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Both Earlier Times and the Future Are “Front”: The Distinction Between Time- and Ego-Reference-Points in Mandarin Speakers’ Temporal Representation

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Abstract

Mandarin speakers, like most other language speakers around the world, use spatial terms to talk about time. However, the direction of their mental temporal representation along the front-back axis remains controversial because they use the spatial term “front” to refer to both earlier times (e.g., front-year means “the year before last”) and the future (e.g., front-road means “prospect”). Although the linguistic distinction between time- and ego-reference-point spatiotemporal metaphors in Mandarin suggests a promising clarification of the above controversy, there is little empirical evidence verifying this distinction. In this study, Mandarin speakers’ time- and ego-reference-point temporal representations on three axes (i.e., sagittal, lateral, and vertical) were separately examined through two tasks. In a time-reference-point task, Mandarin speakers judged whether the time point of the second picture was earlier or later than the time point of the first picture, while in an ego-reference-point task, they judged whether an event or phase had happened in the past or would happen in the future. The results indicate that Mandarin speakers construe an earlier-times-in-front-of-later-times temporal sequence and adopt the front-to-the-future orientation.

Keywords: Space; Time; Mandarin; Time-reference-point; Ego-reference-point; Metaphor

1. Introduction

As a fundamental but abstract concept, time is usually construed through space, which is a richer, more experience-based concept (Bender & Beller, 2014; Núñez & Cooper-rider, 2013). Generally, people not only use spatial metaphors to talk about time, but also represent time spatially in their mind (e.g., Boroditsky, 2000; Boroditsky & Ramscar, 2002; Cooperrider & Núñez, 2009; Núñez, Motz, & Teuscher, 2006; Núñez & Sweetser,

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2006). Nevertheless, the direction of this mental temporal representation is affected by the direction of spatiotemporal metaphors in the language. For example, English, like most documented languages, has a spatial metaphor that maps future events in front of the ego and past events behind the ego (e.g., “she left the sad past behind and moved forward into the future”); correspondingly, native English speakers gesture backwards for the past and forwards for the future (Casasanto & Jasmin, 2012). Conversely, however, Aymara speakers gesture backwards for the future and forwards for the past, which is related to their Future-is-behind-Ego and Past-is-in-front-of-Ego spatial metaphor mapping (Núñez & Cornejo, 2012; Núñez & Sweetser, 2006).

Similar to Aymara speakers, it has been suggested that Mandarin speakers also face toward the past (e.g., Alverson, 1994), because they use the spatial term “front” (*qian*, 前) to refer to earlier times (e.g., *qian-nian*, 前年, front year, “the year before last”) and “back” (*hou*, 后) to refer to future times (e.g., *hou-nian*, 后年, back year, “the year after next”). However, there is also the contrary view that Mandarin speakers face toward the future (i.e., similar to English speakers; Yu, 1998, 2012), as they also use the spatial term “front” to refer to the future, as in *qian-tu* (前途, front road, “future; prospect”). Moreover, the flexibility of the temporal direction of “front” leads to a third view; that is, that Mandarin speakers can face toward both the future and the past (Ahrens & Huang, 2002).

In order to resolve the above controversy in relation to Mandarin speakers, it is crucial to theoretically distinguish time-reference-point (time-RP) from ego-reference-point (ego-RP) and empirically scrutinize the corresponding representations, as Núñez and Sweetser (2006) did when investigating Aymara speakers’ temporal representation. However, only Yu (2012) has distinguished between time-RP and ego-RP metaphors in Mandarin, and there has been no empirical investigation confirming that Mandarin speakers have corresponding temporal representations.

Following the distinction of time-RP and ego-RP, Yu (2012) has argued that Mandarin shares earlier-times-in-front-of-later-times and front-to-the-future metaphor mappings with English rather than Aymara. In words such as *qian-nian* and *hou-nian*, the reference point is the time (i.e., this year), not the observer. Therefore, these time-RP metaphors cannot suggest the direction that Mandarin speakers are facing but rather the direction of the temporal sequence, with earlier times in front of and later times behind the current time (e.g., “*qian-nian*” in front of “this year,” and “*hou-nian*” behind “this year”). On the other hand, the reference point of words such as *qian-tu* and *hui-shou* (回首, turn around-head, “look back; recollect”) is the ego (i.e., ego-RP), and this suggests that the observer is facing toward the future with the past behind him/her.¹

