**Metaphor to Memory: Effects of Spatiotemporal Metaphors on the Emotional Valence
of Autobiographical Memories**

by

Jayne Williamson-Lee

A thesis submitted to the

University of Colorado at Boulder

in partial fulfillment of the requirements to receive

Honors designation in Linguistics

May 2018

Abstract

English speakers conceptualize the passing of time in one of two ways: as events in time moving toward them (the time-moving perspective) or as themselves moving through time (the ego-moving perspective). Previous studies suggest that these construals of time have corresponding emotional valences (positive and negative, respectively), which influence perceptions of emotional experiences. This study investigates whether spatiotemporal metaphors evoke valence-specific memories – specifically whether the ego-moving perspective evokes positive memories and the time-moving perspective negative memories. Participants read statements depicting events in motion and wrote about autobiographical memories. Memories recalled were evaluated as positive or negative by the researcher. Results showed no difference in memory valence between the two conditions. Although previous studies have demonstrated that event valence influences spatial construals of time, these results suggest that there is no significant influence of time construals on memory valence.

1. Introduction

Abstract concepts like time are thought of in terms of more concrete,

experiential domains (Lakoff & Johnson, 1980). People base their understanding of time

on their spatial experience. Time, considered a "borrower domain," derives its structure

from that of space, a "lender" domain, which is reflected in how we speak about time.

Time is conceptualized as a "unidimensional, directional, and dynamic entity," and these

qualities dictate the sort of spatial terms that can also be used in the temporal lexicon

(McGlone & Pfiester, 2009, p. 4; Clark, 1973). Speakers use spatial terms such as "long"

and "short" to describe the duration of time (e.g. a "long weekend") but not terms that

imply more than one dimension such as "deep" or "shallow." The directionality of time

is expressed linguistically in the form of sequential terms (e.g. *before-after*) rather than

symmetric terms (e.g. *left-right*),[1] and its dynamic quality employs terms which describe

physical movement, e.g. *time passes, moves, speeds up, slows down.*

Spatial construals of time are represented linguistically in two metaphors: the

ego-moving and time-moving metaphors (Nuñez et al., 2006; Clark, 1973; Gentner,

2001). English speakers can conceptualize themselves figuratively moving forward

toward the future, adopting an ego-moving perspective as in the sentence, "We are

---

[1] Although symmetric terms like "left" and "right" are not used in the temporal lexicon, people can recruit symmetrical sides of space to conceptualize time. For English speakers, the past resides on the left side of space and the future on the right (Santiago et al., 2007). The left-right space-time mapping is influenced by writing direction. Cross-cultural research also demonstrates that people represent time from right to left, front to back, or back to front (e.g. Boroditsky, 2000; Boroditsky & Ramscar, 2002; Fuhrman & Boroditsky, 2010; Bergen & Lau, 2012; Núñez & Sweetser, 2006; Santiago et al., 2007; Torralbo et al., 2006; Tversky et al., 1991).

approaching the deadline." English speakers can also think of events in time as moving from the future to the past. In the time-moving perspective, when events move toward the speaker in the present, as in the sentence, "The deadline is approaching."

These time perspectives are demonstrated in the ambiguous question, "Next Wednesday's meeting has been moved forward two days. What day is the meeting now that it has been rescheduled?" (McGlone & Harding, 1998; Boroditsky & Ramscar, 2002; Lai & Boroditsky, 2013). If people conceptualize themselves as moving through time, that is, thinking with the ego-moving perspective, they are likely to say that the meeting has been moved "forward" from Wednesday to Friday, further toward the future in the same direction as their own direction of motion. If people conceptualize events moving toward them, that is, thinking with the time-moving perspective, they are likely to say that the meeting has been moved "forward" from Wednesday to Monday, further toward the present where they themselves are situated. People thinking with the time-moving perspective move the meeting from Wednesday to Monday because the meeting moves further toward the present, where they are situated.

1.1. Temporal communication of affective events

Considerable research has documented the linguistic conventions for describing states and events with positive and negative emotional valence (Lakoff & Johnson, 1980; Kövecses, 1991; Meier & Robinson, 2004; Schubert, 2005; Crawford et al., 2006; Margolies & Crawford, 2009; McGlone & Pfiester, 2009). We talk about our feelings using the 'Good is Up' metaphor (Lakoff & Johnson, 1999). For example, people talk

about positive feelings in terms of upward motion or position in space, such as "her spirits soared." Negative feelings are described in terms of downward motion or position, e.g. "I'm feeling down." People also use spatiotemporal metaphors to talk about the valence of events. The way speakers choose to encode their temporal experiences conveys information about their affective orientation toward events. People tend to use the ego-moving metaphor to describe positive events but the time-moving metaphor to describe negative events. Here I will focus my discussion on experimental studies most relevant to my work.

Margolies and Crawford (2008) found in one of their experiments that people had strong intuitions about how a speaker felt about a scheduled event depending on whether a description was framed in the ego-moving or time-moving perspective. In this study, participants were given a third-person description of a neutral event in either ego-moving or time-moving language and asked to rate how positively or negatively the character felt about the event. The description in the ego-moving condition read, "Paul explained, 'It was scheduled for a week from Wednesday. As I got closer to the event, I learned that it had been moved forward two days to Friday'" (p. 1409). Here, the event has been moved from Wednesday to Friday because this is the direction of motion of the ego in time (from past to future). Participants who read this ego-moving description rated that Paul felt more positively about the event than those who read the description in the time-moving condition, which read, "Paul explained, 'It was scheduled for a week from Wednesday. As I got closer to the event, I learned that it had been moved forward two days to Monday'" (p. 1409). Here, the event has been moved from Wednesday to

Monday because this is the direction of motion of the event in time (from future to past). Participants rated that Paul felt more negatively about the event based on this description. This study demonstrates that people attribute a positive valence to events described with an ego-moving metaphor and a negative valence to events described with a time-moving metaphor. These results are evidence that the ego-moving and time-moving spatial metaphors of time have affective associations.

This finding has been extended by McGlone and Pfiester (2009)'s observation that temporal agency assignment is a linguistic marker which listeners use to infer how the speaker feels toward an event. In their view, the entity attributed agency determines the direction of motion through time as well as the event valence. They refer to the time metaphors based on the type of agent, e.g. the ego-moving metaphor as a human-agent expression and the time-moving metaphor as an event-agent expression. Encoding temporal experiences in the time-moving perspective may convey that a speaker feels negatively toward an event.[2] In the time-moving perspective, the event in time is encoded as the agentive grammatical subject that moves toward the observer in the direction of the past, as in the sentence, "Midnight is approaching" (p.

