). The Temporal Focus Hypothesis demonstrates that the space-time mappings in people's minds are conditioned by their cultural attitudes towards time. It is claimed to be dependent on attentional focus and can be independent from the space-time mappings enriched in language. For instance, despite the fact that front-back time metaphors in Arabic are similar to Spanish and English (future-in-front mappings), Moroccans have a strong past-in-front mapping when asked in a temporal diagram labelling experiment, whereas the majority of Spaniards have a future-in-front mapping. It has been argued that Moroccans are found to focus more on past times and old generation, and place more value on tradition in comparisons to Americans, Spaniards and other Europeans. Interestingly, that study also reveals that the focus of attention on past or future may play a role in determining the spatializing of time in people's minds. For example, after performing a short writing exercise that induces participants' focus of attention on the past, half of the Spaniards perform a past-in-front mapping, the proportion of which is higher than those without having the writing exercise (de la Fuente et al., 2014).

Although linguistic, cultural and bodily experiences have been found to have separate influences on people's spatial representation of time (e.g., Boroditsky, 2001; Fuhrman & Boroditsky, 2010; Núñez & Sweetser, 2006; Saj et al., 2014), we still have limited knowledge on why some communities adopt a future-in-front mapping whereas others a past-in-front mapping for time. For instance, Chinese people show a strong tendency to gesture according to the past-in-front mapping (Gu et al., in preparation), whereas English and Dutch people have an opposite tendency in the sagittal axis (Casasanto & Jasmin, 2012). Based on the gesture data, it would appear that Chinese speakers can think of time as the Aymara do. However, gestures about time are not only shaped by temporal thinking, but also by lexical choices (Gu et al., 2014). Given that Mandarin speakers sometimes also verbally produce “前 / qián” (front) (e.g., qián-tiān, front day, the day before yesterday) when they gesture about a past event, it could be that they just perform a forward

gesture to make it congruent with the word “qián” (front, before). Therefore, a more explicit approach will be helpful to bring a clearer picture.

Furthermore, as for the temporal focus in Chinese culture, most studies find that Chinese people are primarily past-oriented. For example, Chinese attend to a greater range of temporal information in the past than do European Canadians (Ji et al, 2009), and they perceive objects in the past as being much more valuable than their American counterparts do (Guo et al, 2012). If the cross-cultural differences in temporal focus indeed predict a different space-time mapping (*Temporal Focus Hypothesis*, de la Fuente et al., 2014), we will expect that Chinese people are more likely to have a past-in-front mapping than European people (e.g., Spaniards).

The purpose of this paper first is to find out whether Chinese people indeed have a past-in-front mapping. If they do, then we further explore possible accounts for that mapping.

### Experiment 1: Do Chinese people place the past events in front?

Rather than the gesture approach that tested implicit knowledge of sagittal timeline (Gu et al., in preparation), in experiment 1 a more explicit paradigm was used to examine whether Chinese people have a past-in-front mapping. This paradigm has been used to test Moroccans and Spaniards to study the cross-cultural differences in space-time mapping at the sagittal axis (de la Fuente et al., 2014), and we use their Spanish data as comparison materials.

### Method

#### Participants

38 Mandarin speakers participated in the experiment. They were tested in Rizhao, China, and all materials were in Mandarin.

#### Materials and Procedure

Participants performed a temporal diagram task adapted from de la Fuente et al., (2014, Experiment 1). Participants sat at a table and they saw a toy doll (named Xiaoming) with one box in front of the toy and one box behind it. Participants and the character faced the same direction in the sagittal plane (Fig. 1). Participants read that yesterday (昨天, zuó-tiān) Xiaoming went to visit a friend who liked eating apples, and tomorrow (明天, míng-tiān) he would be going to visit a friend who likes eating pears (or vice versa, depending on the version of the task the participant received). Participants were given an apple and a pear and were instructed to put the “apple” in the box that corresponded to *what happened at an earlier time* and the “pear” to the box that corresponded to *what would happen at a later time*. The order of mentioning of the apples and pears was counterbalanced, as were their pairs with “yesterday” and “tomorrow”. Note that the temporal expressions (i.e., yesterday, tomorrow, earlier, later) in the instructions consisted of

neutral wording in a sense that they had no spatial metaphors.

