

“During the New Jersey Turnpike”:  
Asymmetric Preferences in  
Spatial & Temporal Prepositions

**Carolyn Lee**

Advisor:  
Prof. Claire Bower, PhD

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## Contents

<b>Abstract.....</b>	<b>3</b>
<b>1. Intro/Background.....</b>	<b>4</b>
1.1. Conceptual Metaphor: Using the Concrete to Understand the Abstract	
1.2. From Space to Time: An Asymmetrical Relationship	
1.3. Innovation: A Window into the Space/Time Relationship	
<b>2. Methods.....</b>	<b>12</b>
2.1. Participants	
2.2. Materials	
2.3. Design	
<b>3. Results &amp; Analysis.....</b>	<b>17</b>
3.1. Results by Age	
3.2. Results by Region	
3.3. Results by Question	
3.4. Results by Order of Presentation	
<b>4. Further Discussion &amp; Implications.....</b>	<b>27</b>
4.1. Diachronic Unidirectionality	
4.2. Directions for Future Research	
<b>5. Conclusion.....</b>	<b>29</b>
<b>References.....</b>	<b>30</b>

## Abstract

In response to Boroditsky (2000), which demonstrated asymmetry in the way that space and time are conceptualized, the present paper asks whether this asymmetry (called the TIME IS SPACE metaphor) extends also to language innovation. In a forced-choice acceptability judgment task (delivered as an online survey), native speakers of American English were shown pairs of unacceptable English sentences and asked to choose the better sentence. Each pair contained one sentence wherein the spatial preposition ‘along’ was used to express a temporal meaning, and one sentence wherein the temporal preposition ‘during’ was used to express a spatial meaning. Participants preferred spatial ‘along’ sentences 80% of the time, which is consistent with the TIME IS SPACE metaphor. I conclude that the TIME IS SPACE metaphor can influence innovation practices, although the strength of its influence varies by person and between sentences. Further research is required to confidently determine the source of variability, and to determine whether these effects occur cross-linguistically.

## 1. Introduction

One of the more striking peculiarities of language is the existence of linguistic universals. Among the languages of the world, there is extraordinary diversity across most (and perhaps all) levels of linguistic structure (Evans & Levinson 2009). Whether dealing with absolute universals (those completely without exception; e.g., that all spoken languages contain vowels and consonants), or statistical universals (those with few exceptions; e.g., that the vast majority of spoken languages contain nasal consonants), the existence of commonalities shared cross-linguistically despite the vast diversity of the world's languages is of interest to scholars in almost every subfield of linguistics. Some (notably, Chomsky 1965) would suggest that the existence of universals points to an innate and universal language capacity that in fact specifies some of the details of language. Others (e.g., Bengtson & Ruhlen 1994; Greenberg 1897:337) would perhaps hypothesize that all the languages of the world descend from a single common ancestor. Regardless, linguistic universals are a matter of import for any substantive theory of language. One such universal that has been much discussed is the observation that language users employ terminology from more easily perceptible or “concrete” domains to describe more abstract domains, despite rarely doing the reverse (Lakoff & Johnson, 1980. Also see Gruber, 1965; Jackendoff, 1983). An example of this asymmetrical tendency is the fact that words from the concrete domain of space are often used to describe the more abstract domain of time,<sup>1</sup> while words from the temporal domain are rarely used to describe the spatial domain (Traugott, 1978). This asymmetry lies at the center of the investigation carried out here.

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<sup>1</sup> The term “abstract” is used to refer to anything that is relatively less available for perception by the human senses than its “concrete” counterpart. Further discussion of these concepts appears at the end of this subsection.

## 1.1. Conceptual Metaphor: Using the Concrete to Understand the

### Abstract

Two propositions are central to this research. The first comes from Lakoff & Johnson (1980), and it is that human thought is, by and large, metaphorically structured. More specifically, concepts are the basic unit of thought, and most concepts are typically understood through comparison to *other* concepts. Practically, this means that, given a source concept and a target concept, the target is understood mostly in terms of shared characteristics with the source. The term ‘conceptual metaphor’ simply refers to that association between source and target concepts. One example discussed in detail is the target concept ARGUMENT, which, the authors propose, is understood through comparison to the source concept of WAR. The resulting metaphor is referred to as ‘ARGUMENT IS WAR’. It is proposed, then, that the concept ARGUMENT is understood mainly in terms of shared characteristics with the concept WAR. As evidence of this conceptual metaphor, the following sentences are offered (Lakoff & Johnson 1980:4).

- (1)
- a. Your claims are *indefensible*.
  - b. He *attacked every weak point* in my argument.
  - c. His criticisms were *right on target*.
  - d. I *demolished* his argument.
  - e. I've never *won* an argument with him.
  - f. You disagree? Okay, *shoot!*
  - g. If *you* use that *strategy*, he'll *wipe you out*.
  - h. He *shot down* all *of my* arguments.

Crucially, the authors point out that the association between ARGUMENT and WAR is not merely linguistic: in fact, “[w]e can actually win or lose arguments. We see the person we are arguing with as an opponent. We attack his positions and we defend our own. We gain and lose ground. We plan and use strategies. If we find a position indefensible, we can abandon

it and take a new line of attack.” (Lakoff & Johnson 1980:4). The concept of WAR describes an interaction involving attacks, defenses, opponents, positions, strategies, winners, and losers, and ARGUMENT is structured in the same way. Thus, the authors maintain that the link drawn between argument and war is both linguistic and conceptual. Examples of many more metaphors are given, and the authors conclude that metaphors of this nature are typical of and central to normal human thought processes.

