SPACE-TIME CONCEPTUALIZATIONS AMONG MALAYSIAN CHINESE BILINGUALS

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SPACE-TIME CONCEPTUALIZATIONS AMONG MALAYSIAN CHINESE BILINGUALS

ABSTRACT

A questionnaire and experiment were conducted to investigate whether there is evidence for linguistic relativity among the Malaysian Chinese population. In order to make the influence of language on thought measurable, this study used the principles of conceptual metaphor theory and the conceptual domains of SPACE and TIME. The research aimed to detect the degree to which participants' conceptualizations of time were conditioned by space-to-time metaphors (STMs) in their primary language (English and Mandarin). A psycholinguistic experiment conducted designed after Fuhrman et. al. 2011 to accomplish this aim. Analysis of the results reveal no influence of STMs on conceptualization of time. Rather, the data revealed bias in a direction opposite of what was predicted. It is concluded that the findings of the current study run counter to the claims of linguistic relativity. More accurate knowledge of the usage of STMs in English and Mandarin is needed as well as more empirical research isolating the influence of STMs on conceptualizations of time.

Keywords: linguistic relativity, conceptual metaphor theory, space-time metaphor, conceptualization

PENGARUH KONSEP MASA DI KALANGAN WARGA CINA MALAYSIA

YANG BERTUTUR DWI BAHASA

ABSTRAK

Soal selidik dan eksperimen telah dijalankan untuk menyiasat sama ada terdapat bukti untuk relativiti linguistik di kalangan penduduk Cina Malaysia. Untuk menjadikan pengaruh bahasa pada pemikiran yang dapat diukur, kajian ini menggunakan prinsip teori metafora konseptual dan domain konseptual RUANG dan MASA. Penyelidikan ini bertujuan untuk mengesan sejauh mana konseptualisasi masa peserta dikondisikan oleh metafora ruang-kepada-masa (STM) dalam bahasa utama mereka (Bahasa Inggeris dan Mandarin). Eksperimen psikolinguistik dijalankan mengikuti Fuhrman et. al. 2011 untuk mencapai matlamat ini. Analisis keputusan menunjukkan bahawa tiada pengaruh STM terhadap konsep masa. Sebaliknya, data mendedahkan bias ke arah yang bertentangan dengan apa yang telah diramalkan. Disimpulkan bahawa penemuan kajian semasa bertentangan dengan tuntutan relativiti linguistik. Pengetahuan yang lebih tepat tentang penggunaan STM dalam Bahasa Inggeris dan Mandarin serta penyelidikan empirikal yang mengasingkan pengaruh STM pada konseptualisasi masa diperlukan.

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LIST OF SYMBOLS AND ABBREVIATIONS

CMT	:	Conceptual metaphor theory
STM	:	Space-to-time metaphor
FoR	:	Frame of reference
F	:	The figure in the frame of reference taxonomy
G	:	The ground in the frame of reference taxonomy
V	:	The observer in the frame of reference taxonomy
X	:	The origin of the coordinate system in the frame of reference taxonomy
RT	:	Response time
UD	:	The vertical up-down construal of the conceptual timeline
DU	:	The vertical down-up construal of the conceptual timeline
LR	:	The transverse left-right construal of the conceptual timeline
RL	:	The transverse right-left construal of the conceptual timeline
BF	:	The sagittal back-front construal of the conceptual timeline
FB	:	The sagittal front-back construal of the conceptual timeline

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CHAPTER 1: INTRODUCTION

1.1 Linguistic Relativity

The Sapir-Whorf hypothesis states that the language one speaks influences the way one thinks, and consequently that different languages will influence their speakers to think differently from each other (Evans, 2006). In modern times, the ideas behind the Sapir-Whorf hypothesis have been given a new name: *linguistic relativity*. A growing body of researchers has taken interest to investigate the claims of linguistic relativity (Boroditsky, 2001, 2010; Casasanto, 2008a; Fuhrman, McCormick, Chen, Jiang, Shu, Mao, & Boroditsky, 2011; Haun, Rapold, Janzen, & Levinson, 2011; Lucy, 1997). The most notable research has studied the conceptual domains of SPACE and TIME (Boroditsky, 2001; Casasanto, 2008a; Fuhrman et. al., 2011; Haun et. al., 2011).

However, it has consistently proved difficult to demonstrate repeatedly that different languages cause their native speakers to think differently about these domains (Chen, 2006; Chen, Fredreich, & Shu, 2013; Chen & O'Seaghdha, 2013). It is also difficult to account for extraneous cultural factors, such as writing direction. More evidence with fewer intervening factors is needed to gain confidence as to the existence of linguistic relativity.