Instead of doing the task on paper (de la Fuente et al., 2014), we asked participants to do the task with real entities. This can not only record how participants fulfil the task, but also minimize the potential projection of vertical timeline into the sagittal axis (as in Chinese there are vertical spatial metaphors of “up” and “down” representing the time conceptions of “early” and “late”). Each participant individually did the task with the experimenter in a quiet room. After the task, s/he was given a questionnaire to fill in some background information such as gender and age. Participants were paid a small fee and signed a consent form.

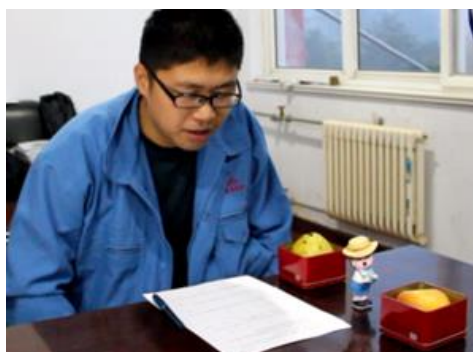


Figure 1: Setting up of Experiments 1-3.

### Results and Discussion

36.8% of participants responded according to the past-in-front mapping, placing the past event in the box in front of the character and the future event in the box behind it. This rate was not significantly different from chance,  $p = .14$  (a sign test,  $N = 38$ ), which suggests that Chinese people may have no bias for the past/future-in-front mapping. In comparison to the Spaniards (12%) in de la Fuente et al’s (2014) study, Chinese people were significantly more inclined to place the past in front of the character, as revealed by a binary logistic regression, Wald  $\chi^2(1, N = 88) = 6.98, p = .008$ , odds ratio = 4.28, 95% confidence interval (CI) = [1.46, 12.57].

The space-time mappings shown by this diagram task confirmed the mappings that were previously observed in native Mandarin speakers’ spontaneous hand gestures (Gu et al, in preparation) and forced pointing gestures (Lai & Boroditsky, 2013): some Chinese appear to conceptualise time according to a past-in-front mapping. Furthermore, the cross-cultural differences between Chinese and Spaniards seem to indicate a long-term effect of cultural attitudes on the spatialization of time, as predicted by the Temporal Focus Hypothesis (de la Fuente et al, 2014).

In experiment 1, the temporal expressions in the instructions were constructed with neutral words. However, in Chinese very often the wording of the temporal conceptions of “the past” and “the future” contained the lexicons of “前 / qián” (front, before) and “后 / hòu” (back, after), which share the same lexicons with the spatial location of front and back (like Aymara speakers). That means, Chinese people can use past-in-

front/future-in-back spatial metaphors to express time (e.g., 后天 / hòu-tiān, back day, the day after tomorrow; 今后 / jīn-hòu, from today back, from now on). If spatial metaphors for time can have an immediate effect on people’s mental representations (e.g., Boroditsky, 2000; Lai & Boroditsky, 2013), we expect that Chinese people will have more past-in-front mapping when the temporal relations are expressed with such explicit spatial markers (e.g., use “front day” and “back day” rather than “yesterday” and “tomorrow”; use “to front” and “from now back” rather than “an earlier time” and “a later time”), with a comparison to the result in Experiment 1.

## Experiment 2: Does the spatial lexicon matter: past-in-front language

### Method

#### Participants

A new group of 37 Mandarin speakers participated in the past-in-front metaphor condition. They were tested in Rizhao, China, and all materials were in Mandarin.

#### Materials and Procedure

Participants followed the same procedure to fulfil the temporal diagram task as described in experiment 1. However, the instructions about the temporal task were different from those in experiment 1.

First, in the statement they now read that the day before yesterday (前天, qián-tiān, front day) Xiaoming went to visit a friend who liked eating apples, and the day after tomorrow (后天, hòu-tiān, back day) he would be going to visit a friend who likes eating pears. This new pair of temporal constructs have a similar period of time unit as the pair of “yesterday” and “tomorrow”, both being one or two days in reference to now. Furthermore, both pairs convey a clear contrast between the past and future time conceptions while the new pair has past-in-front / future-in-back spatial metaphors.