However, as Yu (2012, p. 1352) has noted, his linguistic study “says nothing about psychological reality in the individual minds of speakers of Chinese.” Thus, empirical investigations are needed to attest to Mandarin speakers’ cognitive reality. Since the seminal study of Boroditsky (2001), many behavioral studies have focused on Mandarin speakers’ temporal representation on the up-down axis, because they uniquely use up-down spatiotemporal metaphors (e.g., *shang-ge-yue* [上个月, up-particle month, “last month”) and *xia-ge-yue* [下个月, down-particle month, “next month”). However, although investigations on the front-back axis have been apparent in many task designs,

the front-back axis has often been conflated with other axes or confounded with other factors. Moreover, none of these studies has made the important conceptual distinction between reference points nor specifically examined the direction of ego-RP representation.

In early studies, the front-back axis has been conflated with the left-right axis, and together, both axes are referred to as a horizontal dimension (Boroditsky, 2001; Chen, 2007; Chen & O'Seaghdha, 2013; Tse & Altarriba, 2008). For example, in a spatial priming task (c.f., Boroditsky, 2001), Mandarin speakers viewed spatial primes horizontally (i.e., left-right) presented on the computer screen and then verified a temporal sentence with a horizontal (i.e., front-back) spatiotemporal metaphor (e.g., "March comes before April"). The way in which the left-right spatial prime facilitated verification of the front-back metaphor was suggested as an indicator of a horizontal temporal representation (Boroditsky, Fuhrman, & McCormick, 2011).

In a card-sorting task, meanwhile, the front-back axis was instead conflated with the up-down axis. In this task, a Mandarin speaker had to arrange several photographs into a temporally ordered sequence and placed them on a piece of cardboard along the horizontal plane. The front-back arrangement on the cardboard was taken as evidence of up-down temporal representation (e.g., Bergen & Chan Lau, 2012; Miles, Tan, Noble, Lumsden, & Macrae, 2011). Due to the psychological equivalence between forward and up (Levine, 1982), this front-back arrangement could be attributed to either the front-back or up-down temporal representation.

Although the front-back axis was tested exclusively in the "moving-forward Wednesday's meeting" question, the effect of language conceals the temporal representation on this axis. This question (e.g., "Next Wednesday's meeting has been moved forward 2 days. What day is the meeting now that it has been rescheduled?") is well known for its ambiguity to English speakers, who answer "Monday" or "Friday" in approximately equal measure (Boroditsky & Ramscar, 2002; McGlone & Harding, 1998). However, when this question was tested in Mandarin, more than 96% of Mandarin speakers answered "Monday" (Bender et al., 2010; Lai & Boroditsky, 2013). This dominant preference bias might have resulted from the confusion caused by the Mandarin word *ti-qian* (提前, bring forward, "shift to an earlier time"). Mandarin speakers might spontaneously translate "move forward" to *ti-qian* and thus change the ambiguity of the question.

One of the tasks that attempts to distinguish the temporal representation on the front-back axis from those on other axes is the 3D pointing task; nonetheless, the result seems to suggest a flexible temporal direction. In this task, an experimenter, who was standing next to a Mandarin speaker, selected a spot in a space directly in front of the participant and asked, "If this here is this week, where would you put last/next week?" Although 24% of participants laid out the time point along the front-back axis, they were equally likely to place last week or next week further in front (Lai & Boroditsky, 2013; see also Fuhrman et al., 2011). The authors explained this flexible temporal arrangement in terms of Mandarin speakers facing both the past and the future (Ahrens & Huang, 2002), yet they also addressed Yu's (1998, 2012) linguistic analysis as a possible alternative

interpretation. Since the answers were given after participants' introspection, it was possible that the flexible temporal arrangement was derived from the various references to either the time-RP or ego-RP temporal representations among participants.