_____

[2] This is similar to how using the grammatical passive voice influences perceived blame and financial liability. For example, Fausey and Boroditsky (2011) demonstrated that people were more likely to place blame on a person if they read an agentive account of an accidental event than a passive account. In their study, participants read a description of an accidental restaurant fire which caused property damage and then made a judgment about who was responsible and how much they should pay. Participants who read an agentive (transitive) account of the accidental event judged the person involved to be at fault and estimated that they should pay more for the damages than those who read a passive (intransitive) account.

11). Time-moving expressions are defined in terms of agency as event-agent expressions. In the ego-moving perspective, the grammatical first person pronominal subject is assigned agency moving toward the event situated in the future, as in the sentence, "We are approaching midnight" (p. 11). Ego-moving expressions are defined in terms of agency as human-agent expressions. People use agency assignment as a linguistic marker when using time metaphors in order to express their affective orientation toward events.

McGlone and Pfiester examined the frequency of positive and negative events[3] encoded with human-agent or event-agent expressions in several large American English corpora. They found that positive events were more frequently encoded with human-agent expressions, showing that speakers describe positive events by assigning agency to themselves. Negative events tended to be encoded with event-agent expressions. In a subsequent experiment, McGlone and Pfiester considered whether people drew different inferences about a speaker's affective orientation toward an event depending whether the event was described with human- or event-agency (Experiment 3). To test this claim, they asked participants to read a series of fictitious journal entries written by a college student, Leslie, describing her activities and plans. The target event was a description of one of Leslie's weekend plans, attending a conference on academic peer counseling, which had three versions. In the first version,

---

[3] They also examined the frequency of neutral events and found that the encoding pattern of neutral events was similar to that of negative events. However, because they had difficulty distinguishing neutral events from other valenced events, they considered the encoding pattern of neutral events to be weak and possibly misleading.

the event was encoded with human-agent expressions, e.g. "We are fast approaching

the day of the peer counseling conference, so I'd better get my notes together for the

roundtable" (p. 20). In the second version, the event was encoded with event-agent

expressions, e.g. "The day of the peer counseling conference is fast approaching, . . ." (p.

20). The third version was the control version, which encoded the event in literal

language (e.g. "The peer counseling conference is happening in just a few days, . . .").

After reading a version of the journal entries, participants rated how excited and how

worried they perceived her to be about the event on Likert-type scales.[4] They found that

participants who read descriptions of the event with human-agent expressions rated

Leslie to be more excited (and less worried) about the event than those who read

descriptions of the event with event-agent expressions. In the event-agency condition,

participants perceived Leslie to be more worried (and less excited) about the event.

These results show that participants "affectively distinguished between the different

metaphorical encodings of event passage," demonstrating that spatiotemporal

metaphors have attributional consequences (p. 23). The ego-moving perspective,

characterized by human agency, implies that the speaker has a positive disposition

toward an event, whereas the time-moving perspective, characterized by event agency,

implies that the speaker has a negative disposition toward an event.

In summary, the corpus study showed that positive events are described with

---

[4] Likert-type scales are rating scales used in questionnaires to assess people's judgments ranging along a scale. In this study, participants' judgments of the speaker's attitude toward the temporal event were evaluated, ranging from 1 (e.g. *Leslie was not at all excited*) to 7 (e.g. *Leslie was very excited*).

human-agent expressions and negative events with event-agent expressions. Second, rating studies showed that neutral events described using human-agent expressions were rated more positively than events described using event-agent expressions. These findings suggest that spatiotemporal metaphors correspond with event valence.

1.2. Effects of event valence on spatial construals of time

With evidence from the previous studies showing a correspondence between spatial construals of time and event valence, McGlone and Pfiester (2009) considered whether the valence of temporal events influences the time perspective people adopt. They examined whether there is a causal relationship between event valence and temporal agency assignment. In their study (Experiment 2), they asked participants to write about an autobiographical experience that had been a pleasant, unpleasant or neutral event for them. They analyzed the frequency of human- and event-agent expressions in the narratives and found that people who wrote narratives describing pleasant events used human-agent expressions more frequently—that is, they granted agency to themselves when describing the passage of pleasant events. Event-agent expressions were more frequent in narratives of unpleasant events, showing a preference to describe the passage of unpleasant events by granting agency to the events themselves.

The authors propose that these patterns of metaphorical agency assignment in descriptions of temporal passage reflect people's understanding of time and emotion, which is based in bodily experiences. This explanation is supported by the theory of embodied simulation, the notion that the bodily experiences we have when directly

interacting with the world are reactivated (or simulated) when we engage in tasks that

do not involve physical movements, such as language processing. Both our

understanding of emotion and of time are grounded in our bodily experience. Our

emotional states activate and interact with sensorimotor behaviors such that emotional

valences are paired with certain movement patterns. In space our movement patterns

include approach, moving toward affectively positive stimuli, and avoidance, moving

away from or passively observing the arrival of affectively negative stimuli. Studies

investigating these motion-emotion entailments have found that positive emotional

valence corresponds with approach behavior toward a stimulus and negative emotional

valence corresponds with avoidance of an oncoming stimulus, or passivity. For example,

Chen and Bargh (1999) present findings that show people responded more quickly to a

positive stimulus when they pulled a lever toward themselves (approach) than when

they pushed it away (avoidance). However, people responded to a negative stimulus

quicker when pushing a lever away than when pulling it toward themselves.

These motion-emotion entailments are present in construals of time. In time we

conceptualize ourselves moving toward pleasant temporal events but passively

observing the arrival of unpleasant events.[5] The authors propose that the patterns of

---

[5] We cannot "avoid" unpleasant temporal events because this movement suggests a change of direction. Since the human agent moves unidirectionally toward the future, it is only possible to modulate the speed at which you advance toward the future. Glicksohn and Ron-Avni (1997) found that people perceive themselves moving through time at a relatively faster rate than when they conceptualize events moving through time. This suggests that time seems to pass more quickly in the ego-moving perspective than in the time-moving perspective. Based on these findings, one can modulate their speed through time by adopting the time perspective associated with their desired

agency assignment are consistent with motion-emotion entailments. They also propose

that an explanation for the patterns of agency assignment are consistent with the self-

serving attributional bias (Miller & Ross, 1975). The self-serving attributional bias refers

to the tendency to causally attribute favorable outcomes to the self and unfavorable

outcomes externally to others. I interpret this in regard to time construals as the

following: people assign agency to themselves (the self) when they move toward a

positive temporal event (denoting a favorable outcome), whereas people assign agency

(externally) to the event when the temporal event is negative (denoting an unfavorable

outcome).