The second key proposition was mentioned briefly above, and is expounded upon by Boroditsky (2000). It is the proposition that with this type of metaphor, the more abstract concept is the one that draws its structure from the more concrete concept. That is, the target concept is relatively abstract, while the source concept is more concrete. Consider several examples, taken from both Lakoff & Johnson (1980) and Boroditsky (2000)<sup>2</sup>:

- (2)
- a. MIND IS A CONTAINER
  - b. LOVE IS A JOURNEY
  - c. IDEAS ARE FOOD
  - d. SIGNIFICANT IS BIG
  - e. UNDERSTANDING IS SEEING
  - f. LIFE IS A GAMBLING GAME
  - g. THEORIES ARE BUILDINGS

I defined “abstract” as referring to anything that is not readily available to perception. Similarly, Boroditsky (2001:19) defines “abstract” as “not so reliant on sensory experience”. By contrast, a “concrete” concept is one “more clearly delineated in...experience” (Lakoff & Johnson, 1980:108-9). One observes that each of these target concepts (MIND, LOVE, IDEAS, SIGNIFICANT, UNDERSTANDING, LIFE, THEORIES) intuitively seems more abstract than the corresponding source concepts (CONTAINER, JOURNEY, FOOD, BIG, SEEING, GAMBLING

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<sup>2</sup> Examples are taken from both sources because the latter clearly identifies itself as a response to the former. Both papers, therefore, use the same types of examples.

GAME, BUILDINGS). The idea is that people use metaphors to borrow features from a concrete source concept, and apply them to an abstract target concept. Thus the abstract is understood in terms of the concrete.

## 1.2. From Space to Time: An Asymmetrical Relationship

The work presented in Boroditsky (2000) provides the foundation for the present study. As mentioned above, Boroditsky looks at the proposition from Lakoff & Johnson (1980) that people use metaphor to import characteristics from concrete concepts onto abstract ones. Specifically, the paper uses the domains of space and time as a test-bed, where space is considered relatively more concrete than time<sup>3</sup>. Boroditsky (2000) ultimately concludes that there is in fact an asymmetrical dependence between the conceptual representations of space and time. By ‘asymmetrical dependence’, it is meant that conceptualization of spatial concepts influences that of temporal concepts, but not vice-versa.

To clarify the forthcoming explanation of Boroditsky’s study, two concepts need be explained. First is the concept of priming. The term ‘priming’ refers to a phenomenon whereby use (or perception) of a particular element subconsciously inclines someone to use the same element soon after. The term ‘priming’ also describes a method whereby a researcher deliberately presents a particular element (or elicits the element from the participant) with the goal of producing the aforementioned phenomenon. (For a more in-depth discussion, see Jaeger & Rosenbach, 2008:89). In the case of Boroditsky (2000), the latter meaning is intended. The second necessary explanation is that of the ego-moving

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<sup>3</sup> The definitions of ‘abstract’ and ‘concrete’ given in Section 1.1 support this. Spatial relationships can be easily perceived through sensory experiences like sight and touch. A student can see how far the chair is from the desk, and a gymnast can feel that her feet are on the balance beam. Temporal relationships, by contrast, are less easily accessed by sensory experience. One cannot see, touch, smell, hear, or taste the relationship between right now and tomorrow.

schema and the domain-moving schema<sup>4</sup>. Each describes a particular way of conceptualizing the relationship between oneself and a domain (either spatial or temporal) in which one exists. Suppose we are to apply each schema to the domain of time. The ego-moving schema views the domain (time) as stationary, and the self as moving through the domain. Use of the ego-moving schema (EM schema) leads to the production of sentences like “We’re getting close to Mothers’ Day”. By contrast, the domain-moving schema views the self as stationary, while the domain moves past the self. Use of the domain-moving schema (DM schema) would instead produce “Mother’s Day is getting close”.

In the Boroditsky (2000) study, participants were primed with sentences which referred to one of the two domains (space or time), and were consistent with one of the two schema. Thus, there were four types of priming sentences:

- Spatial; using the EM schema
- Spatial; using the DM schema
- Temporal; using the EM schema
- Temporal; using the DM schema

Participants subsequently answered questions that were ambiguous in the sense that either schema could be used to interpret the question. Half of the questions were ambiguous space questions, and half were ambiguous time questions. Boroditsky (2000:11) provides this example:

- (3) “Next Wednesday's meeting has been moved forward two days. Which day is the meeting, now that it’s been moved?”

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<sup>4</sup> This is traditionally referred to as the ‘time-moving schema’. However, Boroditsky (2000) applies it not only to the temporal domain but also to the spatial domain. Thus, rather than refer to it as the ‘space/time-moving schema’, I simply abstract away from that distinction and call it the ‘domain-moving schema’.



According to the EM schema, the answer would be Friday. But according to the DM schema, the answer would be Wednesday. In this way, the researcher was able to understand which schema participants used for each question. Boroditsky (2000) then investigated the frequency with which participants gave consistent responses (that is, they used the same schema that they were primed with to answer the test questions). There were two important findings. (1) When the participants were given spatial primes, but the test question was temporal (consider this a space to time transfer), participants responded consistently with the prime 63.9% of the time, which is a statistically significant bias. (2) By contrast, in the case of time to space transfers, participants responded consistently with the prime only 47.2% of the time, which is statistically comparable to the chance prediction of 50%. These are the key findings that reveal an asymmetrical relationship between space and time.

### **1.3. Innovation: A Window into the Space/Time Relationship**

The present study is a response to the work of Boroditsky (2000), with the aim of going one step farther. The goal is to find further confirmation of the asymmetrical relationship described in the Boroditsky paper, by approaching the relationship from a different angle: semantic innovation (the act of accepting a novel link between a particular form and meaning).<sup>5</sup> Innovation from a source meaning to a target meaning typically occurs only if the

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<sup>5</sup> Innovation is an extremely interesting linguistic phenomenon, because it is the link between a synchronic linguistic state and the greater diachronic trajectory of change. The literature on semantic change (Croft 2000; Hollmann 2009; Traugott & Dasher 2001:38) describes it in terms of two steps: (1) innovation—the initial use of a new construction, and (2) propagation—the spreading of the new construction throughout the speech community. This framework reflects the idea that long-range changes are necessarily instigated by a single instance of innovation. Therefore, by looking at innovation, one should be able to see the seeds of diachronic change in contemporary speakers. With regard to this research, if conceptual metaphors influence innovation practices, they may ultimately

source is somehow conceptually relevant to the target. For that reason, if time is truly asymmetrically dependent on space, then one can expect people to innovate asymmetrically. Specifically, people should be more willing to recruit spatial elements into the temporal domain, because, while space is considered conceptually relevant to time, the reverse is not true. Thus, the question investigated here is whether people are in fact more willing to recruit spatial elements into the temporal domain, rather than vice versa. Additionally, Boroditsky shows that spatial information can asymmetrically prime people's conceptualizations of time. A secondary aim of the present work is to determine if an asymmetrical relationship between space and time can be found even without priming participants.