Second, the neutral words of “future” and “past” events in the task instruction were replaced with time conceptions consisting of spatial words. Specifically, participants were instructed to put the “apple” in the box that corresponded to the past (以前, yǐ-qíán, to front, before) events and the “pear” to the box that corresponded to the future (今后, jīn-hòu, now back, from now on) events (or vice versa) (Table 1).

### Results and Discussion

Interestingly, for the past-in-front metaphor condition, there were 57% of participants who responded according to the past-in-front responses. This rate was not significantly different from chance (a sign test,  $p > 0.05$ ,  $N = 37$ ), which may indicate that Chinese people probably do not have a bias for the past or future in-front mapping when primed by the past-in-front metaphors. However, the proportion was significantly higher than that of 36.8% in the neutral condition (Experiment 1), Wald  $\chi^2$  (1,  $N =$

75) = 2.95,  $p = .086$  (two tailed), odds ratio = 2.25, CI = [.89, 5.68].

The results showed that the space-time mapping was sensitive to the spatial lexical choices. When temporal conceptions were constructed with past-in-front spatial metaphors (spatial words “front” and “back” for the past and future conceptions), participants were more likely to perform a past-in-front mapping than temporal conceptions that were constructed with neutral wording. The result is consistent with previous finding on spontaneous gestures that Chinese tend to produce past-in-front temporal gestures when they are using past-in-front spatial metaphors (Gu et al, in preparation).

Table 1: Instructions for Experiments 1, 2 & 3.

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*Yesterday* (Exp 1 & 3) / *The day before yesterday* (Exp 2)  
 Xiaoming went to visit a friend who liked eating apples, and *tomorrow* (Exp 1 & 3) / *the day after tomorrow* (Exp 2) he would be going to visit a friend who likes eating pears. There are two boxes near Xiaoming. Please put the “apple” in the box that corresponds to [past: *what happened at an earlier time* (Exp 1) / *to front* (Exp 2) / *pass go* (Exp 3)] and the “pear” to the box that corresponds to [future: *what would happen at a later time* (Exp 1) / *now back* (Exp2) / *hasn’t yet come* (Exp 3)].

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Table 2: Examples of Mandarin Chinese phrases showing a Future-in-Front and a Past-in-Back Mapping.

(1)	展	望	未	来
	zhǎn	wàng	wèi	lái
	unfold	gaze-into-distance	hasn’t	come
	Looking into the future			
(2)	回	首	过	去
	huí	shǒu	guò	qù
	turn-around	head	pass	go
	Looking back to the past			

Nevertheless, Chinese do not exclusively use lexical cues to associate past with front, but also have the option to use words that suggest future is in front in that sense being similar to speakers of familiar future-in-front languages (e.g., English, Dutch and Spanish). For example, apart from “以前 / yǐ-qíán” (to front, before) and “今后 / jīn-hòu” (now back, from now on) (Experiment 2), “过去 / guò qù” (pass go, past) and “未/将来 / wèi/jiāng-lái” (hasn’t come yet / will come, future) are common translations of past and future. Metaphorically, the word “来 / lái” (come) refers to the future as coming to us and the words “过去 / guò qù” (pass go) refers to that time as moving away from us to the past. For instance, as shown in Table 2, “未来 / wèi-lái” (hasn’t come yet) is suggested to be in front and “过去 / guò qù” (pass go) is at the back. Time in these metaphors is taken as an ego-reference point, with the future in front and past in back of the speaker (Yu, 2012). In other words, the linguistic metaphors suggest a future-in-front/past-in-back mapping. If there is an immediate effect of temporal wording on

mental representation that can be independent from the culture (cf. Experiment 2), Chinese people are expected to perform fewer past-in-front mappings when the instructions of temporal concepts are in future-in-front metaphors, in comparison to that of when instructions are in past-in-front metaphors and neutral words.