The experiment in this study will measure the influence of language on the conceptualization of time. It will be shown how the principles of conceptual metaphor theory naturally lead one to the central claims of linguistic relativity. It will also be shown how conceptual metaphors provide a tangible starting point for measuring the influence of language on thought. Since SPACE and TIME are two of the most basic cognitive domains, and since space-to-time metaphors exist in everyday language, they will be the focus of this study.

1.2 Linguistic Relativity and Space-to-Time Metaphors

In what has become a seminal work (over 1300 citations on Google Scholar and 450 citations on Science Direct), Boroditsky (2001) conducted a series of experiments measuring the difference between English and Mandarin speakers' conceptualizations of time. English and Mandarin use different space-to-time metaphors. English uses such sagittal language as "A bright future *ahead* of us" (Boroditsky, 2001; Fuhrman et. al., 2011). Mandarin also uses sagittal, back-front descriptions for time, but it additionally describes a vertical up-down construal of time (Boroditsky, 2001; Fuhrman et. al., 2011; Scott, 1989). Therefore, if the two language groups showed a difference in how they perceived time, it could suggest that these perceptions were shaped by the space-to-time metaphors (STMs) available in each language. If such STMs did shape a difference in conceptualization, it would confirm the central claims of linguistic relativity. Indeed, her experiments confirmed this hypothesis; the participants perceived time differently.

However, when several other researchers revisited and replicated her work, the results varied and most ran counter to her findings (Chen, 2006; January & Kako, 2007; Tse & Altarriba, 2008). Some credited difference in writing direction (up-down and left-right) to be responsible for the original observed difference (Chen, 2006). Writing direction is not considered a linguistic feature, but an orthographic artifact of culture (Chen et. al., 2013; Chen & O'Seaghdha, 2013; Fuhrman et. al., 2011). Therefore, the influence of writing direction on thought cannot be considered a manifestation of linguistic relativity (Chen & O'Seaghdha, 2013; Fuhrman et. al., 2011). In response, Boroditsky published an improved version of her original study (Fuhrman et. al., 2011). It even accounted for writing direction (Fuhrman et. al., 2011). Her results again indicated that Mandarin and English speakers thought of time in accordance with the way their first language spoke of it.

1.3 Need for More Empirical Data

In order to move the discussion of linguistic relativity forward, more empirical evidence must inform the arguments (Lakoff & Johnson, 2003; Chen & O'Seaghdha, 2013). To gain confidence as to the existence of the effect observed in Fuhrman et. al. 2011, it is important to replicate that study in another sample group. In addition, if the data again reveals a bias for conceptualizations of time described by STMs in English and Mandarin, it would further confirm the assertions of linguistic relativity.

Therefore, this study has sought to accomplish the following research objectives:

i. Investigate the existence and strength of linguistic relativity
ii. Measure to what extent a person's concept of time is influenced by conceptual metaphors in their primary language.

The key research questions follow from these objectives:

i. To what extent can linguistic relativity be observed?
ii. To what extent does a person's concept of time conform to the way conceptual metaphors in their primary language describe it?

As mentioned above, linguistic relativity asserts that differences in language systems cause differences in thought. The theoretical groundings for this claim lie in conceptual metaphor theory. In section 2.2.1, the link between linguistic relativity and conceptual metaphor theory will be explicated. Chapter 2 describes STMs and gives examples of them in English and Mandarin. A discussion follows of the previous empirical studies mentioned above, giving an overview of the key findings and issues which lead to the current study.

1.4 Design of the Current Study

It was stated that the current study derives its methodology from a theoretical framework akin to that of Fuhrman et. al. 2011. Whereas they used native speakers of Mandarin and English from China and the United States respectively, the current study has an advantage in that participants in both language groups were Chinese Malaysian. This common ethno-cultural heritage minimizes the possibility of cultural factors interfering with the experimental data (Bender & Beller, 2014; Boroditsky & Ramscar, 2002; Chen & O'Seaghdha, 2013; Fuhrman et. al., 2011; Tse & Altarriba, 2008).

However, to make discrete English and Mandarin testing groups of multilingual Malaysians Chinese, the researcher assembled a linguistic background questionnaire. Out of 145 respondents, 35 were found suitable and were invited to participate in the experiment.

Finally, to test for the influence of STMs on thought, a temporal-reasoning task experiment was designed and programmed in the likeness of that used by Fuhrman et. al. 2011. This task activated in participants a conceptual timeline oriented in each of six possible directions. It then measured their time to respond. These response times will reveal whether participants' primary language had any effect on their conceptualization of time. The results of this study and its experiment will give indication whether linguistic relativity can be observed operating through STMs.