The elements used to probe this question are the spatial preposition 'along' and the temporal preposition 'during'. The main reason that these two prepositions are effective representatives of their respective domains is that unlike many English prepositions, neither has both a spatial and a temporal sense. A brief look at some of the other prepositions of English reveals considerable overlap between space and time descriptors. As shown in Figure 1, a great many of these terms have both spatial and temporal senses.

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be influencing long-range diachronic change as well. See section 4.1 for further discussion of this matter.

SPATIAL	TEMPORAL
There is a bee-hive <b>in</b> the garage.	Vacation starts <b>in</b> a few weeks.
Andrea biked <b>around</b> the corner.	The winter solstice is <b>around</b> Christmas.
I want to sail <b>on</b> the Mississippi River.	That lady never arrives <b>on</b> time.
The dog stood <b>by</b> the fence.	The paper is due <b>by</b> next Thursday.
Joseph stayed <b>under</b> his umbrella.	She was in town for <b>under</b> three days.
The author will be <b>at</b> the bookstore.	Students leave <b>at</b> 3:00pm every day.
A bat flew in <b>through</b> the chimney.	The baby slept <b>through</b> the night.
The pilot flew <b>over</b> the Pacific Ocean.	Aaron was sick for <b>over</b> a month.

Figure 1. Examples of spatio-temporal prepositions used in both domains.

By contrast to those in Figure 1, English contains some prepositions that have a temporal or a spatial sense, but (crucially) not both. Because this research examines differences between the usage of spatial prepositions and that of temporal ones, prepositions that are exclusively spatial or exclusively temporal are necessary. The goal is to work around any overlap between space and time descriptors by using only words that describe only one of the two domains. This is the benefit of using ‘along’ and ‘during’: the former has only a spatial sense in English, and the latter only a temporal one. It can therefore be determined whether there is a significant bias (consistent with the TIME IS SPACE metaphor) such that people will prefer to recruit ‘along’ to express temporal meanings, rather than recruit ‘during’ to express spatial ones.

## 2. Methods

As mentioned above, the goal here was to determine whether people prefer to recruit ‘along’ to express temporal meanings, rather than recruit ‘during’ to express spatial ones. This was achieved through a forced-choice acceptability judgment task wherein participants were presented with pairs of unacceptable sentences and asked to choose between the two, which was ‘better’<sup>6</sup>. In one of the sentences, ‘along’ was used to express temporal meaning. In the other, ‘during’ was used to express spatial meaning. The hypothesis was that participants would consistently prefer sentences with temporal ‘along’ to those with spatial ‘during’.

### 2.1. Participants

The participants involved in this study were 168 native speakers of American English, who did not learn a second language before the age of 5. By their own report, participants had never been diagnosed with any brain injury or linguistic, cognitive, or developmental disorder at the time of testing. Gender and ethnicity were not recorded<sup>7</sup>. Participants were recruited primarily through social media, and the distribution of their ages (ranging from 18 to 76) is represented in Figure 2.

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<sup>6</sup> Because participants were required to choose between ill-formed sentences, it was assumed that they would not consider *either* sentence acceptable. ‘Better’ is used throughout this study to refer to sentences that participants deemed *less* unacceptable. Specifically, ‘good’ sentences were defined for the participants as ones that were more like “normal English sentences”. Arppe & Järviö (2007) presents a similar type of experiment where Finnish speakers were given sentences in groups of three and asked to choose the “most natural” (*luontevin*) of the three. They investigated the same research question using two other methods as well, all of which converged on the same answer, thereby corroborating the effectiveness of the methods.

<sup>7</sup>Some research suggests that women are typically at the forefront of sound change (Maclagan et al. 1999; Labov 1990). Although variation by gender was not examined here, it would be interesting to explore whether women take the lead in semantic innovation as well. This could be a fruitful avenue for further research.

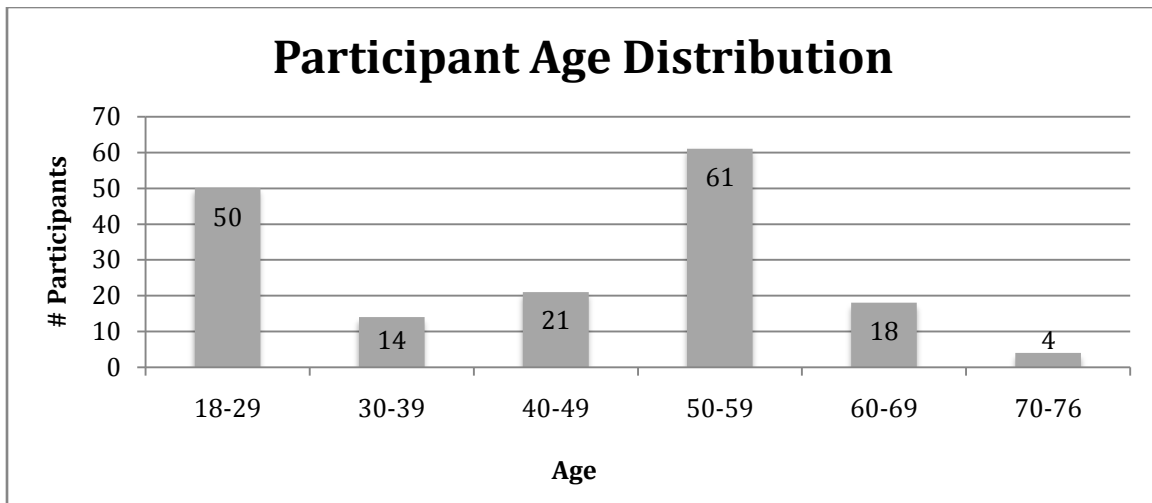


Figure 2

The map in Figure 3 reveals that a significant majority of the participants were from the eastern half of the United States, especially Massachusetts and Connecticut. Others listed hometowns primarily along the west coast.