Compared to the 3D pointing task, the congruency priming task is more implicit and clearly constrains participants' response to a certain axis. More important, it specifically tests the direction of time-RP representation (Boroditsky et al., 2011; Fuhrman et al., 2011). For example, in Fuhrman et al. (2011), Mandarin speakers viewed a "middle" time point picture of a temporal progression theme (e.g., a half-peeled banana in the banana-being-eaten theme) for 1,500 ms, followed by either an "earlier" or "later" time point picture (e.g., either a whole banana or an empty banana peel). Participants pressed the adjacent keys on a keypad in front of them to indicate whether the second picture was earlier or later than the first. In six blocks, the adjacent keys were aligned with any one of the three axes: transverse (left/earlier-right/later or right/earlier-left/later), vertical (up/earlier-down/later or down/earlier-up/later), and sagittal (far/earlier-near/later or near/earlier-far/later). The Mandarin participants favored directions of time mapping along the transverse (faster in the left/earlier-right/later than the reversed key mapping) and the vertical (faster in the up/earlier-down/later than the reversed key mapping) axes, suggesting a left/earlier-right/later and an up/earlier-down/later mental time line; this, as explained, was the consequence of the left-to-right writing direction and vertical spatiotemporal metaphors in Mandarin. However, the Mandarin participants did not respond reliably faster in the far/earlier-near/later than in the reversed key mapping condition. This insignificant result may reveal the absence or bi-directionality of the sagittal mental time line. However, it is also possible, as suggested by Fuhrman et al., that the far-near key pressing response is not well tuned to test the time representation on the front-back axis.

In Experiment 1, we adapted the time-RP congruency-priming task of Fuhrman et al. (2011) by asking participants to respond with joysticks. After viewing consecutively presented pictures, participants pulled or pushed the joystick to the direction of front/back, left/right, or up/down to indicate whether the second picture was earlier or later than the first (Fig. 1). Similar to pointing with fingers, people can effectively point with joysticks to any direction around them, including the front and back (e.g., Mou, McNamara, Rump, & Xiao, 2006; Xiao, Lian, & Hegarty, 2015). Like front-back gestures, front-back pointing may be more sensitive than far-near pressing to the difference between the two conflicting response mappings. Besides replicating Fuhrman et al.'s results on transverse and vertical axes, we further expected that the participants would respond faster in the front/earlier-back/later than in the reversed mapping, in parallel to the direction of time-RP metaphors in Mandarin (e.g., *qian-nian*).

Moreover, to the best of our knowledge, no previous studies have provided conclusive empirical evidence as to the direction of ego-RP temporal representation in Mandarin speakers, namely whether they are facing toward the future or the past. In Experiment 2, we further modified Fuhrman et al.'s paradigm to create an ego-RP congruency-priming task. Participants were shown words that described life events or phases, and they judged whether they had happened in the past or would happen in the future by pushing or



Fig. 1. The holding positions of the joystick when participants performed along the sagittal and transverse axes (left) and vertical axis (right). [Color figure can be viewed at wileyonlinelibrary.com]

pulling the joystick to the direction relative to their body's front/back, left/right, or up/down. According to the ego-RP metaphor in Mandarin (e.g., *qian-tu*), we expected that the Mandarin speakers would respond faster in the front/future-back/past than in the reversed mapping.

2. Experiment 1

2.1. Method

2.1.1. Participants

The participants in this study comprised 57 native Mandarin speakers from Nanjing University (31 males, mean age = 22.18 years, range 19–27). Their participation was compensated with monetary benefits. All participants had normal or corrected-to-normal vision.

2.1.2. *Materials*

In this experiment, 18 temporal process themes were included (e.g., an apple being eaten, Mao Zedong at different ages). Each temporal process theme included three pictures, which represented “early,” “middle,” and “late” time points, respectively. For example, in the theme of “an apple being eaten,” the early picture showed a whole apple, the middle picture showed a half-eaten apple, and the late picture showed an apple core.

The pictures were presented in the middle of a computer screen. A joystick connected to the computer was used to record participants’ responses.

2.1.3. *Procedure and design*

In each trial, a fixation cross was presented in the middle of the screen with the duration randomly varying between 500 and 800 ms, and then a middle time-point picture was presented for 2 s (e.g., a half-eaten apple). Next, an early or late time-point picture of the same theme was presented (e.g., a whole apple or an apple core). Participants pushed or pulled the joystick to a prescribed direction to indicate whether the second picture was earlier or later than the first. They were asked to respond as accurately and quickly as possible and had 5 s in which to respond; after each response, the second picture disappeared and feedback was given (i.e., “✓” or “X” was presented in the middle of the screen); otherwise, the second picture would disappear, and the “timeout” feedback would be presented in the middle of the screen. The feedback was presented on the screen for 1 s, and the fixation cross would then appear to indicate the start of the next trial.