Similar to McGlone and Pfiester (2009), Lee and Ji (2013) examined the effect of

event valence on people's shifts in time perspectives. One of their studies focused on

future events. In this study, they asked participants to write about a future event that

would make them feel either happy or unhappy. To determine participants' time

perspective, they used a novel word puzzle task with the words *deadline*, *we*, *the*, *is*,

are, *approaching*, *us*, which could be arranged in one of the two ways: (a) in the ego-

moving condition, *"we are approaching the deadline,"* and (b) in the time-moving

condition, *"the deadline is approaching us.*" Participants who wrote about a happy

future event were more likely to unscramble the word puzzle with the solution, *"we are*

approaching the deadline." Participants who wrote about an unhappy future event were

more likely to unscramble the word puzzle with the solution, *"the deadline is*

---

speed (consequently, reassigning the agency role). One study, Lee and Ji (2013),
mentioned later in this paper, builds on this notion.

approaching us." These results are consistent with McGlone and Pfiester (2009) and the conventional understanding that the ego-moving perspective is associated with positive events and the time-moving perspective with negative events.

In another study in the same paper, however, their results differed from the conventional understanding of time construals and their corresponding valences. Unlike in previous studies of past events, participants who thought of positive events adopted the time-moving perspective. In contrast, participants who thought of negative events adopted the ego-moving perspective. In this study, participants wrote about a past experience in which they had felt "either embraced or rejected by their friends" (p. 22). They then answered the ambiguous temporal question, "The meeting originally scheduled for next Wednesday has been moved forward two days. Which day has the meeting been rescheduled for?" Based on previous studies' findings about responses to the ambiguous temporal question (Boroditsky & Ramscar, 2002; Lai & Boroditsky, 2013), it would be expected that participants in this study who recalled a past experience in which they felt "embraced" (a positive event) would be likely to say that the meeting had been rescheduled from Wednesday to Friday because this would orient the event in the direction of the future (the ego-moving perspective). For participants who recalled an experience in which they felt "rejected" (a negative event), they would be likely to say that the meeting had been rescheduled from Wednesday to Monday, orienting the event toward the present (coming at the self, e.g. the time-moving perspective). However, "rejected" participants were more likely to say that the meeting had been rescheduled to Friday and "embraced" participants to say it had been rescheduled to

Monday.

Lee and Ji reason that people mediate between the ego-moving and time-moving perspectives in order to regulate their psychological distance from temporal events. Regulating their psychological distance from temporal events entails moving "away" from negative events and "toward" positive events (based on approach-avoidance behaviors). However, because the time perspectives dictate the direction of motion through time, people cannot change the direction of motion but can modulate the speed at which they perceive time passing, moving at a faster rate "away" from negative events and "toward" positive events. This explanation is based on previous studies' findings that people perceive temporal passage as faster or slower depending on their time perspective (Glicksohn & Ron-Avni, 1997; Boltz & Yum, 2010). People taking the ego-moving perspective perceive time to pass more quickly. Because they conceptualize themselves as actively moving through time, they perceive progressing toward future temporal landmarks at a faster rate than in the time-moving perspective (which assumes passive motion through time). Taken together, the ego-moving perspective allows for active psychological distancing. In Lee and Ji's view,

> Unpleasant events from the past and pleasant events in the future, though differing in valence, both encourage people to move forward as quickly as they can. Given that time is perceived to be faster in the ego-moving perspective than it is in the time-moving perspective, the ego-moving perspective [is] more likely adopted when an unpleasant past or a pleasant future is brought to mind. (2013, p. 22)

Conversely, people are more likely to adopt the time-moving perspective in regards to pleasant past events and unpleasant future events. People are reluctant to

psychologically move away from pleasant past events as they are a source of happiness. People's unhappy feelings about unpleasant future events also prompt them to passively oversee the passage of these events and "let time do the moving" (p. 24).

Taken together, these studies both demonstrate effects of event valence on spatial construals of time. However, their results are contradictory and explained by different mechanisms. McGlone and Pfiester (2009) showed that positive events prompt the ego-moving perspective (communicated with human-agent expressions), whereas negative events prompt the time-moving perspective (communicated with event-agent expressions). They contend that metaphorical agency assignment is based on motion-emotion entailments. In contrast, Lee and Ji (2013) showed that psychologically, people move at a faster rate "away" from negative events and "toward" positive events in both the past and future. By adopting the ego-moving and time-moving perspectives, people can modulate the speed at which they perceive temporal passage in response to the event's valence and temporal location. In this regard, Lee and Ji consider the ego-moving and time-moving perspectives to be methods of active and passive psychological distancing, respectively.

1.3. Metaphorical mental representation and emotional experience

The previous studies have employed spatiotemporal metaphors as an indicator of people's affective orientation toward events (Margolies & Crawford, 2008; McGlone & Pfiester, 2009; Lee & Ji, 2013). Few studies have employed time metaphors in order to understand their implications on people's perception of emotional experiences, despite

prevailing evidence that spatiotemporal metaphors are tied to motion-emotion

entailments and have corresponding affect. This section focuses on activations of

metaphorical mental representations and their effect on emotional experience.

One study by Ruscher (2011) investigated the implications of spatiotemporal

metaphors on affective forecasts. This study primed participants to adopt either the

ego-moving or time-moving perspective using static images of objects moving in space

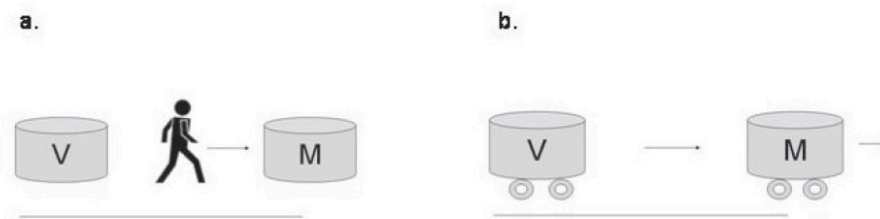from Boroditsky (2000), shown in Figure 1.[6]

Figure 1. Examples of (a) ego-moving primes and (b) time-moving primes.

Participants then read a story about a woman whose son had died and were asked to

estimate her immediate affect intensity and the duration of affect intensity (for how

much time they perceived she would grieve). Following this, participants gave a free

response about what returning to a normal life would denote for a person who had

experienced this type of loss. Participants in the ego-moving condition expected her

---

[6] "[The] different views of time also can be prompted by their respective representations of objects in space. Objects that move forward through space will prime the perspective that time moves, whereas stationary objects amid moving people will prime the perspective that time is stationary" (Ruscher, 2011, p. 226).

grieving period to be shorter, at about 5 months, than participants in the time-moving condition, who expected her grieving period to continue past 10 months. Because this study concerned the duration of the woman's affect, participants conceptualized her affective state as moving through time, instead of the event in which she lost her son. Ruscher asserts that in the ego-moving condition, "an affective state is left behind as a function of the actor's forward motion along the road of life" (p. 227). Here, the actor is conceptualized as having moved past her son's death (now further in the past) but since her grieving continues, her initial affective states follows her as she moves forward in time. The ego-moving perspective encouraged participants to think she agentively moves past her initial affective states into the present where she resumes her daily routine. In contrast, the time-moving perspective encouraged participants to think that her initial affective state follows her as she passively moves further into the future (constituting a longer grieving period) until eventually the negative affect recedes back into the past, marking the end of her grieving period. This study showed the effects of spatiotemporal metaphors (adopted using spatial primes) on how people perceived an actor's emotional experience, particularly how long (or short) a woman would grieve for depending on whether their time perspective implied agentive and passive movement through time.