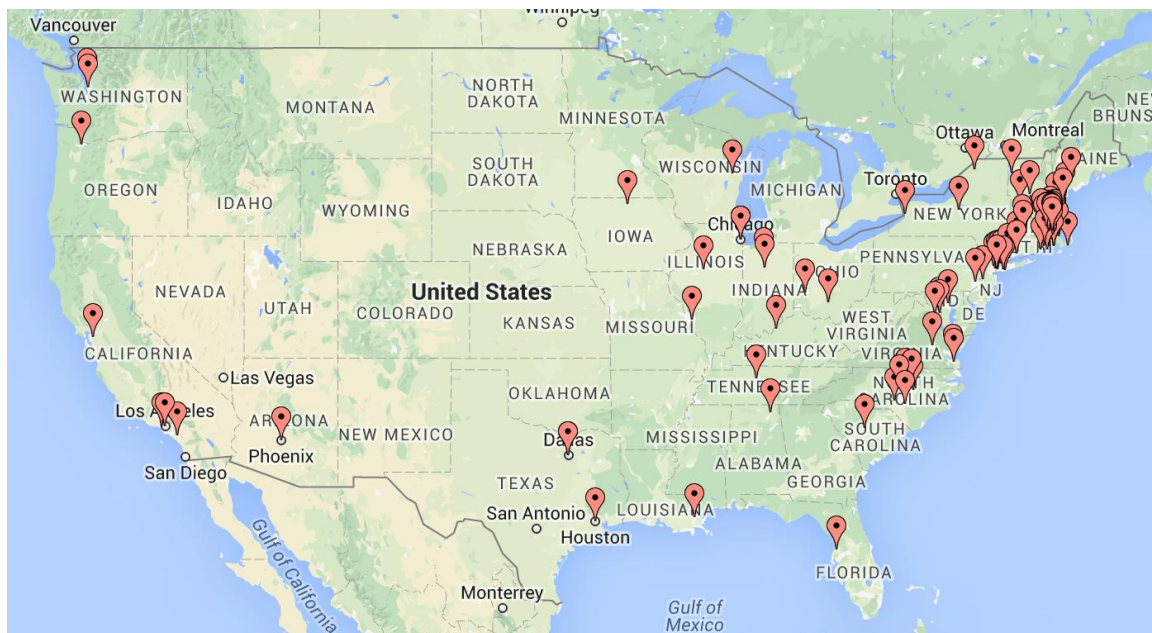


Figure 3. Map of participant hometowns. Each pin represents one participant.

## 2.2. Materials

The stimuli consisted of syntactically grammatical but semantically ill-formed sentences. The ill-formedness of the sentences lies in the fact that either the spatial preposition ‘along’ was used where only a temporal one was appropriate, or the temporal preposition ‘during’ was used where only a spatial one was appropriate. Consider an example of each sentence type.

(4)

- a. Type 1 (temporal along): \**“There are three birthdays **along** this week.”*
- b. Type 2 (spatial during): \**“There are three stores **during** the sidewalk.”*

Note that all of the test sentences were designed such that if another, domain-appropriate preposition were used instead, the sentence would become uncontroversially grammatical.

Consider, for example, the grammatical counterparts to the sentences listed above:

(5)

- c. There are three birthdays **during** this week.
- d. There are three stores **along** the sidewalk

The test sentences were presented in pairs as shown above, each pair containing one Type 1 sentence and one Type 2 sentence. In total there were 20 test sentence pairs (40 individual sentences), in addition to 40 pairs of filler sentences<sup>8</sup>. The filler sentence pairs both well-formed and ill-formed sentences. However, in the case of the ill-formed sentences, the source of ill-formedness varied across sentences. Consider the following four examples:

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<sup>8</sup> It is typical to use the same number of test sentences and filler sentences. In this study, more filler sentences than test sentences were used in an effort to further obscure the test condition from the participants.

- (6)
- e. \*The 18th century **loved** many historic moments.
  - f. \*There are a bunch of landmarks **inside** the trail.
  - g. \*The road is lined with **telephone pole** on both sides.
  - h. \*The toddler ran around until **she** exhausted **himself**.

Among these four example sentences lie issues of morpho-syntactic, semantic, and pragmatic ill-formedness, each of which produces a different but nonetheless salient type of ill-formedness.

### 2.3. Design

This test was presented in the form of an untimed online survey, designed on qualtrics.com that took about 15 minutes to complete. Before beginning the main portion of the test, participants were asked to provide biographical information. (Although it is customary to provide such information at the end of a study, this portion was included at the beginning in order to filter out participants<sup>9</sup> who did not meet the specifications listed in section 2.1.) After providing this information, participants were presented with the following instructions:

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<sup>9</sup> Of 368 total participants, 200 were filtered out. The most frequent reason for exclusion was having learned a language other than English before 5 years of age.

In this survey, you will read several sentences. You may find that some of the sentences sound weird. We can consider these sentences bad sentences. Good sentences are ones that basically sound like normal English sentences.

**Good:** “Two horses are in the barn.”

**Bad:** “Two farmer is in the barn.”

**Good:** “There are lots of aliens on Jupiter.”

**Bad:** “There are lots of aliens into Mars.”

**Good:** “Lisa got sick on Tuesday.”

**Bad:** “Frustration got sick on Tuesday.”

A pair of sentences will appear on the screen. For each pair, select which sentence seems **better** to you. No need to think too hard about it, just go with your gut.

**Thank you so much for taking this survey! Every response is invaluable.**

Figure 5. Survey instructions.

Before beginning the main portion of the test, participants were given a brief pretest (although participants were not informed that these were not the actual test questions). These were more traditional acceptability judgments, in that each pair included one clearly acceptable sentence and one clearly unacceptable sentence. One pretest question juxtaposed the unacceptable spatial ‘during’ with an acceptable spatiotemporal alternative. Another pretest question juxtaposed the unacceptable temporal ‘along’ with an acceptable spatiotemporal alternative. These two pretest questions were necessary to establish that each participant did in fact consider spatial uses of ‘during’ and temporal uses of ‘along’ to be unacceptable. The final two pretest questions both compared unacceptable filler sentences



with acceptable filler sentences. Only participants who answered all four pretest questions correctly were permitted to continue.