### Experiment 3: Does the spatial lexicon matter: future-in-front language

#### Method

##### Participants

A new group of 39 Mandarin speakers participated in the future-in-front metaphor condition. They were tested in Rizhao, China, and all materials were in Mandarin.

##### Materials and Procedure

Participants followed the same procedure to fulfil the temporal diagram task as described in experiment 1, except that the temporal words used in the instruction were different.

The neutral wording of “what happened at an earlier time” and “what would happen at a later time” in the task instruction of experiment 1 were replaced with “past events” and “future events”, conveying future-in-front metaphors. Specifically, participants were instructed to put the “apple” in the box that corresponded to “过去 / guò-qù” (pass go, past) events, and the “pear” to the box that corresponded to “未来 / wèi-lái” (will/not yet come, future) events (Table 2).

#### Results and Discussion

In this future-in-front metaphor condition, only a small proportion of Chinese people performed a past-in-front mapping, which was significantly different from that in the past-in-front metaphor condition (8% vs. 57%), Wald  $\chi^2(1, N = 76) = 16.13, p = .0001$ , odds ratio = 15.75, CI = [4.10, 60.48]. The rate was also significantly different from that of the neutral wording condition (8% vs. 36.8%) Wald  $\chi^2(1, N = 77) = 7.99, p = .0047$ , odds ratio = 7.00, CI = [1.82, 26.99]. Additionally, a sign test showed that 8% was significantly lower than chance, ( $p < .0001, N = 39$ ), which indicates that Chinese participants in the future-in-front metaphor condition have a bias towards future-in-front mappings.

When we merged the data from Experiments 1, 2 and 3, and recoded the three temporal wording conditions according to the extent to which they hinted past-in-front mappings: that is, the least for future-in-front metaphors, than the neutral wording, and the most for past-in-front metaphors. The result showed that wording was indeed a significant factor in predicting Chinese participants’ past-in-front mappings. Wald  $\chi^2(1, N = 114) = 17.99, p < .0001$ , odds ratio = 3.51, CI = [1.96, 6.26]. In other words, the more a temporal expression is conveying a past-in-front mapping, the more likely a Chinese will conceptualise the past in the front. This again demonstrates an effect of spatial metaphors on people’s mental representation of time within the Chinese culture.

To further confirm the assumption of this lexical effect, we did a random check on some participants who performed future-in-front mappings. They were shortly asked to perform the task again after receiving an oral instruction, in which the temporal expressions were changed to the past-in-front spatial metaphors (thus using the same temporal wording as in Experiment 2, i.e., “以前 / yǐ-qian” (to front, before) and “今后 / jīn-hòu” (now back, from now on). Interestingly, some Chinese people (the same participants) shifted from a future-in-front mapping to a past-in-front mapping. We immediately asked them the reason why they had two completely different placements. Their response then usually was a variant of: “Because you used the words of “以前 / yǐ-qian” (to front, past), and my feeling for what happened in “yǐ-qian” should be in front...” Therefore, lexical spatial metaphors of time indeed seem to have an immediate influence on people’s mental representation of time.

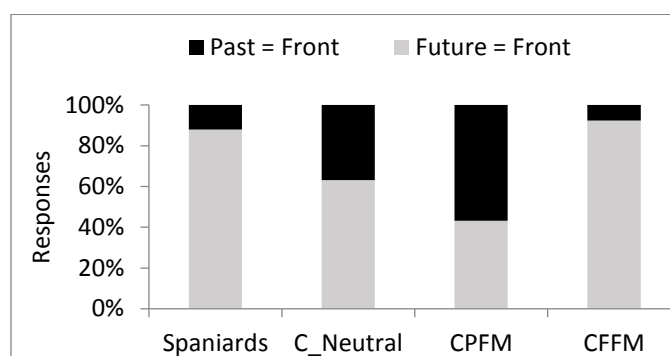


Figure 2: Results of Exps 1-3: percentage of past-in-front and future-in-front responses, separately for Spaniards (de la Fuente et al, 2014), Chinese neutral group (Exp 1) Chinese past-in-front metaphor group (CPFM Exp 2), and Chinese future-in-front metaphor group (CFFM, Exp 3).