Each participant performed six blocks (one block comprised 36 trials), with two blocks on each axis. Along each axis, the response mappings were reversed between the two blocks. For example, along the sagittal axis, in one block, participants pushed the joystick to the front to indicate “earlier” and pulled it to the back to indicate “later.” In the other block, they pushed the joystick to the front to indicate “later” and to the back to indicate “earlier.” Along the transverse axis, participants pushed the joystick to the left or right to indicate “earlier” or “later.” Along the vertical axis, participants pushed the joystick up or down to indicate “earlier” or “later.” As shown in Fig. 1, when performed along the transverse and sagittal axes, participants put the front edge of the base of the joystick against their abdomen, so they could push the joystick to the right, left, front, or back. When performed along the vertical axis, participants put the base of the joystick against their abdomen, so they could pull or push the joystick up or down. At the beginning of each block, participants first read an instruction in Mandarin on the screen and completed six practice trials. The themes of the practice trials were not included in the testing phase.

Eighteen testing themes were randomly divided into three sets and then assigned to the three axes. That is, for each axis, the two blocks included the same six themes. Across participants, the testing order of axes and assignment of the three sets of themes to the three axes were counterbalanced. Participants first finished one response-mapping block from each of the three axes and then finished the reversed response mapping blocks in the same axes order, similar to the first three blocks. The testing sequence of the two

blocks along each axis was counterbalanced across participants. Within each block, every theme was tested six times, with three times showing early time point pictures and the other three times showing late time point pictures. The order of the trials was randomized.

2.2. Results

Error responses (2.76%) were not included in the analyses. Paired sample *t*-tests were used to compare the mean response times of the two reversed response-mapping blocks along each axis.² As shown in Fig. 2, participants had favored response mapping directions along all three axes. Along the vertical axis, participants responded faster in the up/earlier-down/later than in the down/earlier-up/later mapping condition, $t(56) = 2.17$, $p = .03$, 95% CI [5.53, 137.42]. Along the transverse axis, participants responded faster in the left/earlier-right/later than in the right/earlier-left/later mapping condition, $t(56) = 2.21$, $p = .03$, CI [7.10, 144.12]. Along the sagittal axis, participants responded faster in the front/earlier-back/later than in the back/earlier-front/later mapping condition, $t(56) = 3.39$, $p = .001$, CI [56.96, 221.50].

The results along the vertical and transverse axes are parallel to the results of Fuhrman et al. (2011), suggesting that Mandarin speakers favor temporal directions on these two axes, with earlier times on the left or top and later times on the right or bottom. Moreover, the result on the sagittal axis suggests that Mandarin speakers also have a favored temporal direction on this axis, with earlier times in front of later times. This result is

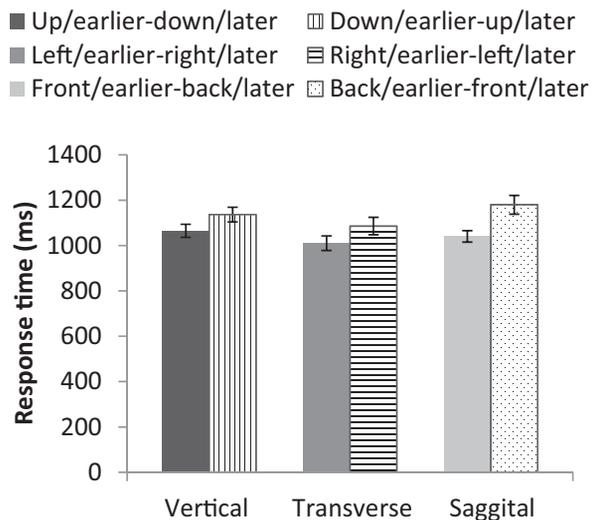


Fig. 2. Response times in Experiment 1. The error bars are confidence intervals that correspond to ± 1 SEM.

parallel to the direction of time-RP spatiotemporal metaphors in Mandarin, such as *qian-nian* and *hou-nian*.

3. Experiment 2

3.1. Method

3.1.1. Participants

The participants comprised native Mandarin speakers from Nanjing University. In this experiment, 11 participants (3 males, mean age = 25.27 years, range 22–33) took part in the preliminary rating tasks, and 126 participants (34 males, mean age = 21.41 years, range 18–29) took part in the ego-RP congruency priming task. They received monetary benefits as compensation for their participation. All of them had normal or corrected-to-normal vision.