CHAPTER 2: LITERATURE REVIEW

2.1 Overview of Linguistic Relativity

Does language shape thought? In the first half of the twentieth century, Edward Sapir and Benjamin Whorf answered this question with a resounding "yes" (Evans, 2006). Their writings built up what has become known as the Sapir-Whorf hypothesis. At its simplest, the Sapir-Whorf hypothesis has two assertions. First, the language one speaks exerts a measure of influence on how that person conceives of her or his world (Evans, 2006). Second, because language systems differ, speakers from different languages will conceive of their worlds differently (Evans, 2006). These two assertions are separate, but inherently linked.

2.1.1 Difference between Linguistic Determinism and Linguistic Relativity

Since the inception of the Sapir-Whorf hypothesis, its proponents have diverged on the *amount* of influence language has on thought (Evans, 2006). Some have argued that language's influence is so strong that it completely determines one's categories and possibilities of thought (Evans, 2006). In other words, one cannot think of or understand concepts that one's language does not have a common way of speaking about. This version of the hypothesis has been dubbed *linguistic determinism*, and it has since been all but rejected by most linguists (Boroditsky, 2001; Evans, 2006). However, others have suggested that one's language may not determine the limits and possibilities of thought, but it does *shape* the way one thinks (Evans, 2006). This tempered view has been called *linguistic relativity* (Boroditsky, 2001; Evans, 2006). A growing body of linguists, particularly from the tradition of cognitive linguistics, have taken interest in linguistic relativity. Studies in various areas of linguistics have employed an array of methodological tools to contrast the way members of different language groups think (Boroditsky, 2001; Casasanto, 2008a, 2008b, 2009; Fuhrman & Boroditsky, 2010;

Fuhrman et. al., 2011; Gao & Malt, 2009; Haun et. al., 2011; Lakoff & Johnson, 2003; Lucy, 1997, 2004; Miles, Tan, Noble, Lumsden, & Macrae, 2011; Pederson, Danziger, Wilkins, Levinson, Kita, & Senft, 1998; Tai, 2005). The current research joins the tradition of these studies; it is interested in measuring the level of influence of language on thought.

2.1.2 Structure of Literature Review

Some may point out that *thought* is unhelpfully vague and broad. This is true, and the studies listed above take various cognitive approaches to more clearly define *thought* and to make it measurable. One of the most common and natural ways to approach the assertions of linguistic relativity has been through conceptual metaphor theory. Still, evaluating linguistic relativity through all conceptual metaphors is impossible for one study. Therefore, this research has determined to focus on space-to-time conceptual metaphors (henceforth STMs), since the taxonomy of these metaphors, the theoretical framework, and appropriate instruments of measurement have already been somewhat developed (Bender & Beller, 2014; Boroditsky, 2014; Chen & O'Seaghdha, 2013). However, even STMs must be evaluated empirically using data from real human languages. Bender and Beller (2014) reviewed empirical studies of space-to-time metaphors covering a total of 16 language systems. Since it is unrealistic for this research to study all language systems, it will join the discussion comparing just two: English and Mandarin. By narrowing this study to these languages, to STMs, and to conceptual metaphor theory, this study can operationalize a methodology to evaluate the two key assertions of linguistic relativity.

In this literature review, therefore, first the two key assertions of linguistic relativity will be reiterated along with their emphasis on the role of the influence of language. Second, five basic principles of conceptual metaphors are outlined, and it will be shown how these principles naturally lead to the assertions of linguistic relativity. Third, the conceptual domains of SPACE and TIME will be introduced, leading to a robust taxonomy for metaphoric space-to-time mappings. Fourth, the systems of STMs in English and Mandarin will compared, showing their differences. Fifth, a theoretical framework for a methodology will be explicated. Finally, previous English-Mandarin space-to-time studies, their results, and the key issues raised will be reviewed, further specifying the methodology this study will use. Through this review, it is hoped that the rationale for the current research will become evident. The remainder of the paper will be concerned with actually measuring the strength of linguistic relativity.