At this point, participants who were not filtered out by the pretest then began the test proper. As mentioned above, each participant interacted with 60 sentence pairs in total: 20 test sentence pairs and 40 filler sentence pairs. Participants saw only one pair at a time, and were required to answer all questions. The question order was randomized for each participant, and participants were not permitted to return to earlier questions (although they were permitted to save their progress and return to the survey later). Additionally, to prevent order bias within each sentence pair, the order of the two sentence options was also randomized.

### 3. Results & Analysis

To recap, the hypothesis was that participants would tend to prefer sentences with temporal ‘along’ over sentences with spatial ‘during’. The average frequency with which each participant preferred temporal ‘along’ was calculated. These results were consistent with the hypothesis, and are summarized in Figure 6.

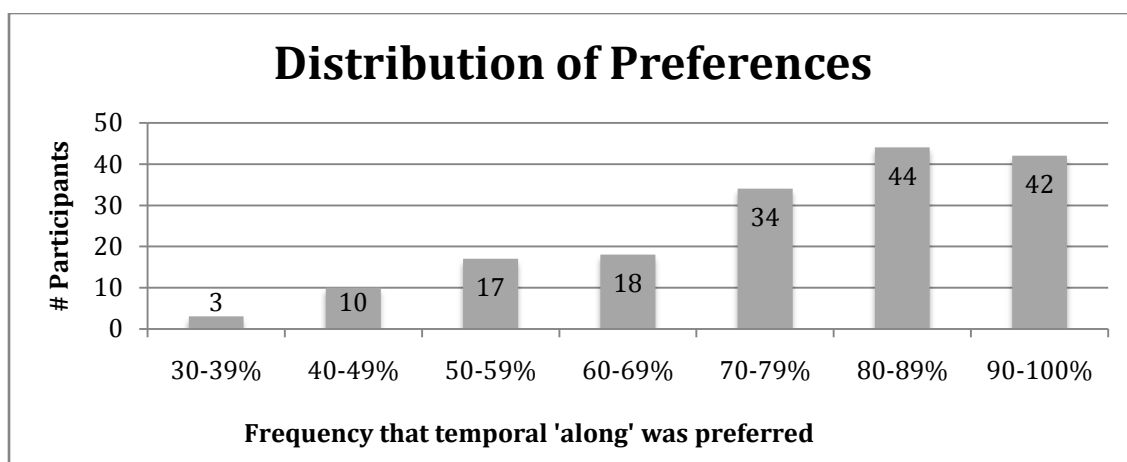


Figure 6

As shown, the vast majority of participants (155 in total) preferred temporal ‘along’ more than half of the time. On average, participants chose the sentence containing temporal ‘along’ 80% of the time. Statistically, there is a 95% chance that the true mean is between 77% and 82%, which is of course well above the 50% that would be predicted if there weren’t any bias at all between the two sentence types. Thus, on average, participants generally behaved consistently with the hypothesis<sup>10</sup>. The following subsections take a closer look at the data, asking first whether responses varied according to participant characteristics like age (3.1) and hometown (3.2), and secondly if responses varied by question (3.3), and/or by the order in which answers were presented (3.4)

### 3.1. Results by Age

Participants were divided into six different age groups, and Figure 7 does reveal some variation by age among the participant responses.

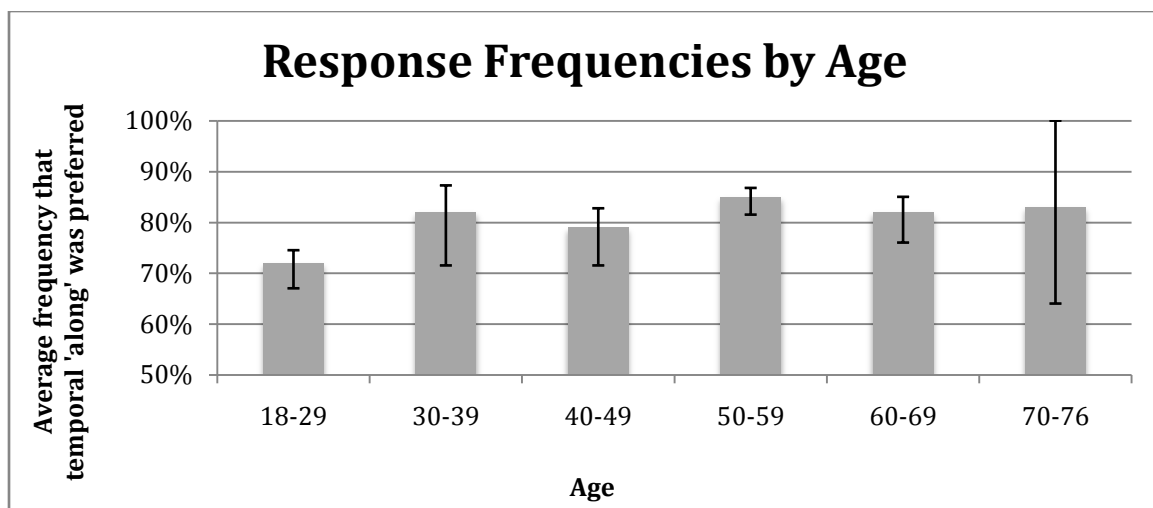


Figure 7

<sup>10</sup>It is worth noting that not *all* participants manifested this tendency. Figure 6 reveals that there were 13 participants who chose spatial ‘during’ more than half of the time.

What stands out perhaps the most about Figure 7 is the uncertainty regarding the 70-76 year old group. This is due to a very small sample size: only four participants fell into this group, with one averaging as low as 65%, and another as high as 95%. Thus, uncertainty for this age group is to be expected, and need not be paid much attention. The other interesting takeaway from this graph is that the youngest age group (18-29) does seem to prefer temporal 'along' with a notably lower frequency than the other age groups. While the other five groups hover around 80% frequency, this youngest group chalks in at only 72%. It can be said with 95% certainty that the true mean for the youngest group is between 67% and 77%. Thus the evidence suggests that this may in fact be a real difference, and not merely a byproduct of uncertainty due to variation within the group. However, this is really the only group where a clear distinction can confidently be made, which suggests that age may not be a particularly meaningful factor.

