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# Do English and Mandarin Speakers Think Differently About Time?

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## Abstract

Do the languages we speak shape the ways we think? Boroditsky, (2001) demonstrated that speakers of English and Mandarin think differently about time. This work has recently been brought into question (January & Kako, 2007; Chen, 2007). Here I present new evidence that again demonstrates a difference between English and Mandarin speakers' construals of time. Both languages use horizontal and vertical spatial language to talk about time. For example, in English we might say that the best is ahead of us, or we may move a meeting up. In English, vertical metaphors are relatively infrequent and horizontal metaphors predominate. In Mandarin, both horizontal and vertical metaphors are frequent. Importantly, vertical metaphors are much more frequent in Mandarin than they are in English. The new evidence once again suggests that Mandarin speakers don't just talk about time vertically more frequently than do English speakers, they also think about time vertically more frequently than do English speakers.

**Keywords:** Language and Thought, Space, Time, Metaphor, Mandarin

## Introduction

Time is a topic of central importance in our culture. According to the latest Oxford dictionary, the word "time" is the most frequently used noun in English, with other temporal words like "year" and "day" also placing in the top 10. How does our understanding of the domain of time develop? What are the ingredients of our mental representations of time?

Certainly some elements of time are apparent in our experience with the world. From experience, we might be able to learn that each moment in time only happens once, that we can only be in one place at one time, that we can never go back, and that many aspects of our experience are not permanent (i.e., faculty meetings are not everlasting, but rather begin and end at certain times). In other words, our experience dictates that time is a phenomenon in which we, the observer, experience continuous unidirectional change that may be marked by appearance and disappearance of objects and events. These aspects of conceptual time should be universal across cultures and languages. Indeed, this appears to be the case. In order to capture the sequential order of events, time is generally conceived as a one-dimensional, directional entity. Across languages, the spatial terms imported to talk about time are also one-dimensional, directional terms such as ahead/ behind or up / down rather than multidimensional or symmetric terms such as narrow/ wide or left / right (Clark, 1973; Traugott, 1978). Aspects of time that are extractable from world experience (temporally

bounded events, unidirectional change, etc.) appear to be universal across cultures and languages.

However, there are many aspects of our concept of time that are not observable in the world. For example, does time move horizontally or vertically? Does it move forward or back, left or right, up or down? Does it move past us, or do we move through it? All of these aspects are left unspecified in our experience with the world. They are however, specified in our language —most often through spatial metaphors.

Across languages, people use spatial metaphors to talk about time. Whether they are looking forward to a brighter tomorrow, proposing theories ahead of their time, or falling behind schedule, they rely on terms from the domain of space to talk about time (Clark, 1973; Lehrer, 1990; Traugott, 1978). Those aspects of time that are not constrained by our physical experience with time are free to vary across languages and our conceptions of them may be shaped by the way we choose to talk about them. This article focuses on one such aspect of time and examines whether different ways of talking about time lead to different ways of thinking about it.

## Time in English

In English, we predominantly use front / back terms to talk about time. We can talk about the good times ahead of us or the hardships behind us. We can move meetings forward, push deadlines back, and eat dessert before we are done with our vegetables. On the whole, the terms used to order events are the same as those used to describe asymmetric horizontal spatial relations (e.g., "he took three steps forward" or "the dumpster is behind the store").

## Time in Mandarin Chinese

In Mandarin, front / back spatial metaphors for time are also common (Scott, 1989). Mandarin speakers use the spatial morphemes qian ("front") and hou ("back") to talk about time. What makes Mandarin interesting for present purposes is that Mandarin speakers also systematically use vertical metaphors to talk about time (Scott, 1989). The spatial morphemes shang ("up") and xia ("down") are frequently used to talk about the order of events, weeks, months, semesters, and more. Earlier events are said to be shang or "up," and later events are said to be xia or "down."

Although in English vertical spatial terms can also be used to talk about time (e.g., "hand down knowledge from generation to generation" or "the meeting was coming up"), these uses are not nearly as common or systematic as

is the use of *shang* and *xia* in Mandarin (Chun, 1997a, 1997b; Scott, 1989). The closest English counterparts to the Mandarin uses of *shang* and *xia* are the terms *next (following) / last (previous)* and *earlier / later*.