2.1.3 The Two Key Assertions of Linguistic Relativity

Before going further, it is important to clarify the central claims of linguistic relativity. The first assertion of linguistic relativity is that one's language influences one's thought (Evans, 2006). To measure this assertion is to demonstrate that some linguistic form in some way shapes a person's thought within one language (Evans, 2006). Gentner and Gentner (1982) designed an experiment in which they sought to find whether teaching people differing analogies for electricity would cause them to understand different aspects of it (electricity is a field relatively unfamiliar to most people). After splitting the participants into two groups, they taught one group that electricity was like a big crowd of people, and the other group that it is like water flowing through pipes (Gentner & Gentner, 1982). Each analogical model was accurate about a different configuration of electrical circuitry (Gentner & Gentner, 1982). Then they presented participants with two different electrical configurations, asking them to predict what would happen to the current (Gentner & Gentner, 1982). The two groups predicted dramatically different results, which lined up with the analogical models they had been taught (Gentner & Gentner, 1982). This study indicates that language may indeed shape thought.

The second assertion of linguistic relativity is an extension of the first. Not only does linguistic relativity mean that language shapes thought, it asserts that *different* languages cause difference in thought (Evans, 2006). Demonstrating this can be difficult, because it is quite easy to misunderstand a language foreign to the researcher (Chen & O'Seaghdha, 2013; Tse & Altarriba, 2008). What is more, even when the cross-linguistic differences are understood, one must design an experiment that can accurately capture conceptual models being activated in both languages being studied. Still, some studies have overcome these factors and found interesting results. One study found that Dutch and Namibian children showed a tendency to remember the spatial layout of toys differently, according to the way their respective languages described the spatial relations of objects (Haun et. al., 2011). The Namibian children's language consistently describes spatial relations using cardinal directions such as *north, south, east, west*, whereas the Dutch language often describes the spatial layout of objects in embodied terms such as *right*, *left*, *in front*, and *behind* (Haun et. al., 2011). The children arranged the objects according to these differences, the Dutch children re-locating the toys according to their spatial paradigm, and the Namibian children according to compass directions (Haun et. al., 2011). This joins the findings of other studies which seem to indicate a difference in thought due to a difference in language (Bender & Beller, 2014; Boroditsky, 2001; Fuhrman et. al., 2011).

2.1.4 Linguistic Focus

Many have pointed out that a variety of factors, especially cultural elements, seem to also shape a person's perception of the world (Bender & Beller, 2014; Fuhrman et. al., 2011). This is true. For example, writing direction, considered a cultural artifact, has been observed as a possible influence on a person's conceptualization of time (Bender & Beller, 2014; Chen, 2006; Fuhrman et. al., 2011; Fuhrman & Boroditsky, 2010). Considering the extraneous variables of cultural artifacts, it is critical to note that linguistic relativity is only concerned with how one's perception is facilitated and shaped by *language*-or *linguistic* factors (Chen & O'Seaghdha, 2013; Evans, 2006; Fuhrman et. al., 2011). Therefore, any empirical measurement must incorporate some sort of control for the possible confounding variables of culture.

As mentioned above, the assertion of the influence of language on thought must be narrowed and clarified in order to form an appropriate way of evaluating this claim. Fortunately, conceptual metaphor theory (henceforth CMT) provides linguistic relativity with the necessary specification.

2.2 Conceptual Metaphor Theory

Some may wonder if there is any motivated connection between CMT and linguistic relativity. Such skeptics may be surprised to know that Lakoff and Johnson themselves acknowledged their indebtedness to the Sapir and Whorf's core ideas (Lakoff & Johnson, 2003). In fact, they said, "Our observations about how a language can *reflect* the conceptual system of its speakers derive in great part from the work of Edward Sapir, Benjamin Lee Whorf, and others who have worked in that tradition" ([my emphasis] Lakoff & Johnson, 2003, p. xii). Some may point out that it is merely mentioned that a "language *reflects* the conceptual system", but it does not say language *shapes* it. However, it is argued in section 2.2.1 that CMT not only has derived certain core concepts from linguistic relativity, but it also serves as a basis for those assertions and helps clarifies them.

In 1980, Lakoff and Johnson published bold words to sum up their bold new conceptual metaphor theory: "Our ordinary conceptual systems, in terms of which we both think and act, are fundamentally metaphorical in nature" (Lakoff & Johnson, 2003, p. 8). They knew their claim about the pervasive and fundamental nature of metaphoric conceptualization was so foreign to most of their readers, that they spent most of the

Metaphors We Live By expounding what a conceptual metaphor is and by showing countless examples of it in everyday language (Lakoff & Johnson, 2003). One may believe he or she uses metaphoric language or thought only on very special occasions. However, conceptual metaphors are not restricted to complex or poetic language (Lakoff & Johnson, 2003). Conceptual metaphors are essentially using a system of terms embodying concepts and ideas from one conceptual domain to structure one's understanding of another conceptual domain (Lakoff & Johnson, 2003).

2.2.1 Five Key Principles of Conceptual Metaphors

Consider the following everyday example:

(1) His life is completely out of control.