Another study by Casasanto and Dijkstra (2010) showed how activating a metaphorical mental representation through motor action influenced whether people recalled positive or negative memories. In this study, participants moved marbles upward and downward while retelling autobiographical memories with either positive

or negative valence. They recalled more positive memories when moving marbles upward and more negative memories when moving marbles downward. This is because upward movements are implicitly associated with positive emotional valence and downward movements with negative emotional valence. This result is evidence that the metaphorical mental representation influenced the valence of the memories that people recalled.

2. The study

The present study investigates the implications of spatiotemporal metaphors on the valence of autobiographical memories. This study recruits a similar priming method to activate metaphorical mental representations as Ruscher (2011) and Casasanto and Dijkstra (2010) have used and evaluates the valence of recalled autobiographical memories as Casasanto and Dijkstra (2010) have. Whereas other studies such as Lee and Ji (2013) and McGlone and Pfiester (2009) have examined how the valence of autobiographical memories predisposes people to adopt a time construal, this study looks at the reverse effect, examining how differing time construals predispose people to recall valence-specific memories. The contrastive linguistic framings of the ego-moving and time-moving metaphors have corresponding positive and negative emotional valences, respectively. I propose that the affective responses evoked by spatiotemporal metaphors provide emotional contexts which mirror the conditions under which positive and negative memories have been encoded. The encoding specificity principle of memory holds that present sensory or perceptual cues similar to

those present when past memories were encoded can result in the recall of specific

memories (Tulving & Thomson, 1973). It is possible that when people process

spatiotemporal metaphors, the metaphors evoke the affective responses similar to

those that people had in situations where they encoded positive and negative

memories. This explanation is based on the theory that language processing involves

embodied simulations of actions described in language. A previous study by Matlock

(2004) found that processing non-literal descriptions of motion involves mental

simulations of motion.[7] Although these findings regard processing sentences of fictive

motion (such as *the road runs through the* valley), it is likely that processing

spatiotemporal metaphors also involves simulating motion through time. Due to the

motion-emotion entailments present in spatiotemporal metaphors (McGlone & Pfiester,

2009), we conceptualize ourselves, for example, moving toward pleasant temporal

events, which evoke positive emotions. The emotions evoked by responding to positive

and negative events may provide the emotional context which mirrors the emotions felt

---

[7] Matlock (2004) found that people processing sentences of fictive motion (such as *the road runs through the* valley) appeared to simulate motion. In this study, participants read a story about travel and then made a decision about whether a fictive motion (FM) sentence related to the story. For example, participants read about travelling a long distance across a desert and then made a decision about whether a FM sentence such as, "Road 49 crosses the desert," related to the story (Experiment 1). Other participants read about travelling a short distance across a desert. The participants who read about long-distance travel took a longer time to decide whether the FM sentence was related in comparison to those who read about short-distance travel. This result shows that people simulated motion in order to process FM sentences. Matlock explains that while reading the story, people imagined a path similar to Road 49 described in the story and used this model when making a decision about the FM sentence. In order to process the FM sentence, they simulated motion along the imagined path in a similar manner to how the protagonist had moved in the story. If the protagonist travelled a long distance, people simulated motion along a longer path, resulting in a longer decision time than if the protagonist travelled a short distance.

when positive and negative memories were originally encoded. Thus, valence-specific memories can be evoked by the emotional context provided by spatiotemporal metaphors.

Based on the encoding-specificity principle, I hypothesize that it is possible to recall valence-specific memories if people are exposed to linguistic framings of time construals that evoke affective responses. Prior research suggests the following hypotheses:

1. When people conceptualize themselves as agentive entities moving through time (or adopting the ego-moving perspective), they are more likely to remember autobiographical memories with positive valence because of the congruency with ego-moving perspective's positive affective association.

2. When people assign agency to events moving through time (or adopting the time-moving perspective), people are more likely to recall autobiographical memories with negative valence because of the congruency with the time-moving perspective's negative affective association.

3. Methods

3.1. Participants

Thirty-five monolingual English speakers over the age of 18 were recruited in the United States on the University of Colorado Boulder campus, under IRB Protocol 16-0475. They completed a questionnaire in person or online via email in exchange for

extra course credit or monetary compensation.

3.2. Materials

Questionnaire. Two versions of a questionnaire were created for the ego-moving and time-moving conditions. The three-page questionnaire consisted of two TRUE or FALSE priming questions, a writing prompt asking participants about a time they had felt proud or ashamed, and a series of follow-up questions to evaluate the experience about which they had written.

On the first page of the questionnaire, participants were given two statements depicting events moving in time and asked to circle whether the statements were TRUE or FALSE. An example of an ego-moving statement is "Toward the end of July, we are leaving summer," and a time-moving statement is "Toward the end of July, summer is leaving us." These statements were adapted from Boroditsky (2000)'s temporal primes. She used ego-moving sentences such as "In March, May is ahead of us," and time-moving sentences such as "March comes before May," including other month pairings. I have adjusted these statements to use the present progressive and motion verbs, rather than static locative verbs, in order to convey more clearly that the entities (either "we" or a season like "summer") are dynamically moving toward or away from each other with the intention of encouraging participants to conceptualize events in time as moving (Bergen & Wheeler, 2010; Glenberg & Kaschak, 2002; Langacker, 2005; Zwaan, Madden, Yaxley, & Aveyard, 2004). For both of these statements, the correct answer is TRUE. For all surveys, the correct answers to the questions are TRUE. Once participants answered

the TRUE or FALSE questions, they were provided with a writing prompt to describe a past experience they had that made them feel proud or ashamed. This prompt is the same prompt used by Lee and Ji (2013) in Study 3 and included in Casasanto and Dijkstra (2010)'s list of memory prompts in Experiment 1. They were asked to include as much vivid detail about their experience that they could. Following this writing prompt, participants were asked a series of questions to evaluate the experience about which they had written. They were asked to:

- classify their experience as positive, negative, neither or both, as Casasanto and Dijkstra (2010) has done.

- indicate on a Likert scale how far or close their memory feels to them, a measure included in Lee and Ji's (2013) study for participants to express the psychological distance they perceived of the event.