3.1.2. Materials

For Experiment 2, 54 words that describe a typical phase or an event in a person's life were selected (e.g., elementary school and middle age). All of them were composed of two to four characters. For this task, 11 native Mandarin speakers rated the familiarity (1 = totally don't know the meaning, 7 = very clear about the meaning) and valence (1 = extremely negative, 7 = extremely positive) of the words on a seven-point scale and judged whether the words described events/phases that had happened in the past or would happen in the future. Of the 54 words selected, 18 words that were consistently judged as "future" or "past" by all participants (familiarity, mean = 6.60, range [6.27, 6.91]; valence, mean = 4.45, range [3.09, 5.64]) were selected as stimuli (see Appendix). From the total, nine words described a time point/phase that had happened in the past (e.g., elementary school), whereas the other nine words described a time point/phase that would happen in the future (e.g., middle age). The evaluations of familiarity and valence were equal between the future and past words, $t_s(16) < 1.38$, $p_s > .18$. The other six words (i.e., three future and three past words) of similar familiarity, valence, and that were consistently judged as "future" or "past" were selected as practice words.

The words were presented in the middle of a computer screen. A joystick connected to the computer was used to record participants' responses.

3.1.3. Design and procedure

The participants were randomly assigned to make judgments along one of the three axes. They pushed or pulled the joystick to the front/back (sagittal axis condition), up/down (vertical axis condition), or left/right (transverse axis condition) to indicate "future" or "past." In each axis, response mappings were reversed across two blocks. The order of blocks was counterbalanced across participants. Within each block, all 18 words were tested twice. The order of trials was randomized.

In each trial, a fixation cross was presented in the middle of the screen with the duration randomly varying between 500 and 800 ms, before a word was presented. Participants pushed or pulled the joystick in a prescribed direction to indicate whether the word described a time point/phase that had happened in the past or would happen in the future. They were asked to respond as accurately and quickly as possible. After each response, the word would disappear, and feedback was given (i.e., “✓” or “X” was presented in the middle of the screen). Participants had 5 s to respond before the word disappeared and the “timeout” feedback appeared in the middle of the screen. The feedback was presented on the screen for 1 s, before the fixation cross appeared to indicate the start of the next trial.

3.2. Results and discussion

Error responses (5.82%) were not included in the analyses. Paired sample t-tests were used to compare the mean response times (RTs) in the two blocks of each axis. As shown in Fig. 3, participants had a favored temporal orientation along each of the axes. They responded faster in the down/past-up/future than in the up/past-down/future mapping condition, $t(41) = 2.20$, $p = .03$, CI [2.79, 66.27], faster in the left/past-right/future than in the right/past-left/future mapping condition, $t(41) = 2.62$, $p = .01$, CI [15.32, 117.96], and faster in the back/past-front/future than in the front/past-back/future mapping condition, $t(41) = 2.12$, $p = .04$, 95% CI [2.40, 95.34].

The result along the sagittal axis is parallel to the direction of the ego-RP spatiotemporal metaphor in Mandarin, such as *qian-tu* and *hui-shou*, thus supporting the view that Mandarin speakers face toward the future (Yu, 1998, 2012).

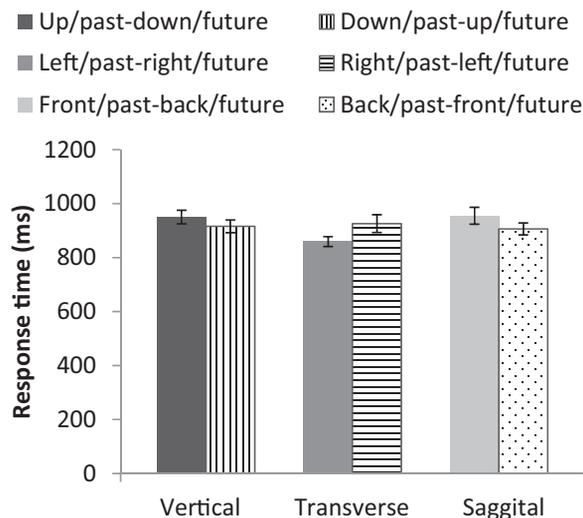


Fig. 3. Response times in Experiment 2. The error bars are confidence intervals that correspond to ± 1 SEM.