This sentence is metaphoric in that life is not a single entity that can be controlled, but is spoken of as though it were. It is an example of the conceptual metaphor LIFE IS A WILD ANIMAL. For the purposes of this paper, sentences and words in all-caps represent conceptual domains and metaphors. From example (1), one can observe several of the key principles of CMT. First, it is ordinary language. One can imagine hearing this in normal everyday discussion without being impressed with the speaker's metaphorical imagination. This is because example (1), like most expressions of conceptual metaphors, is a commonplace way to *speak* about life. CMT adds that it is also a normal way to *think* about life (Lakoff & Johnson, 2003). In this sentence, life is spoken of as though it were something wild.

This is a second principle of CMT: one borrows from one conceptual domain to structure and highlight certain aspects of another (Lakoff & Johnson, 2003). In this case, the source domain is WILD ANIMAL and the target domain is LIFE. Often conceptual metaphors borrow a system of terms from a more concrete domain and map that system onto one's experience of a more abstract domain (Lakoff & Johnson, 2003). By concrete, CMT means that a conceptual domain is more or less directly experienced by one's physical senses. SPACE is an example of a concrete and basic conceptual domain and will be written about at some length below. Critically, such system mappings are unidirectional (Lakoff & Johnson, 2003). For example, LIFE can be structured in terms of WILD ANIMALS, but the conceptual domain WILD ANIMALS in not structured in terms of LIFE. In fact, it is hard to speak of LIFE at all without relying on metaphoric language from other domains; for example, LIFE IS A CONTAINER: "His life was filled with joy," or LIFE IS A JOURNEY: "See where she's made it in her life?".

These latter examples provide a glimpse into yet a third aspect of conceptual metaphors: their tendency to highlight and hide different aspects of the target domain (Lakoff & Johnson, 2003). LIFE IS A WILD ANIMAL highlights that life is often harsh, difficult, and unpredictable. However, such a conceptual metaphor does not adequately describe all the experiences one has with life, because conceptual metaphors necessarily also hide certain aspects of the target domain. LIFE IS A WILD ANIMAL would not help a person express statements about life such as "See where she's made it in her life?", but this statement is naturally facilitated by the conceptual metaphor LIFE IS A JOURNEY. This latter conceptual metaphor provides a system which highlights a different aspect of experiences in life: that people pass through different experiences and times in life like sojourners. Equipped with the conceptual metaphor LIFE IS A JOURNEY, one can "look back over his life" or "wonder what's coming just around the corner"; these aspects LIFE IS A WILD ANIMAL does not highlight. However, the wild animal conceptual metaphor assists one to express the following about life:

(2) I worked up the courage to face the day

(3) He took on the day.

(4) They all looked so downtrodden.

(5) Take life by the horns.

(6) She really seized the day.

A fourth principle of conceptual metaphors is that they are a *system* of *coherent* mappings from a source domain to a target domain (Lakoff & Johnson, 2003). Examples (1)-(6) demonstrate a coherent system of mappings from the source domain WILD ANIMAL. A wild animal can have horns, it can trample a person, one can face it, seize it, and try to control it. A system of mappings is what differentiates conceptual metaphors from *dead* metaphors such as the "legs" of a table (Lakoff & Johnson, 2003). A table is said to have *legs*, but not a *face* or *organs*; it may have *leaves*, but not *branches* or a *trunk* (Lakoff & Johnson, 2003). Such metaphors for the parts of a table do not form a coherent system from the source domain but merely isolated terms (Lakoff & Johnson, 2003). One more important note is that not all aspects of a source domain are imported into the target domain (Lakoff & Johnson, 2003). In the metaphor LIFE IS A WILD ANIMAL, life is not said to mark its territory, scavenge for food, howl, hunt, or have fur. These are aspects of wild animals that are not imported into the target domain of LIFE.

Finally, a fifth principle is that conceptual metaphors not only *reflect* but also *shape* the way one experiences, thinks about, and interacts with the target domain (Lakoff & Johnson, 2003). LIFE IS A WILD ANIMAL is most clear when one feels pushed down and trampled and overwhelmed with all the responsibilities in life or when a drastic change in life takes a person by surprise. This conceptual metaphor *reflects* these recurring experiences with one's life. It also *shapes* the understanding and expectations one has of life. One may feel the need to get out of bed in the morning and get moving to *get on top of* his or her life lest it *get out of control*. Contrastingly, one may find little motivation to get out of bed, dreading the *struggle* of the day or feeling like she or he has been *beat down* by life too many times already. In these everyday situations, the conceptual metaphors one uses influence the way one interacts with life. This fifth principle is all important in the following discussion about linguistic relativity.