### **3.2. Results by Region**

Finally, the results were also analyzed for regional variation. Participant hometowns were sorted into the 6 regions listed below, with a 7<sup>th</sup> category for any other locations within the United States.

1. Eastern Massachusetts/Boston <sup>11</sup>
2. Northern New England (ME, NH, VT, western MA)
3. Southern New England (CT, RI)
4. Southeastern New York

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<sup>11</sup> It is worth noting that that Region 1 is substantially over-represented (relative to the other regions), with nearly half of the total participants listing hometowns in Eastern Massachusetts. However, this probably does not influence the data significantly, because there seems to be very little (if any) regional variation on this topic.

5. North Carolina
6. Pacific Coast (WA, OR, CA)
7. Other

As shown in Figures 8 and 9, the variation by region was minimal. Region 4 differed somewhat from the others, having the lowest median (70%) and the lowest mean (72%). Nonetheless, every region (New York included) manifested a bias in favor of temporal 'along' that was notably stronger than the chance prediction of 50%.

	Region	# People	Median	Average	95% Confidence Interval	
1	Eastern MA	80	80	79	75	82
2	Northern New England	15	90	78	67	89
3	Southern New England	12	90	84	74	94
4	Southeastern New York	11	70	72	60	83
5	North Carolina	6	93	89	79	99
6	Pacific Coast	6	88	88	79	98
7	Other	37	85	81	77	86

Figure 8. Frequency of Temporal 'Along' by Region

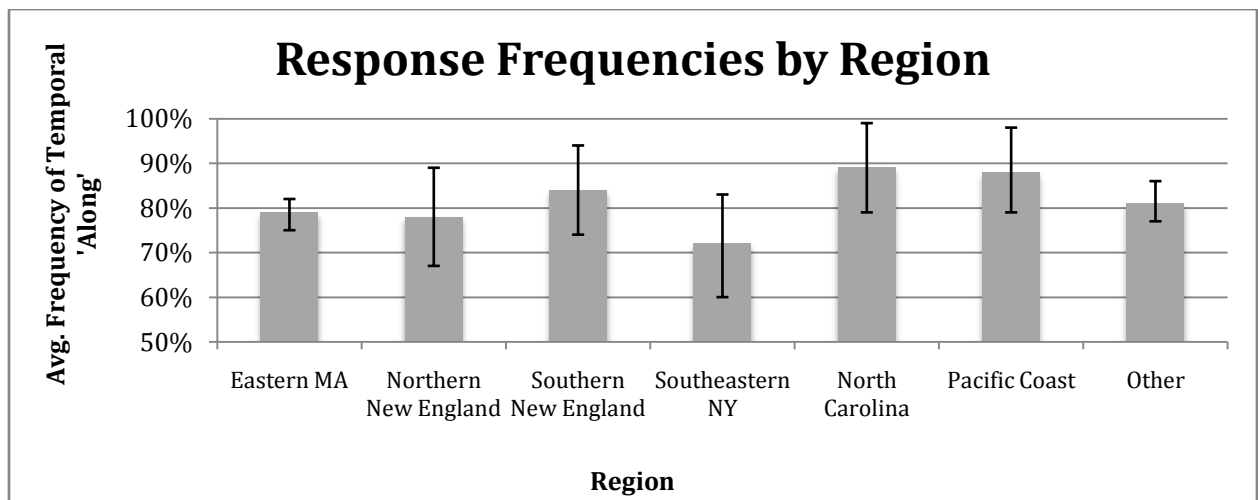
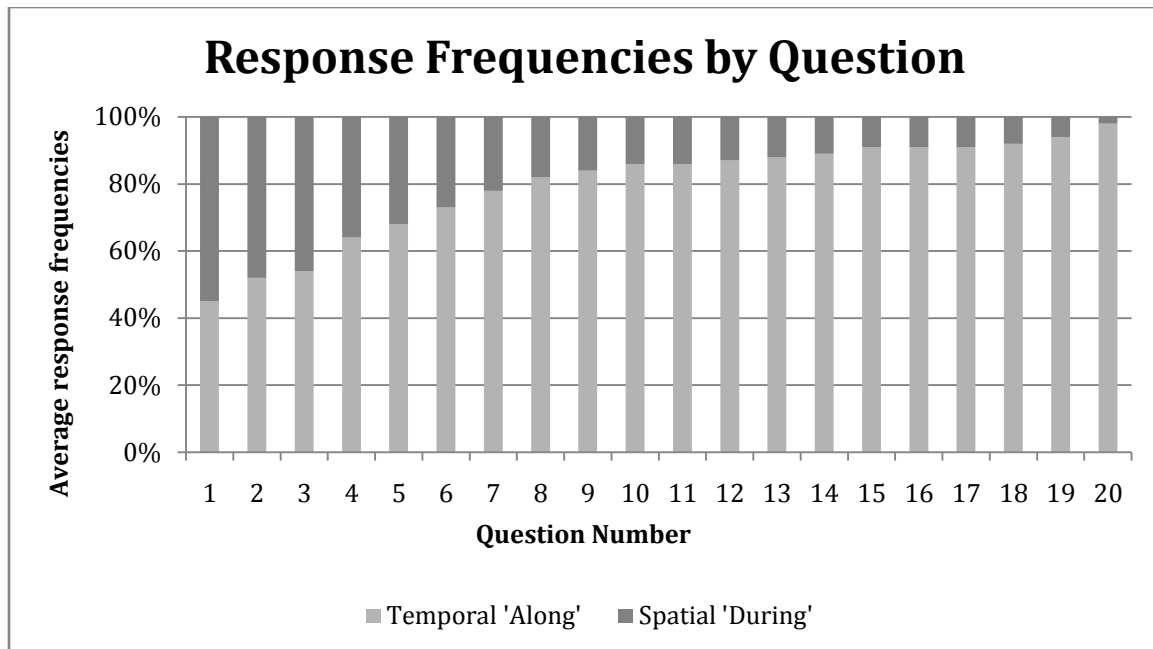


Figure 9

### 3.3. Results by Question

Although the averages of all participant responses showed a bias in favor of temporal ‘along’, the degree to which this occurred varied by question, as shown in Figure 10.<sup>12</sup>



**Figure 10**

Figure 10 reveals a relatively wide range of response frequencies among the twenty sentence pairs. For example, participant preferences did not significantly differ from the chance prediction of 50% for Questions 1 and 2; however, the frequency with which participants preferred temporal ‘along’ did not differ significantly from 100% for Question 20.