In summary, both Mandarin and English speakers use horizontal terms to talk about time. In addition, Mandarin speakers commonly use the vertical terms *shang* and *xia*.

### The critical difference between English and Mandarin

The critical difference between English and Mandarin descriptions of time for present purposes is that Mandarin speakers use vertical metaphors more often than do English speakers.

This claim has sometimes been misunderstood or misrepresented in the literature. The claim is not that Mandarin speakers only talk about time vertically, nor that Mandarin speakers talk about time vertically more often than they talk about time horizontally. The critical difference between Mandarin and English being described here is that Mandarin speakers talk about time vertically more often than English speakers do. Figure 1 shows typical proportions of horizontal and vertical metaphors reported in corpus studies of English and Mandarin time metaphors (e.g., Chen, 2007).

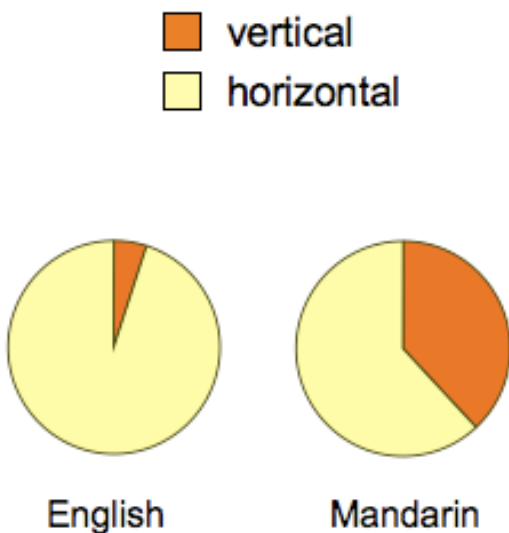


Figure 1. Proportions of vertical and horizontal spatial metaphors typically reported in corpus studies of English and Mandarin time metaphors (e.g., Chen, 2007)

### Do patterns in language predict patterns in thought?

If Mandarin speakers talk about time vertically more often than do English speakers, does this mean that they also think about time vertically more often than do English speakers?

Previous work on this question has come up with some contradictory answers (Boroditsky, 2001; January & Kako, 2007; Chen, 2007). I will discuss these studies in detail in a separate paper. For the purpose of this paper let us note that all three of these studies have relied on the same paradigm.

Subjects were primed with horizontal or vertical spatial arrangements presented on a computer monitor and were then timed as they answered a question about time.

This priming paradigm was developed to answer two separate questions. First, do people automatically make use of spatial representations when thinking about time? And second, do the spatial representations that people construct differ across languages?

Since Boroditsky (2001), many other studies using a wide array of paradigms have found that people indeed automatically create spatial representations for thinking about time (e.g., Torralbo et al, 2006; Gevers et al, 2003; Casasanto & Boroditsky, 2007; Casasanto & Lozano, 2006). This allows us to set this first question aside and focus on the second question: do speakers of different languages construct different spatial representations of time?

Some answers to this second question have also come in in the affirmative (Tversky et al, 1991; Nunez & Sweetser, 2006; Boroditsky & Gaby, 2006; Casasanto et al, 2004; Fuhrman & Boroditsky, 2007). For example, Nunez & Sweetser (2006) have found that the *Ayamara* arrange time so that the past is in front of them and the future is behind them. Other studies have found that *culturo-linguistic* factors like writing direction affect how people spatialize time, with Hebrew and Arabic speakers for example tending to arrange time from right to left rather than left to right as do English speakers (Tversky et al, 1991; Fuhrman & Boroditsky, 2007). Speakers of *Kuuk Thaayorre* – an Australian Aboriginal language that relies primarily on absolute frames of reference for talking about space - have been found to lay out time from East to West (rather than left to right for English speakers for example) (Boroditsky & Gaby, 2006).

This brings us back to the question of English and Mandarin speakers and whether or not they indeed construct different spatial representations for thinking about time. The studies reported in this paper make use of a simple new paradigm to get at this question. This paradigm improves on several aspects of the paradigm used in Boroditsky (2001).

In this new set of studies an experimenter stands next to a participant, points to a spot in space directly in front of the participant and says (for example) “If I tell you that this here is TODAY, where would you put YESTERDAY? And where would you put TOMORROW?” One advantage of this paradigm is that participants are able to point anywhere around them in 3-dimensional space. This improves on the original paradigm in which the two horizontal dimensions (left to right and front to back) were collapsed together on the 2-dimensional computer monitor.