Furthermore, the results on the transverse and vertical axes suggest that Mandarin speakers also construe the past leftward or downward, and the future rightward or upward. On the transverse axis, similar to English speakers, Mandarin speakers in P. R. China also write and read from left to right, which may account for their left/past-right/future ego-RP temporal representation (Casasanto & Jasmin, 2012; Walker, Bergen, & Núñez, 2017). On the vertical axis, most of the disclosed Mandarin up-down spatiotemporal metaphors are time-RP rather than ego-RP (e.g., the reference points of *shang-ge-yue* and *xia-ge-yue* are time but not ego) (Scott, 1989). Thus, there is little possibility that the vertical metaphors in Mandarin shape this ego-RP representation. Since this study focuses on Mandarin speakers' temporal representation on the sagittal axis, the cause of their vertical ego-RP representation needs to be further investigated.

4. General discussion

With the time- and ego-RP congruency-priming tasks, the present study revealed that Mandarin speakers construe an earlier-times-in-front-of-later-times temporal sequence and adopt a front-to-the-future orientation. These findings parallel the direction of sagittal time- and ego-RP spatiotemporal metaphors in Mandarin, providing a possible solution to the controversy over Mandarin speakers' temporal facing direction and supporting the hypothesis that the Mandarin ego mentally faces toward the future.

The results reveal that Mandarin speakers' sagittal time- and ego-RP temporal representations parallel those of English speakers (e.g., Núñez & Sweetser, 2006). As shown in Fig. 4, Mandarin speakers may conceive of time as a moving train consisting of a

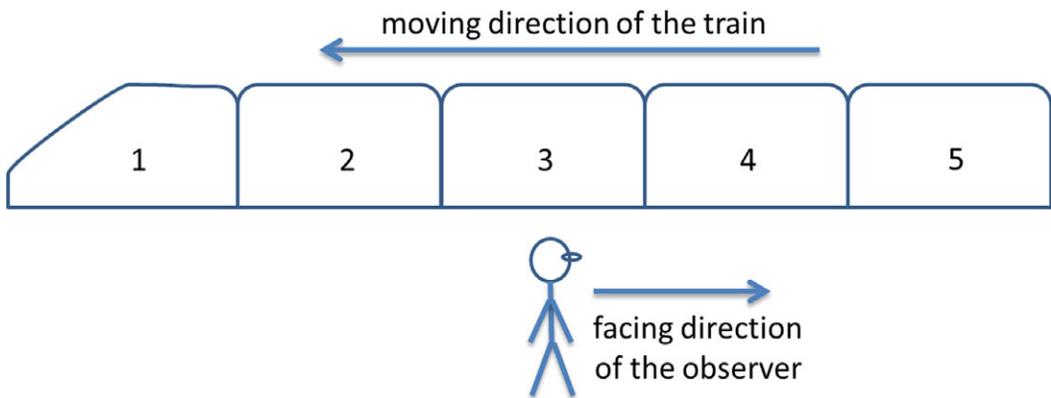


Fig. 4. The analogy of “a moving train and an observer,” which demonstrates the time- and ego-RP temporal representations of Mandarin speakers. The time is analogous to a moving train consisting of a series of carriages. The time-RP representation refers to the relationship among time points (or carriages), whose direction is earlier times (e.g., carriages 1 and 2) in front of later times (e.g., carriages 4 and 5). The ego-RP representation refers to the relationship between the observer and each time point, whose direction is the future (e.g., carriage 5) in front of the observer.

series of carriages, with earlier times (e.g., carriage 1 is *qian-nian*) in front of present time (carriage 3 is this year), and later times (e.g., carriage 5 is *hou-nian*) behind present time. Conceiving of ego as co-located with a temporal sequence (time-RP) introduces a present time (here: carriage 3), with the ego facing toward the future (e.g., carriage 4 and 5 is *qian-tu*); whenever he/she wants to recollect the past (e.g., carriage 1 and 2), he/she must first “turn around” (e.g., *hui-shou*).

The findings and paradigms in the present study underline two important distinctions when explaining previous results and designing further empirical investigations on the spatial properties of temporal representation, of both Mandarin and other language speakers:

First, it is important to distinguish between the transverse, vertical, and sagittal axes. As noted above, some tasks confounded the axes; therefore, it is unsuitable to attribute the findings of these tasks to a certain dimension. If further studies attempt to continue, using these tasks to investigate the spatial properties of temporal representation, modifications are needed to distinguish the three axes. For example, if the card-sorting task were to test the temporal representations on three dimensions, the experimental setting should provide three-dimensional response options.