Furthermore, in comparison to Spaniards, we see an interaction between lexical effect and culture (Fig. 2). For instance, Chinese people in the past-in-front metaphor condition were significantly different from Spaniards (57% vs 12%), Wald  $\chi^2(1, N = 87) = 17.12, p < .0001$ , odds ratio = 9.62, CI = [3.29, 28.13]. Nevertheless, Chinese people in the future-in-front metaphor condition did not exhibit significant differences from the Spaniards (8% vs. 12%), Wald  $\chi^2(1, N = 89) = 0.44, p = .51$ , odds ratio = 0.61, CI = [1.14, 2.62]. When combining data from Experiments 1, 2, and 3, Chinese people were still more likely to have past-in-front mappings than the Spaniards (12% vs. 33%), Wald  $\chi^2(1, N = 164) = 7.38, p = .0066$ , odds ratio = 3.67, CI = [1.44, 9.36]. This result confirms that there were significant differences between Chinese and Spanish cultures, as predicted by the Temporal Focus Hypothesis, according to which Chinese are more past-oriented than Europeans. These differences may not be explained by the wording of the task, as approximately equal numbers of participants had past-in-front, future-in-front and neutral wording tasks.

## General Discussion and Conclusion

Previous studies observed that Chinese people can perform forward temporal gestures for past events and backward gestures for future events (Gu et al, in preparation; Lai & Boroditsky, 2013), and in addition display the universally more common pattern that past is gestured towards the back and future towards the front (e.g., English, Dutch and French people). The present study used a temporal diagram task to explicitly test whether Chinese people have a past-in-front mapping. In three experiments, the lexicons of temporal expressions were manipulated as neutral, past-in-front and past-in-back metaphors. According to the results of Experiments 1 and 2, in which temporal expressions were constructed with neutral or past-in-front mappings, Chinese people did not have a bias towards past-in-front or future-in-front mappings. This pattern of space-time mapping was different from Spaniards, who predominately had a future-in-front mapping. Interestingly, when the wording of the temporal expressions consisted of future-in-front metaphors, Chinese appeared to have similar future-in-front mappings as Spaniards (Experiment 3). On average, around one third of Chinese participants (Experiments 1, 2 & 3) had past-in-front mappings, and this proportion was much larger than that of Spaniards (Fig. 2).

We further explored several aspects that can account for Chinese people's past-in-front mapping. First, the differences among three experiments show that lexical spatial metaphors have an online effect on the space-time mapping. Chinese people are more likely to have past-in-front mappings when past and future time conceptions are expressed with lexical "qián" (front, before) and "hòu" (back, after) than when they are expressed with neutral wording. By contrast, Chinese are less likely to have past-in-front mappings when past and future are expressed with lexicons of "guò-qù" (past go, past) and "wèi-lái" (hasn't come, future) than when they are expressed with neutral wording. The lexical spatial metaphor is a significant predictor of Chinese people's space-time mappings.

This raises the question as to what causes some Chinese people to use a past-in-front mapping even in the neutral condition (Experiment 1). Partly, this pattern could be related to a long term use of the past-in-front spatial metaphors, such that participants form a habitual space-time mapping even in the neutral condition.

This is in line with the proposal that speaking and learning different spatial metaphors can lead to different conceptualisations of time (e.g., Boroditsky, 2001). For instance, in a top/down plane, Chinese speakers can use vertical spatial metaphors to talk and gesture about time (e.g., "up week" means last week). Due to the habitual vertical conceptualisation of time, they also perform vertical gestures for temporal conceptions with no spatial metaphors (e.g., yesterday, tomorrow), though to a lesser extent (Gu et al., 2014).

However, we observed cross-cultural differences between Chinese and Spaniards in space-time mappings. Chinese people are significantly more often spatializing the past in front than the Spaniards, both in the lexical neutral condition and all conditions combined. One can

ascribe this discrepancy to the differences in cultural values towards the past and future. If Chinese people perceive past more valuable and are more past-focused than the Europeans (Ji et al, 2009), it is plausible that Chinese people will more often have past-in-front mappings than the Spaniards. Given the fact that people usually put in front what they consider to be important, if the past is important, it is of a high priority to be placed in the front. Therefore, the differences in temporal focuses between Chinese and Spanish cultures may be part of the explanation for why Chinese people have a larger proportion of past-in-front mappings than the Spaniards. This provides new evidence supporting the Temporal Focus Hypothesis (de la Fuente, 2014).