Another advantage of the new paradigm is that it allows us to measure not just the axis on which time is laid out (e.g., is there preference for horizontal versus vertical) but also the direction (e.g., is the future placed further up or further down?).

To preview, results from this new paradigm support the original conclusion: English and Mandarin speakers think

about time differently. Mandarin speakers talk about time vertically more than English speakers do, and Mandarin speakers also think about time vertically more often than English speakers do.

## Study Description

### Participants

57 native Mandarin speakers and 13 native English speakers participated in this study. Of the Mandarin speakers, 15 were residing in Taiwan and tested in Mandarin, 33 were residing in California and tested in Mandarin, and an additional 9 were residing in California and tested in English. The experimenters conducting the study in Mandarin were native speakers of Mandarin.

### Procedure & Materials

All participants were tested on the same three questions about time. An experimenter stood next to the participant, pointed to a spot in space directly in front of the participant and said (for example) “If I tell you that this here is TODAY, where would you put YESTERDAY?” The experimenter waited for the participant to point and then asked “And where would you put TOMORROW?” Three sets of durations were tested with each participant. In addition to Yesterday/Today/Tomorrow, participants were also asked to locate Breakfast and Dinner with respect to Lunch, and September and October with respect to August. The central time point was always mentioned first (e.g., today), followed by the earlier time point (yesterday), and then the later time point (tomorrow). No spatial language was used to describe the time points in either English or Mandarin (e.g. participants were not asked which is the “up month” or the “down month” in Mandarin).

### Results

The results are shown in Figure 2. Overall, Mandarin speakers were more than 8 times more likely to lay out time vertically than were English speakers,  $t(68)=3.87$ ,  $p<.0005$ . Across the three temporal durations tested, English speakers produced horizontal arrangements 95% of the time, and vertical arrangements only 5% of the time. In contrast, Mandarin speakers tested on the same stimuli produced vertical arrangements 42% of the time. This was true even though no vertical spatial language was used in the Mandarin testing stimuli. Even when tested entirely in English, Mandarin-English bilinguals produced vertical arrangements 37% of the time.

The proportions of vertical and horizontal points found in this study correspond well with patterns found in language. For example, recent analyses of Mandarin corpora reveal that around 40% of time descriptions in Mandarin contain vertical metaphors (Chen, 2007).

Because writing direction has been shown to be an important factor in shaping people’s representations of time (Tversky et al, 1991; Fuhrman & Boroditsky, 2007), it was

important to consider whether differences between English and Mandarin speakers may have stemmed from differences in writing direction. Mandarin was traditionally written in vertical columns from right to left, but is now more commonly written as English, horizontally from left to right (with important regional variation).

To be able to measure effects of writing direction all Mandarin speakers tested in California filled out a detailed language background questionnaire after completing the study. The questionnaire included questions about the kinds of Mandarin scripts participants were familiar with (traditional, simplified, pinyin, etc), and how often they read text laid out in different orientations (vertically from right to left, horizontally from left to right, etc). Analyses of participants’ reading patterns showed that reading direction alone cannot explain these cross-linguistic differences. Mandarin speakers who reported only reading text written horizontally from left to right (as English), were still seven times more likely to arrange time vertically than were English speakers (35% vs 5% vertical arrangements respectively).