<sup>12</sup> Recall that questions were presented to each participant in random order. Thus, the numbers in Figure 11 do not correspond to the order in which questions were viewed. Instead, question numbers have been assigned according to the frequencies of participant responses.

At this point, I invite the reader to review sentences from each end of the spectrum in Figures 11 and 12, as I offer potential explanations for these data.

Sentence Pairs 1-5		
1	There were two defining events along his childhood.	45%
	There were two major landmarks during the trail.	55%
2	There were at least two thunderstorms along the night.	52%
	There were at least two coffee shops during this block.	48%
3	There are too many meetings along Memorial Day Weekend.	54%
	There are too many tollbooths during the New Jersey Turnpike.	46%

Figure 11

Sentence Pairs 18-20		
18	There are a bunch of birthdays along the Christmas season.	92%
	There are a bunch of telephone poles during the sidewalk.	8%
19	There were three lunar eclipses along 2013.	94%
	There were three birds during the fence.	6%
20	There were a couple of turning points along World War II.	98%
	There were a couple of potted plants during the back of the house.	2%

Figure 12

One possible explanation for this range is derived simply from the fact that linguistic acceptability is gradient, rather than binary. People do not evaluate acceptability in terms of two fully distinct categories (acceptable or unacceptable). Instead, they evaluate acceptability on a scale whereby constructions can fall into various degrees of acceptability. The fact that participants are able to make relatively consistent judgments between unacceptable sentences is in itself proof of gradient acceptability. Consider, then, a sentence pair with one spatial ‘during’ sentence and one temporal ‘along’ sentence. Suppose that participants rate the former to be relatively high on the acceptability spectrum for spatial ‘during’ sentences. By contrast, they rate the latter to be relatively low on the spectrum of temporal ‘along’ sentences. In such a case, the mismatch in acceptability of each sentence relative to its own category could actually lead participants to select the spatial ‘during’ sentence with an

increased frequency, despite the more general tendency to prefer temporal ‘along’ sentences. Mismatches of this type could explain the varied responses given by participants. Further research in this area would be necessary to determine conclusively that gradient acceptability was a cause of variability in this study.

Another possible explanation derives from the concept of “abstract motion”, which is “the construal of spatial configurations in terms of movement” (Haspelmath 1997:141; see also Langacker 1987). This phenomenon occurs when a person conceptualizes a given entity (e.g., the New Jersey Turnpike) not in terms of the spatial domain as might be expected, but rather in terms of motion across that entity (like a walk, or a drive). Thus, when encountering the sentence “There are too many tollbooths during the New Jersey Turnpike”, participants may be construing the sentence in terms of abstract motion. That would give rise to an interpretation more like, “during **the drive on** the New Jersey Turnpike”. The participant no longer has to interpret ‘during’ in terms of space; it can be understood in terms of motion, instead. This type of reinterpretation is possible also with the other ‘during’ sentences in Figure 11. Seeing the sentence “There were two major landmarks during the trail,” the participant uses abstract motion to reinterpret “during the trail” as something like, “during **my walk along** the trail”. Spatial interpretation of ‘during’ is avoided again. Similarly, the participant reinterprets “There were at least two coffee shops during the block” as “There were at least two coffee shops during **my walk down** the block”, and spatial interpretations of ‘during’ are unnecessary.

However, reinterpretation with the corresponding ‘along’ sentences becomes much more unwieldy. It seems quite unlikely that a person saying, “There were two defining events along his childhood” would expect an interpretation like, “There were two defining events along **the street where** his childhood **took place**”. One would be similarly reluctant to

reinterpret “along the night” as “along **the hemisphere where night had fallen**”, or to reinterpret “along Memorial Day Weekend” as “along **the block where the Memorial Day Weekend party is happening**”. I propose that this asymmetry occurs because spatial items necessarily exist in time, and therefore can be construed in a more temporal way. By contrast, temporal items (e.g., nighttime, the year 2013, etc.), being intangible, do not exist in space, making it much more difficult to construe temporal items in terms of space. Therefore, when given a forced choice task, participants reinterpret only the ‘during’ sentence, which counterbalances the bias in favor of temporal ‘along’, putting the two sentences in the pair on more level ground.

One drawback of the abstract motion explanation is that although it successfully accounts for cases where participants chose ‘during’ sentences with higher frequencies, it is not clear how these sentences differ significantly from those where ‘during’ was rarely chosen. Consider for example, “There are a bunch of telephone poles during the sidewalk”. If participants were using an abstract motion interpretation on this sentence, one would expect people to prefer this sentence relatively often, as occurred with sentence pairs 1-3. Instead, this sentence was chosen only 8% of the time. How is “during the sidewalk” significantly different from “during the trail” and “during the New Jersey Turnpike”? Unfortunately, the reinterpretation hypothesis leaves that question unanswered. A useful direction for further research, then, would be determining the cause of the variability observed here, whether it is gradient acceptability, reinterpretation through abstract motion, or something else entirely.



### 3.4. Results by Order of Presentation

It was mentioned briefly above that for each question, the order of sentences in each pair was randomized for every participant, so that any ordering biases present would not confound the data. Evaluating ordering bias was particularly relevant for this study because part of the goal was to elicit results comparable to those from Boroditsky (2000) *without* priming participants (see section 1.3). Although the priming phenomenon was not deliberately elicited, it is plausible that in each sentence pair, the first sentence could have a priming effect on the second, such that the use of ‘along’ in the first question primes the spatial domain, facilitating a spatial interpretation of ‘during’ in the second question (or vice versa). If this were the case, then one could expect participants to choose ‘during’ with a higher frequency in the cases where it did *not* appear in first position, and the same for ‘along’.