To further explore the extent to which temporal focus plays a role in shaping Chinese people's space-time mappings, we need to do a qualitative survey on Chinese people's cultural focus of attention. Moreover, to better understand the interplay between language and cultural focus of attention, future study can research whether western learners of Chinese can form a habitual past-in-front mapping in the neutral condition after learning Chinese sagittal spatial metaphors, controlling for cultural focus of attention. Alternatively, we can also compare Mandarin speakers with Chinese signed language speakers, who have different sagittal spatial temporal metaphors within the Chinese culture (in Chinese signed language, the spatial metaphors of "front" is only used for the expression of the future temporal concepts) (Gu & Swerts, in preparation).

Furthermore, according to posthoc interviews, the various results may be due to competing time conceptions in Chinese participants. Some participants explained that the past refers to known events so one can see it in front of eyes, whereas the future is unknown and one cannot see it (so it is at the back). This explanation is in line with Aymara speakers, who also have a past-in-front mapping (Núñez & Sweetser, 2006).

Alternatively, some participants explained that they put what has happened first in the front and what has happened afterwards in the back. It is possible that those who put the past in front take a Time-Reference-Point metaphor, where earlier events in time are "in front of" later events (Núñez, Motz, & Teuscher, 2006; Yu, 2012). Specifically, they consider the series of events as a sequence from the front to the back as if they are waiting in a queue. For instance, no matter which direction you look at in the line, there is a front and back to that line according to convention. Those who are or near first position will be served earlier than those who are behind them (later), irrespective of the Ego's point of view (Núñez, Motz, & Teuscher, 2006; Walker, Bergen & Núñez, 2015). In other words, if one would be positioned in such a queue, then the people that are way back in the line will be served later (so in a more distant future).

If Chinese people think of time events as a sequence, then the anteriority refers to one time as being earlier in a sequence than another whereas posteriority refers to one time that is later in a sequence than another. This way of thinking is different from the category of "past" and "future", as a time conception of past can still be earlier in a sequence than a time conception of future, i.e., past is in

front of future. In other words, the spatial-temporal mapping depends on the sequence of the time references regardless of the time conceptions per se. For instance, even if we instruct participants by an anterior event with a past time conception and posterior event with a future time conception, participants are expected to have a past-in-front mapping if they think about time in a sequence.

Note that in our temporal diagram task, there was a character standing between the two boxes. Such a design may require participants to displace the deictic centre from their body to an external location and thus may cause them to avoid using internal deictic time. It is likely that participants mapped earlier or later events on to the inherent “frontness” and “backness” of the character, with earlier events lying ahead of the character and later events lying behind. The finding is consistent with the “earlier events lie ahead of later events” structure found in the study of psychological reality of sequential time (Gentner, Imai & Boroditsky, 2002; Núñez, Motz, & Teuscher, 2006; Walker, Bergen, & Núñez, 2015).

In sum, the experiments demonstrate a cross-cultural difference in spatial conceptions of time and explore the accounts for Chinese people’s past-in-front mappings. The findings of the study support de la Fuente (2014)’s Temporal Focus Hypothesis, provide further evidence to the claim that uttering a different spatial metaphor may influence that speakers’ conceptualisation of time (Boroditsky, 2001; Lai & Boroditsky, 2013), and are also consistent with previous studies on the psychological reality of sequential time (e.g., Núñez, Motz, & Teuscher, 2006). The study contributes to a growing body of evidence that spatial-temporal thinking can be rapidly affected by context (Boroditsky, 2000; Casasanto & Bottini, 2014). Moreover, there appear to be both long-term effects of cultural attitudes on the spatialization of time, and also immediate effects of the space-time metaphors used to probe people’s mental representations.

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