- evaluate on a Likert scale including the vividness, ease of recall, and accuracy of the memory. By eliciting these data, I hoped to learn whether memory details differed based on the method of memory recall, facilitated by spatiotemporal metaphors. In particular, I was interested in whether people taking the ego-moving perspective would feel psychologically closer to the memory they recalled, resulting in the memory being more vivid, easier to recall, and feeling more accurate. Conversely, people taking the time-moving perspective might feel psychologically more distant from the memory they recalled, resulting in their memory being less vivid, more difficult to recall the details of it, and possibly feeling less accurate from their actual experience.

- unscramble the following words to make a grammatically correct 5-word sentence from the words *deadline, I, the, is, am, approaching, me* (provided in this order). From these words, there are two possible combinations that participants can arrange the words in, "I am approaching the deadline," and "the deadline is approaching me." This last question, used by Lee and Ji (2013), was incorporated to detect participants' time perspective.

See both versions of the questionnaire in Appendices A and B.

3.3. Procedure

Participants were randomly assigned to conditions and received a three-page questionnaire. Prior to beginning the study, participants consented to participating by signing a consent form. They were informed of their rights as participants and told they could choose to leave the study at any time.

3.4. Coding and analysis

Surveys were collected in person and via email. One participant was excluded from the analysis because their online survey was in a format that could not be opened. Two other participants' word unscrambling task responses were also excluded because they did not reflect an ego-moving or time-moving perspective. The experimenter evaluated the valence of each memory, blind to the condition (ego-moving vs. time-

moving) in which it had been recounted and the participant's prior evaluation of the event's valence. This was to ensure that the experimenter did not unconsciously interpret the narratives as having a particular valence based on knowledge of the participant's condition, e.g. a memory could be interpreted as positive if the experimenter knew the participant was in the ego-moving condition or as negative if they were in the time-moving condition. The valence was evaluated based on the initial event mentioned in their description of their memory and their emotional state (when explicitly stated, for example, as "I was proud of myself" or "I was ashamed") associated with the event. Although some participants evaluated their memory as both positive and negative or neither positive nor negative, the experimenter's evaluations only included positive and negative as a result of evaluating only the initial event and emotional state mentioned in participants' narratives. For example, one participant wrote about a time in which she had been in a car accident which totaled her car but resulted in her working to purchase a new car through her own means. The participant evaluated this memory as "neither" positive nor negative. The experimenter coded this narrative as 'negative' because the initial event, the car accident, was negative.

The participants' responses were input into Microsoft Excel and examined using the PivotTable feature to calculate the mean proportions of positive and negative memories overall and in each of the priming conditions. The average ratings that participants reported in the self-evaluation section of the survey (e.g. how close/far their memory felt, ease of recall, vividness, and accuracy) were also calculated.

Between-subjects chi-squared tests were performed for positive and negative

memories, TRUE or FALSE questions, and word unscrambling task in each of the priming conditions. Between-subjects t-tests were performed on the ratings of memory details in the self-evaluation section of the survey.

3.5. Results

Analysis of valence by condition. The hypothesis was that participants in the ego-moving condition would recall more positive memories than in the time-moving condition. Conversely, participants in the time-moving condition would recall more negative memories in the ego-moving condition. Therefore, the analysis examined the likelihood that participants would recall details from positive events when primed with an ego-moving perspective and details from negative events when primed with a time-moving perspective.

Results of this experiment showed no statistically significant interaction between time perspective and memory valence, χ^2(1, N = 34) = 0.102, p = 0.37. The graph below (Figure 1) shows the mean proportions of positive and negative memories recalled and reported by participants in each condition.
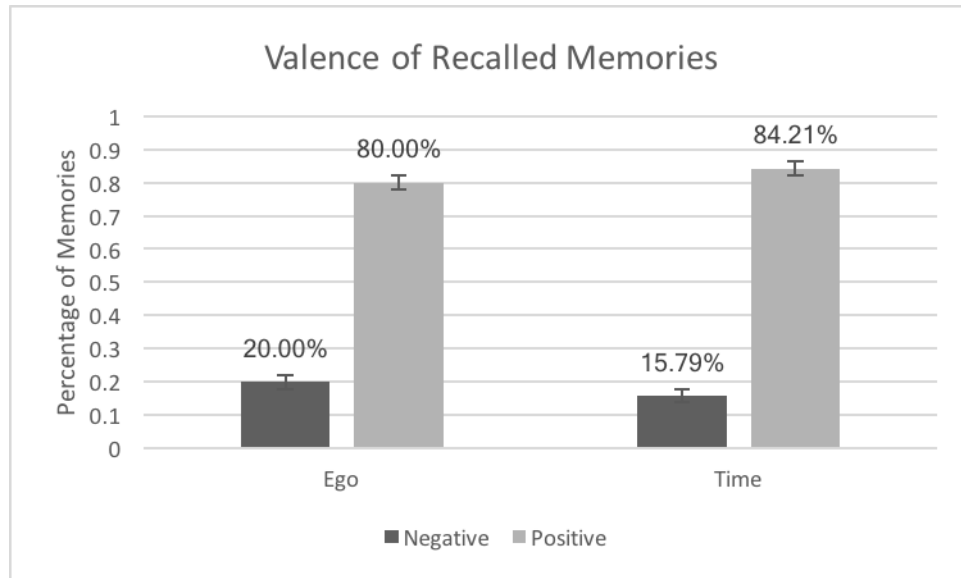
Figure 1. The mean proportions of positive and negative memories
recalled in the ego-moving and time-moving conditions.

Positive memories were more likely to be recalled in both conditions, showing a

positivity bias. Participants in the time-moving condition recalled more positive than

negative memories, a different result from the hypothesis. It was predicted that

participants would recall more positive memories in the ego-moving condition than the

time-moving condition. These data do not support this result.

The analysis above included all the participants, irrespective of the accuracy of

their answers to the questions in the priming phase of the experiment. I also conducted

a second analysis in which participants were grouped based on their accuracy in

responding to priming questions. The data of participants who responded TRUE to both

priming questions were analyzed separately from the data of participants who

answered FALSE to one or both of the priming questions. This decision was based on the

reasoning that participants who answered TRUE to both priming questions were the

most likely to adopt the time perspective of the condition to which they were assigned. I

hypothesized that this group of participants would be more likely to recall memories of

the valence consistent with the time perspective of their assigned condition. Below are

the mean proportions of participants' responses to the priming questions.