		Preferred		
		Along	During	Total
First Position	Along	1406	262	1668
	During	1292	400	1692
	Total	2698	662	3360

**Figure 13. Participant responses by display order.**

Overall, participants chose the sentence in first position 54% of the time. There is a 95% likelihood that the true mean frequency with which participants chose the first sentence is between 52% and 55%, suggesting a slight ordering bias in favor of the first sentence. Nonetheless, each sentence appeared in first position 50% of the time, so this order bias does not invalidate the results. Of the instances when ‘during’ appeared in first position, it was chosen 24% of the time. Of the instances when it did *not* appear in first position, ‘during’ was chosen only 16% of the time. Similarly, of the instances when ‘along’ appeared in first position, it was chosen 84% of the time. When it appeared second, it was chosen only

76% of the time. This is the opposite of the prediction based on priming<sup>13</sup>. Thus, the results of this study reveal that even without the influence of priming, people behave asymmetrically when dealing with space and time, as was asserted in Boroditsky (2000).

## 4. Further Discussion & Implications

Broadly speaking, the results confirmed the hypothesis that participants would prefer to recruit spatial ‘along’ into the temporal domain, rather than recruit temporal ‘during’ into the spatial domain. Despite the variation observed, the bias demonstrated in favor of temporal ‘along’ remains quite strong. This is consistent with the analyses from both Lakoff & Johnson (1980) and Boroditsky (2000), which converge on the idea that people conceptualize space and time as being asymmetrically related to one another through the TIME IS SPACE metaphor. More specifically, the present work is consistent with the idea that in conceptual mappings based on metaphor, space is a source concept for the target concept of time. Furthermore, this illuminates yet another aspect of the conceptual relationship involved in the TIME IS SPACE metaphor. The data presented here suggest that the TIME IS SPACE metaphor influences not only conceptualization processes, but also innovation processes: when forced to choose how they will innovate, a majority of people behave consistently with the TIME IS SPACE metaphor. Thus, space is a source concept for time not only with regard to metaphoric mappings, but also with regard to innovation. Strictly speaking our job here is done. But the aim of this section is to go a bit beyond that immediate research goal, venturing briefly into more tangentially related ideas.

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<sup>13</sup> These data are consistent with ordering effects discussed extensively in the literature about written surveys, whereby people are more likely to select a given option in a checklist when it appears earlier in the list. See Becker (1954) for a discussion of why this occurs, although there is no consensus in the field on the matter.

#### 4.1. Diachronic Unidirectionality

One phenomenon closely related to synchronic asymmetry and innovation is diachronic unidirectionality. The term ‘unidirectional’ describes linguistic changes that are observed to occur in only one direction across the vast majority of the world’s languages. This is particularly relevant because of evidence suggesting unidirectionality between the domains of space and time. It has been widely observed across the languages of the world (and thus rather uncontroversially asserted) that diachronic development from spatial expressions to temporal ones does occur, but that the reverse does not occur (Haspelmath 1997, Svorou 1993, Jaeger & Rosenbach 2008, Traugott 1974). What, then could be motivating this unidirectionality? The evidence from Boroditsky (2000) demonstrated that the TIME IS SPACE metaphor is a psychological reality, and by showing that that the same metaphor also influences innovation practices (which is effectively the mechanism by which diachronic change occurs), the present work has provided some reason to hypothesize a causal link between the type of conceptual metaphor explored here and diachronic unidirectionality.

But how, specifically, could this metaphor be influencing diachronic processes? A possible answer to this question is given in Jaeger & Rosenbach (2008), which offers an account of unidirectional semantic change based on asymmetric priming relationships between concepts. The authors discuss the example of time and space, and their reasoning is as follows. Space asymmetrically primes time, as shown by Boroditsky (2000). Thus, the use of a space word to describe time has the highest probability of occurrence after that space word was recently used. But the use of a time word to describe space cannot be primed in that manner. Because the former can be primed, while the latter cannot, the former occurs more frequently in speech. Over time, multiple exposures to the former structure result in

increasingly positive acceptability judgments, until finally it becomes fully entrenched in the grammars of speakers. The unidirectional bent results simply from the fact that the other construction has a lower probability of occurrence, and therefore a lower probability of entering the grammar. In this way, a metaphor like TIME IS SPACE could actually be influencing the directionality of language change. This is the kind of account that bridges the gap between synchronic and diachronic phenomena, and this is the kind of account that the results discovered here may be pointing to.

#### **4.2. Directions for Future Research**

Going forward, it would be desirable to expand the exploration completed here in a number of different directions. A few of the most important are mentioned here. It has been mentioned already the need to determine the source of variability across different stimuli. Specifically, a deeper look into the influence of abstract motion is necessary. Additionally, further research is required to determine confidently whether the effects observed here occur cross-linguistically. The present work offers persuasive evidence revealing the influence of the TIME IS SPACE metaphor on semantic change. However, the scope of this study was limited to data from American English speakers. Scholars of cross-linguistic phenomena would (rightfully) hesitate to make generalizations based only on data from American English speakers. Lastly, although we may conclude that the TIME IS SPACE metaphor is a psychological reality influencing innovation processes, it is not yet clear if other metaphors cited in the literature (e.g., ARGUMENT IS WAR, MIND IS A CONTAINER, etc.) have a comparable influence on innovation practices. This question would provide plenty of fodder for future research, and its answer would constitute a significant contribution to the study of semantic change.

## 5. Conclusion

The goal of this research was to determine whether human innovation practices are consistent with the TIME IS SPACE metaphor, and the results offer a resounding “yes”. When forced to choose, participants in this study preferred to use ‘along’ temporally (80% frequency), rather than use ‘during’ spatially. This confirmed the hypothesis that the asymmetrical relationship between the concepts of time and space extends not only to conceptualization, but also to innovation. In addition to confirming the claims of Boroditsky (2000), and uncovering a clear answer to the research question at hand, this study has gestured toward various possible areas of future research across the fields of semantics, diachronic linguistics, and cognitive linguistics.

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