The process of evaluating the claims of linguistic relativity is greatly helped by CMT. The fifth principle just mentioned is simply a more specific version of the first assertion of linguistic relativity. The first assertion, that language shapes thought, begs the questions, *what part of language?* and *what is meant by thought*? Reworded in terms of CMT, the first assertion becomes the following: *conceptual metaphors shape one's understanding of and interaction with a target conceptual domain.* The second assertion is formed by extension of the first: *Differing language systems (e.g. Mandarin and English) with diverging conceptual metaphors will shape in their speakers a differing understanding of and interaction with the target conceptual domain. Conceptual metaphors* and *conceptual domains* are specific enough to begin to formulate a methodology which measures and evaluates the assertions of linguistic relativity.

2.2.2 SPACE-to-TIME Conceptual Metaphors

Because there are many conceptual domains and many conceptual metaphors, the current study will focus on just two of arguably the most basic domains: SPACE and TIME. The current research is concerned with the extent to which concepts of space are systematically mapped onto time. First, there will be a brief introduction to the conceptual domains SPACE and TIME. Second, an argument will be made as to the importance of understanding the extent to which languages map concepts from space onto time. Third, the fundamental properties of time-especially those shared by space-will be explained. Fourth, a taxonomy of spatial frames of reference as well as the dimensionality and directionality of space will be explicated. Finally, these components of space and time will be fit together into a coherent and consistent taxonomy of STMs; this taxonomy will be evaluated through the five principles of CMT outlined above. Throughout, everyday examples will serve as linguistic data of these space-to-time metaphors.

2.2.2.1 SPACE

SPACE is one of the most basic human domains of experience (Evans, 2006). Every person directly experiences space. One can see the size difference between a bike and the library or feel the length of a table from corner to corner. In fact, an entire class of conceptual metaphors are dubbed by Lakoff and Johnson as *orientational metaphors* (Lakoff & Johnson, 2003). They are called this, because the various target domains included in this category derive their metaphoric system from SPACE (Lakoff & Johnson, 2003). These domains include HAPPINESS ("I'm feeling down today"), WELL-BEING ("He's on the up and up"), MORALITY ("She's an upright person"), STATUS ("I'm living the high life"), and many others (Lakoff & Johnson, 2003). *Up* and *down, high* and *low*, and other terms from space are systematically mapped onto these domains. SPACE is the concrete source domain for many other conceptual domains. Its nature of being so fundamental to human conceptualization makes it a prime candidate for the study of linguistic relativity.

2.2.2.2 TIME

TIME is also a fundamental domain of human experience (Evans, 2006). There are many metaphoric and non-metaphoric ways of speaking about time. First, in many languages, tense and aspect provide grammatical anchoring in time. Secondly, Boroditsky (2001) argues that people experience the transient (passing) nature of time directly, and that this characteristic of time is partially encoded in language by words like *earlier* or *later.* Evans (2006) reports neuroscience evidence which seems to imply that the human brain perceives discrete moments in time, giving rise to a present *now*. This finding is inherently tied together with the knowledge of "the awareness of the passing of time being linked to memory processes” (Bender & Beller, 2014, p. 343). Therefore, the *getting later* nature of time is one aspect which humans can directly experience. Such a concept of time is seen in the following example:

(7) It’s getting later, isn’t it?

However, beyond these basic elements of time, it is hard to conceive of time without metaphoric structuring. Lakoff and Johnson mention two common conceptual metaphors for TIME: “TIME IS MONEY”, and “TIME IS A VALUABLE COMMODITY” (2003, p. 8-10). Such conceptual metaphors highlight the finite and precious nature of time many people experience. These metaphors can be seen in examples (8-10):

(8) I’ve invested a lot of time in her.

(9) I’m running out of time.

(10) You’re wasting my time

2.2.2.3 Reasons for studying space-to-time mappings

With such varied ways to speak of time, one may consider it completely arbitrary that this current study has chosen to focus on *space*-to-time metaphors. However, there are two strong reasons to study STMs and their influence on conceptualization. First, other than the anchoring help of tense and the direct experience of the transient nature of time, more complex and abstract concepts of time rely on metaphoric structuring from more concrete domains (Boroditsky, 2001). This demand for metaphoric structuring is supplied aptly through the fundamental domain of SPACE. Because SPACE is so basic to human experience and conceptualization, STMs are a particularly common way to interface with time. SPACE provides pervasive and robust structuring for time as will be seen in the properties and examples below.