Mean Proportions of Responses to Priming Questions

Priming Question 2

		False	True
Priming Question 1	False	8.82 %	0 %
	True	35.29 %	55.88 %

There were 19 participants out of the 34 total who answered TRUE to both

priming questions (55.88 percent). For these participants who answered TRUE to both

priming questions and had the greatest likelihood of adopting the time perspective of

their assigned condition, there was no difference in the significance of the interaction

between time perspective and memory valence, $\chi^2(1, N = 19) = 0.323$, p = 0.28. Overall,

82.35 percent of the memories recalled within this group were positive and 17.65

percent were negative. The remaining 15 participants who answered FALSE to one or

both of the priming questions comprised 44.11 percent of all participants. For this

group, there was also no significant interaction between time perspective and memory

valence, $\chi^2(1, N = 15) = 0.085$, p = 0.39. Overall, 80 percent of the memories recalled

within this group were positive and 20 percent were negative.

One reason that there were no significant effects of spatiotemporal metaphors on memory valence may be that the priming questions did not have the intended effect in facilitating people's thinking about time. The unscrambling task was used as a measure for the efficacy of the priming questions as the unscrambling task responses indicate whether their thinking about time had been influenced. The results show there is no relation between priming responses and the unscrambling task, suggesting that the priming questions were not effective in encouraging people to adopt either the ego-moving or time-moving perspective. For participants who answered TRUE to both priming questions, there was no significant interaction between priming responses and the unscrambling task, $\chi^2(1, N = 18) = 0.0$, p = 0.50. For the other participants who had answered FALSE to one or both of the priming questions, there was also no significant interaction, $\chi^2(1, N = 14) = 0.18$, p = 0.45.

Analysis of responses to other questions by condition. Other measures assessed were how far or close the memory felt, the ease to recall the memory, the vividness, and accuracy of the memory to the actual experience. I predicted that people taking the ego-moving perspective would recall memories to which they were psychologically closer, resulting in these memories being more accurately recalled, more vivid, and more easily recalled (Kyung, Menon & Trope, 2010). In contrast, people taking the time-moving perspective would recall memories further away, resulting in these memories being less accurately recalled, less vivid, and less easily recalled. The below graph shows

participants' self-evaluation responses.
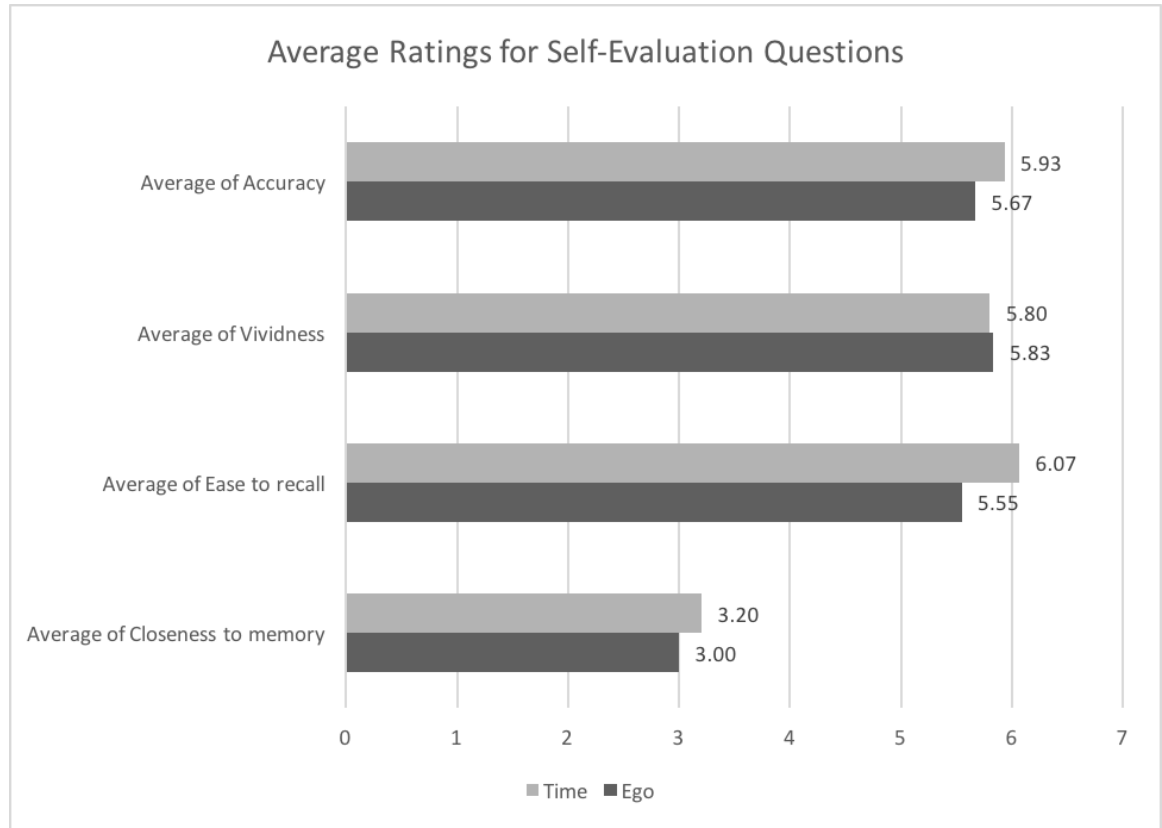
Figure 2. The averages of ratings in memory accuracy, vividness, ease of recall, and closeness to memory in each condition.

Participants in both conditions reported that they felt their memories were less accurate, less vivid, and further away in memory. However, they also reported that the memories were generally easier to recall with the largest difference being in the time-moving condition, where 94 percent of participants rated their memories within the range of 5 to 7 (with 7 as easiest to recall) indicating that their memory was marginally easier to recall (in comparison to 80 percent rating their memories within the range of 5

to 7 in the ego-moving condition). Between-subjects t-tests reveal there was no significant difference between the two conditions in terms of accuracy ($P = .63$), vividness ($P = .48$), ease of recall ($P = .34$), or closeness to memory ($P = .45$). It is possible that there is little variation between the two conditions for these measures because the valence of memories recalled did not vary by condition significantly. Because participants recalled more positive memories in both conditions, these ratings may reflect characteristics of positive memories.

4. Discussion and conclusion

This experiment tested the effects of spatiotemporal metaphors on the recall of autobiographical memory valence. The original question was whether the contrastive linguistic framings of ego-moving and time-moving metaphors would evoke memories with corresponding valences, e.g. an ego-moving metaphor evokes a positive memory and a time-moving metaphor evokes a negative memory. The results show there was no significant difference in the valence of memories recalled between groups primed by the differing time metaphors. These results of memory valences recalled are inconsistent with previous studies on motion-emotion entailments (Chen & Bargh, 1999) and other studies on metaphorical mental representations and emotional valence (Casasanto & Dijkstra, 2010; Ruscher, 2011; McGlone & Pfiester, 2009). However, the positivity bias in autobiographical memory recall is consistent with previous accounts of overall positivity biases in autobiographical memory (Casasanto & Dijkstra, 2010; Dijkstra & Kaup, 2005; Mather & Carstensen, 2005).