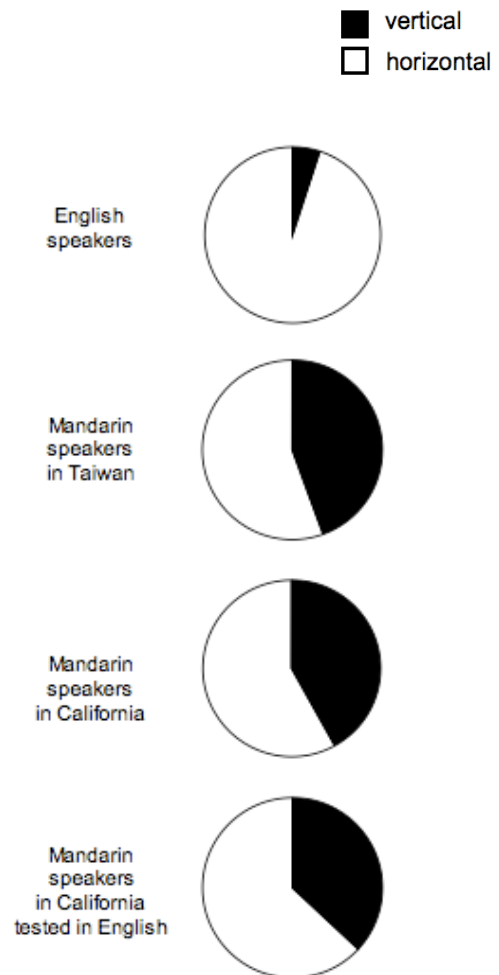


Figure 2: Patterns of spatial layouts of time in the 4 groups tested in this study. The charts show proportions of vertical and horizontal layouts produced by subjects.

## Discussion

The distributional statistics of vertical and horizontal metaphors for time differ between English and Mandarin. These distributional statistics appear to be absorbed by speakers of English and Mandarin into their representations of time. Mandarin speakers talk about time vertically more often than English speakers do, and in these studies, Mandarin speakers appear eight times more likely to construct vertical representations of time than are English speakers.

Beyond establishing these cross-linguistic differences, many interesting questions remain. For example, showing that Mandarin and English speakers differ in this task does not establish that patterns in language (or more specifically patterns in metaphors) per se cause these differences. The lives and cultural experiences of English and Mandarin speakers differ in an infinite number of other ways beyond differences in language. How can we tell if differences in language per se can cause these kinds of differences in thinking?

One way to approach this question is to artificially change the distributional patterns in people's language environment and see if this causes a corresponding change in thinking. In Boroditsky (2001), English speakers were trained to speak about time vertically (for example saying that Monday was above Tuesday, and Thursday was below Wednesday). This training was meant to introduce a temporary shift in the relative frequencies of vertical and horizontal metaphors for English speakers, making vertical metaphors locally more frequent. Indeed after this vertical language training, English speakers' performance shifted to more closely resemble that of Mandarin speakers. These results suggested that experience with language per se can and does shape people's mental representations.

It would certainly be possible to do the same kind of training with English speakers in this new pointing paradigm. However, any shifts in performance in this kind of explicit task are unlikely to be convincing. This unfortunately is one disadvantage of this new paradigm. We are in the process of developing more implicit measures that would be more suitable to this design.

On the other hand, one advantage of the pointing design is that it allows us to take a closer look at the spatial representations English and Mandarin speakers construct for time. These yield some interesting new answers. For example, while the assumption in Boroditsky (2001) was that English speakers' horizontal representations of time are in the front/back axis, the data from the pointing task suggests that the left/right dimension is more dominant for English speakers. These data are consistent with a growing body of work showing a dominant left/right horizontal organization of time in English (Tversky et al, 1991; Gevers et al, 2003, Torralbo et al 2006; Fuhrman & Boroditsky, 2007; Casasanto & Lozano, 2006). Understanding the complementary contributions of patterns in metaphor and patterns in writing direction and other cultural artifacts is the subject of further research.

Other interesting hints emerged in comparing the way that English and Mandarin speakers pointed in the front/back axis. English speakers always placed later or future events further in front (away from the body). Mandarin speakers showed this pattern 58% of the time, but the other 42% of the time they showed the opposite pattern, placing earlier or past events in front. It is possible this reversal stems from the Mandarin use of "front" in phrases like "front year" which means "two years ago."

A more detailed look at English and Mandarin speakers' representations of time revealed several new differences. Understanding the extent and origins of these differences is the subject of further research.

## Conclusions

This paper presented new evidence showing that English and Mandarin speakers differ in their representations of time. When asked to locate events in the 3-dimensional space around their body, English speakers arranged the events in the horizontal plane 95% of the time. Mandarin speakers on the other hand produced vertical arrangements 42% of the time. That is, Mandarin speakers were eight times more likely to produce a vertical arrangement for time than were English speakers. The pattern of results was similar whether Mandarin speakers were tested in Taiwan or in California. Even when tested entirely in English, Mandarin speakers produced vertical arrangements 37% of the time. Further, differences in writing direction cannot alone explain these cross-linguistic differences in performance. Mandarin speakers who only read horizontally left to right (as English) were still seven times more likely to arrange time vertically than were English speakers. These differences in people's time representations were predicted by patterns in language.

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