Second, many researchers have already begun to investigate TIME in terms of SPACE (Bender & Beller, 2014; Boroditsky, 2001; Chen, 2006; Fuhrman & Boroditsky, 2010; Fuhrman et. al., 2011; January & Kako, 2007; Lakoff & Johnson, 2003). The key developments in theory and insights from empirical studies make STMs a helpful starting point to evaluate the claims of linguistic relativity.

2.2.2.4 Initial SPACE-to-TIME metaphors

Before the discussion about the nature of time and STMs can begin, some linguistic examples are needed. Consider the following (taken from Lakoff & Johnson, 2003, p. 42-45):

(11) The time will come when…

(12) The time has long since gone when…

(13) As we go through the years…

(14) We're approaching the end of the year.

In examples (11) and (12) time is spoken of as approaching the speaker or moving away from the speaker. In examples (13) and (14) the speaker seems to be in motion toward future events. Terminology of motion is inherently spatial. In sentences (11) and (12), time has a place it comes *from*, the future, and a place where it goes *to*, the past. In (13) and (14) time is *extended* and becomes something of an environment through which the speaker is moving. Here Lakoff and Johnson offer complimentary conceptual metaphors for these STMs "TIME IS A MOVING OBJECT" and "TIME IS STATIONARY AND WE MOVE THROUGH IT" (2003, p. 42-45). These conceptual metaphors are a helpful start, but a more precise and coherent system of mappings from SPACE to TIME is needed in order to measure the extent of such metaphoric structuring.

2.3 Taxonomy of Space-to-Time Mappings

2.3.1 Key Properties of TIME

If one begins to explore research in space-to-time mappings, one may quickly become dismayed at the lack of consensus over exactly how aspects of space are mapped onto time (Bender & Beller, 2014). The multitude of disparate taxonomies of space-to-time mappings is what prompted Bender and Beller (2014) to find a single and robust taxonomy. The fruit of their labor is the taxonomy that will be used here. Four properties shared by time and space must be considered in any system of space-to-time mappings. A few examples will help illustrate:

(14) We have a bright future ahead of us.

(15) The worst is behind me.

(16) Wednesday's meeting has been moved forward two days.

(17) Where has the time gone?

(18) This year has passed so quickly.

The four properties that time shares with space are extension, linearity, directionality, and transience (Bender & Beller, 2014). That time is not a single point (a single moment), but multiple moments is its property of *extension* (Bender & Beller, 2014). In this aspect, space is identical, having dimension: length and breadth and depth. Time is also *linear*, in that one's present can be *in the middle* of two other moments (Bender & Beller, 2014). In this way it is like space, where one can, stand in between two cars or be halfway home from work. However, unlike space, time only has one dimension (Bender & Beller, 2014). Combining the properties of extension and linearity, time is a line extending through the past, present and future. Which way this timeline extends is a matter of the *directionality* of time (Bender & Beller, 2014). In examples (14) and (15), the future is clearly spoken of as in front of the speaker with the past behind. Example (16) also implies a front, but what is meant by *forward* is ambiguous (Bender & Beller, 2014). Example (16) will be discussed further below. Directionality is the asymmetric nature of time. When a moment has passed, one cannot return to it; in other words, one cannot move toward the past as one can move toward the future. Almost every language in the world, time is spoken of as a unidirectional, one-dimensional line (though some languages have multiple mental timelines, they are separate and still unidirectional and one-dimensional) (Bender & Beller, 2014).

The fourth property of time is its *transience.* As mentioned above, this aspect of time is its "fleetingness", how the present is only momentary and then is gone (Bender & Beller, 2014). Space in and of itself does not share in this property, but requires time to create motion, which is the closest analogue space has to transience (Bender & Beller, 2014).

2.3.2 Properties of SPACE

The above properties provide the core ingredients of mapping space onto time. These properties are a sort of handshake between TIME and SPACE. However, a conceptual metaphor involves more than semi-parallel natures; a conceptual metaphor imports a portion of the conceptual structure of one domain into another. As mentioned in the fourth principle of CMT outlined in section 2.2.1, conceptual metaphors form a coherent system of mappings from the source to the target domain. Therefore, a conceptual model of SPACE is needed to determine which aspects are metaphorically mapped onto the domain of TIME.