These results are qualified by a limitation of the reported study. Methodologically, the efficacy of the priming questions to facilitate people's thinking about moving through time is questionable based on the results of the word puzzle task. Participants most likely to adopt the time perspective encouraged by the priming questions (those who answered TRUE to both priming questions) did not rearrange the words in the unscrambling task reliably to indicate they had adopted the appropriate time perspective.

Time and emotion are domains which borrow their structure from the domain of space (or motion through space). Spatial experience influences people's understanding of time and emotion. However, previous research would suggest that time and emotion would not influence people's understanding of space; there is a unidirectional relationship from space to time or emotion. This study examined the relationship between time and emotion, both abstract or "borrower" domains, which are linked in spatiotemporal metaphors because they reflect people's conception of time and have motion-emotion entailments (McGlone & Pfiester, 2009). Considering the unidirectional relationship from concrete to abstract domains, it is possible that using a spatial prime similar to in Ruscher (2011)'s study may have influenced people's perceptions of time and space more effectively. Although linguistic primes depicting event moving in time has been successful in Boroditsky (2000)'s experiments, those experiments concerned the interactions between space and time, whereas this study also involves the domain of emotion (specifically emotional valence). If there was a priming effect in this experiment, it is likely that it wore off quickly so a future experiment would have to

account for this possibility by including more priming questions or use a vivid narrative to facilitate people's thinking about time. Other related studies which have investigated metaphorical effects on emotional valence have not used linguistic primes in order to activate metaphorical mental representations of time, rather they have used spatial primes (Ruscher, 2011) and motor actions (Casasanto & Dijkstra, 2010). Using linguistic primes is a method that may need to be further refined. However, given the survey methodology, it is also possible that participants were not paying close attention to the priming questions, which would explain why 15 out of 34 participants answered at least one priming question incorrectly.

Even with a refined methodology, the question remains as to whether further experimentation would yield the predicted effects of spatiotemporal metaphors on the valence of autobiographical memories. First, I will consider the possibility that the linguistic primes did not yield an effect in this study because there is no interaction from the direction of time to emotion. To situate this result in relation to the theory of mental simulation and the encoding specificity principle, people might simulate motion through time when processing spatiotemporal metaphors. However, the motion-emotion entailments of spatiotemporal metaphors are not sufficient to evoke similar emotional conditions in which positive and negative memories were encoded. This results in memories being evoked that are not the corresponding valence of the time metaphor used to evoke them, as the results of this study have shown. Because other studies have found effects using spatial primes (Ruscher, 2011) and motor action (Casasanto, 2010), it is possible that language is not a medium in which time can

influence with emotion. This study does not rule out the possibility that there is an interaction from the direction of time to emotion through language. However, by introducing participants to the priming statements and then asking to recall a memory, initial exposure to the priming statements prompted conceptions of motion through time (linking the domains of time with space) with the intention of influencing people's affect. In this regard, the intent was to understand if a linkage of a lending and borrowing domain (time and space) could influence another borrowing domain (emotion). The purpose of the lending domain is to provide the borrowing domain with a structure. If a lending and borrowing domain (time and emotion) are linked, however, it is unclear how their combined structure can be used to derive the other borrowing domain being influenced (emotion). Further research is needed to determine the effects of lending-borrowing domain linkages on other borrowing domains.[8]

Previous studies have suggested that event valence affects people's conceptions of time (McGlone & Pfiester, 2009). This study assessed the interaction in the reverse direction. The results provide no evidence to suggest that spatiotemporal metaphors have an effect on event valence, reflected in people's recall of autobiographical memories. Because linguistic primes were employed to influence people's temporal

---

[8]It is also important to note that spatiotemporal metaphors differ from other valence-related metaphors such as 'Good is Up' (Lakoff & Johnson, 1999; Casasanto & Dijkstra, 2010) because of their motion-emotion entailments. Whereas in 'Good is Up' upward motion or orientation is implicitly associated with positivity, the affective associations that spatiotemporal metaphors presumably come from approach-avoidance behaviors being applied to temporal perception so it is not an association but rather a reaction, which complicates studies wishing to address mappings between time and emotion.

perception, it appears that there is no interaction between spatiotemporal metaphors and emotional valence through language, though there could be through other mediums.

A future study using spatial primes to prompt ego-moving and time-moving perspectives might yield effects on the valence of autobiographical memories, as this would possibly test a more direct mapping of space to both time and emotion. Further efforts are also needed to resolve the contradictory theories of motion-emotion entailments, and active and passive psychological distancing. Future studies involving motor action as a method to influence people's conceptualizations of moving through time may help us to understand how people's approach-avoidance behaviors when moving through space influence their movements through time in response to the valence of temporal events.

References

Bergen, B., & Wheeler, K. (2010). Grammatical aspect and mental simulation. *Brain and Language*, *112*(3), 150-158.

Bergen, B., & Chan Lau, T. T. (2012). Writing direction affects how people map space onto time. *Frontiers in psychology*, *3*, 109.

Boltz, M. G., & Yum, Y. N. (2010). Temporal concepts and predicted duration judgments. Journal of Experimental Social Psychology, 46, 895–904. doi:10.1016/j.jesp.2010.07.002

Boroditsky, L. (2000). Metaphoric structuring: Understanding time through spatial metaphors. *Cognition*, *75*, 1–28.

Boroditsky, L., & Ramscar, M. (2002). The roles of body and mind in abstract thought. *Psychological Science*, *13*, 185–189.

Casasanto, D., & Dijkstra, K. (2010). Motor action and emotional memory. *Cognition, 115*(1), 179-185. 10.1016/j.cognition.2009.11.002

Clark, H. H. (1973). Space, time, semantics, and the child. In T. E. Moore (Ed.), *Cognitive development and the acquisition of language* (pp. 27-63). New York: Academic Press.

Crawford, L. E., Margolies, S. M., Drake, J. T., & Murphy, M. E. (2006). Affect biases memory of location: Evidence for the spatial representation of affect. *Cognition & Emotion, 20,* 1153–1169.

Dijkstra, K., & Kaup, B. (2005). Mechanisms of autobiographical memory retrieval in younger and older adults. Memory and Cognition, 33, 811–820.

Fuhrman, O., & Boroditsky, L. (2010). Cross-cultural differences in mental representations of time: Evidence from an implicit non- linguistic task. *Cognitive Science*. Advance online publication. doi: 10.1111/j.1551-6709.2010.01105

Gentner, D. (2001). Spatial metaphors in temporal reasoning. In M. Gattis (Ed.), *Spatial schemas and abstract thought* (pp. 203–222). Cambridge, MA: MIT Press.