Second, it is important to distinguish between the reference points of temporal representations, both theoretically and methodologically. For example, in Fuhrman et al. (2011), not only Mandarin speakers but also English speakers performed the 3D pointing task (e.g., “If this here is this week, where would you put last/next week?”). Similar to Mandarin speakers, very few English speakers responded along the sagittal axis, and their response was either front or back. Based on these results, we might reach the false conclusion that English speakers do not have a sagittal temporal representation or they have a flexibly oriented one, which is in conflict with the established conclusion derived from linguistic analysis and gesture/posture data (for a review, see Bender & Beller, 2014). However, paradigms separately examining English speakers’ time- and ego-RP representations, as the congruency-priming tasks of this study, provide empirical evidence consistent with the established patterns (Walker et al., 2017). Besides Mandarin and English, many other languages involve time- and ego-RP metaphors, while paradigms similar to those in the present study are applicable to verify the temporal representations of these language speakers.

Finally, it is worth noting that at least two issues need to be further investigated for a deeper understanding of Mandarin speakers’ temporal representation. First, within the ego-RP representations, there are two complementary perspectives, moving-ego and moving-time. From the moving-ego perspective, people construe themselves as moving through stationary time, whereas from the moving time perspective, people construe time as moving towards the stationary ego. Whether these two perspectives additionally affect Mandarin speakers’ ego-RP temporal representation remains an open question. Second, besides the distinction between time- and ego- reference points, Yu (2012) also proposed a distinction between time- and human- referents in Mandarin spatiotemporal metaphors. The reference point and referent are similar to ground and figure or *relatum* and *locatum*, respectively. What we have examined in this study are time-referent temporal

representations; that is, time-RP and ego-RP involve time-to-time and ego-to-time relations. The human-referent, on the other hand, involves ego-to-human (or human-to-human) temporal relations. In Mandarin, the human-referent spatiotemporal metaphors (e.g., *qian-ren* [前人, front-people, “predecessors”], and *hou-ren* [后人, back-people, “descendants”]) suggests a unique temporal representation; that is, people born earlier than the ego are in front of the ego, while people born later than the ego are behind the ego. Whether this human-referent temporal representation was construed in this manner by Mandarin speakers is worthy of further empirical investigation.

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Notes

1. There are other similar or related distinctions in the literature, such as B-series/A-series (McTaggart, 1908; Traugott, 1978), non-deictic/deictic (Tenbrink, 2011), field-based/ego-based (Moore, 2006), or intrinsic/relative (Bender, Beller, & Bennardo, 2010). For a review, see Bender and Beller (2014).
2. In Experiments 1 and 2, analyses that include response direction as a factor (i.e., vertical axis: “up” vs. “down”; transverse axis: “left” vs. “right”; and sagittal axis: “front” vs. “back”) neither exhibited a main effect nor interacted with the effect of response mapping, $ps > .19$. Consequently, the presented results were collapsed across this factor.

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Appendix: Words materials from Experiment 2

In Experiment 2, 18 words that describe a particular past or possible future event or phase in a person's life are listed below.

	Words		
	Mandarin Words	Literal Translation	Semantic Translation
Past	ya ya xue yu (牙牙学语)	tooth tooth learn language	baby talk
	gu gu zhui di (呱呱坠地)	croak croak fall ground	A baby is born with a cry
	da-xue jun xun (大学军训)	big school military training	military training in university
	pan-shan xue bu (蹒跚学步)	staggered learn walking	toddle
	da xue ru xue (大学入学)	big school enter school	college admission
	tong nian (童年)	child year	childhood
	gao kao (高考)	high examination	the university entrance examination
	xiao xue (小学)	little school	primary school
	zhong kao (中考)	middle examination	senior high school entrance examination

(continued)

Appendix (continued)

				Words		
				Mandarin Words	Literal Translation	Semantic Translation
Future	liang bin ban bai (两鬓斑白)	two sideburns	motley-colored white		with graying temples	
	gu xi zhi nian (古稀之年)	ancient rare of age			seventy years of age	
	cheng jia li ye (成家立业)	accomplish family establish undertaking			get married and start one's career	
	hua jia lao ren (花甲老人)	flowery cycle-of-sixty			a senior over sixty	
	sheng er yu nv (生儿育女)	bear son raise daughter			give birth to and raise children	
	lao nian (老年)	old year			old age	
	jiu ye (就业)	get job			get a job	
	tui xiu (退休)	withdraw stop			retirement	
	jie hun (结婚)	unite marry			get married	