Gentner, D., Imai, M., & Boroditsky, L. (2002). As time goes by: Evidence for two systems in processing space > time metaphors. *Language and Cognitive Processes*, **17**, 537–565.

Glenberg, Arthur M., and Michael P. Kaschak. "Grounding language in action." *Psychonomic bulletin & review* 9.3 (2002): 558-565.

Glicksohn, J., & Ron-Avni, R. (1997). The relationship between preference for temporal conception and time estimation. European Journal of Cognitive Psychology, 9, 1 15. doi:10.1080/713752540

Kövecses, Z. (1991). Happiness: A definitional effort. *Metaphor and Symbolic Activity, 6,*29–46.

Kyung, E. J., Menon, G., & Trope, Y. (2010). Reconstruction of things past: Why do some memories feel so close and others so far away? *Journal of Experimental Social Psychology*, *46*(1), 217–220. http://doi.org/10.1016/j.jesp.2009.09.003

Lakoff, George, and Mark Johnson. *Metaphors We Live By:* Chicago, Ill.: U of Chicago, 2011. Print.

Langacker, R. W. (2005). Dynamicity, fictivity, and scanning: The imaginative basis of logic and linguistic meaning. In R. A.

Lee, Albert, and Li-Jun Ji. "Moving Away from a Bad Past and toward a Good Future: Feelings Influence the Metaphorical Understanding of Time." *Journal of Experimental Psychology: General* 143.1 (2014): 21-26. Web.

Margolies, Skye Ochsner, and L. Elizabeth Crawford. "Event Valence and Spatial Metaphors of Time." *Cognition & Emotion* 22.7 (2008): 1401-414. Web.

Mather, M., & Carstensen, L. L. (2005). Aging and motivated cognition: The positivity effect in attention and memory. Trends in Cognitive Sciences, 9, 496–501.

McGlone, M. S., and R. A. Pfiester. "Does Time Fly When You're Having Fun, or Do You?: Affect, Agency, and Embodiment in Temporal Communication." *Journal of Language and Social Psychology* 28.1 (2009): 3-31. Web.

Meier, B. P., & Robinson, M. D. (2004). Why the sunny side is up: Associations between affect and vertical position. *Psychological Science, 15,* 243–247.

Miller, Dale T., and Michael Ross. "Self-serving biases in the attribution of causality: Fact or fiction?" *Psychological bulletin* 82.2 (1975): 213.

Núñez, R., Motz, B., & Teuscher, U. (2006). Time after time: The psychological reality of the ego- and time-reference-point distinction in metaphorical construals of time. *Metaphor and Symbol*, **21**, 133–146.

Núñez, R.E., & Sweetser, E. (2006). With the future behind them: Convergent evidence from Aymara language and gesture in the crosslinguistic comparison of spatial construals of time. *Cogni- tive Science*, *30*, 401–450.

Ruscher, Janet B. "Moving Forward." *Social Psychology* 42.3 (2011): 225-30. Web. Santiago, J., Lupáñez, J., Pérez, E., and Funes, M. "Time (also) Flies from Left to Right." *Psychonomic Bulletin & Review* 14.3 (2007): 512-16. Web.

Santiago, J., Lupiáñez, J., Pérez, E., & Funes, M.J. (2007). Time (also) flies from left to right. *Psychonomic Bulletin & Review*, *14*, 512–516.

Schubert, T. W. (2005). Your highness: Vertical positions as perceptual symbols of power. *Journal of Personality and Social Psychology, 89,* 1–21.

Torralbo, A., Santiago, J., & Lupiáñez, J. (2006). Flexible conceptual projection of time onto spatial frames of reference. *Cognitive Science*, *30*, 745–757.

Tulving, E., & Thomson, D. M. (1973). Encoding specificity and retrieval processes in episodic memory. *Psychological review*, *80*(5), 352.

Tversky, B., Kugelmass, S., & Winter, A. (1991). Crosscultural and developmental trends in graphic productions. *Cognitive Psychology*, *23*, 515–557.

Zwaan, R. A., Madden, C. J., Yaxley, R. H., & Aveyard, M. E. (2004). Moving words: Dynamic mental representations in language comprehension. Cognitive Science, 28, 611-619.

Appendix A. Survey in ego-moving condition

Please underline 'True' or 'False' to indicate your answer for the following questions.

True or False? Toward the end of July, we are leaving summer.

True or False? Toward the beginning of March, we are approaching spring.

STOP! Do not go on to the next page until you have answered these questions.

In the lines provided below, write about a past experience you had that made you feel **ashamed** or **proud**. Please include as much vivid detail about your experience as you can.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Is the experience you described a positive or negative experience? Please circle an option below.

Positive	Negative	Neither	Both

Please indicate on the scale below how far or close the memory you described feels to you.

It feels like yesterday.	1	2	3	4	5	6	7	It feels very far in the past.

How easy was it for you to recall the details of this experience?

I vaguely remember this experience.	1	2	3	4	5	6	7	I remember every detail about this experience.

How vivid is your memory of this experience?

This memory is **very blurry** to me.	1	2	3	4	5	6	7	This memory is **very vivid** to you.

How accurate do you think your description of this memory is to your actual experience?

This memory is **very inaccurate** to my actual								This memory is **very accurate** to my actual

experience.	1	2	3	4	5	6	7	experience.

Unscramble the following words to make a grammatically correct 5-word sentence:

deadline	I	the	is	am	approaching	me

Appendix B. Survey in time-moving condition

Please underline 'True' or 'False' to indicate your answer for the following questions.

True or False? Toward the end of July, we are leaving summer.

True or False? Toward the beginning of March, we are approaching spring.

STOP! Do not go on to the next page until you have answered these questions.

In the lines provided below, write about a past experience you had that made you feel **ashamed** or **proud**. Please include as much vivid detail about your experience as you can.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Is the experience you described a positive or negative experience? Please circle an

option below.

Positive	Negative	Neither	Both

Please indicate on the scale below how far or close the memory you described feels to

you.

It feels like yesterday.	1	2	3	4	5	6	7	It feels very far in the past.

How easy was it for you to recall the details of this experience?

I vaguely remember this experience.	1	2	3	4	5	6	7	I remember every detail about this experience.

How vivid is your memory of this experience?

This memory is **very blurry** to me.	1	2	3	4	5	6	7	This memory is **very vivid** to you.

How accurate do you think your description of this memory is to your actual
experience?

This memory is **very inaccurate** to my actual							This memory is **very accurate** to my actual

experience.	1	2	3	4	5	6	7	experience.

Unscramble the following words to make a grammatically correct 5-word sentence:

deadline	I	the	is	am	approaching	me