2.3.2.1 Frames of reference

The *frames of reference* account is a robust taxonomy which has been used to compare cross-linguistic representations of space (Bender & Beller, 2014; Haun et al., 2011). Frames of reference (henceforth FoR) is a systematic taxonomy of the myriad ways human languages locate entities in space. There are three FoR's: *absolute*, *intrinsic*, and *relative* (Bender & Beller, 2014; Haun et al., 2011). Figure 2.1 provides a visual portrayal of these three FoRs. For each FoR there must be a figure (F) (the entity whose location is being described), a ground (G) (an entity relative to which F is being located), and an origin for the coordinate system (X) (Bender & Beller, 2014). The absolute and intrinsic FoR both require only these components and describe binary relationships between the F and G in the directional terms of X. The relative FoR adds an observer V (for viewpoint), who describes the scene from his or her perspective. Therefore, the relative FoR describes ternary relationships between F and G relative to V.

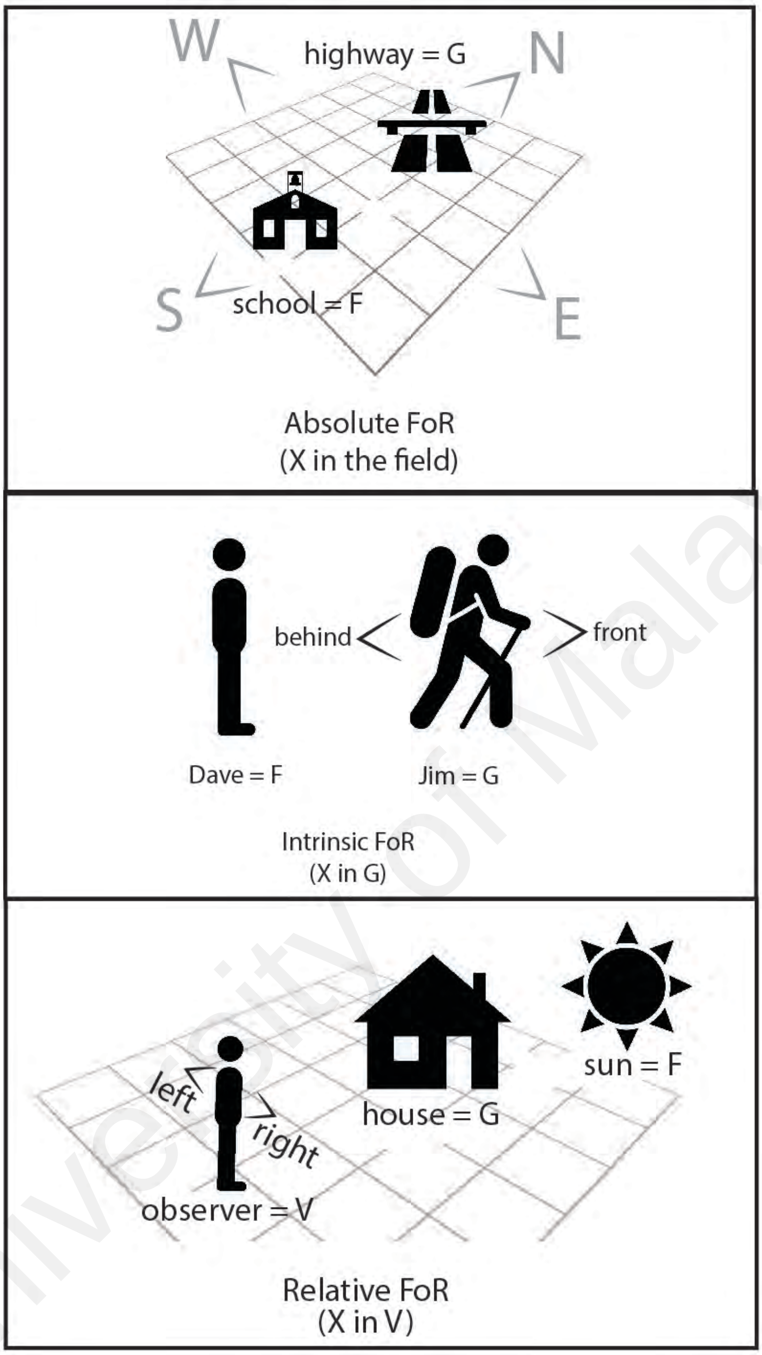

Figure 2.1: Frames of reference

In the absolute FoR, the origin X is placed on a superordinate plane outside F or G. The coordinate system itself is usually cardinal directions (Bender & Beller, 2014; Haun et. al., 2011). F is located relative to G using directions from this plane. An example of the absolute FoR would be:

(19) The school lies south of the highway.

In this example, *school* is F, *the highway* is G, and the coordinate system X used is the cardinal directions, in this case, south.

The intrinsic FoR is called such because the origin of X is located within G itself. G is parsed into having a *front*, *back*, *sides*, etc. F is then located relative to G using the coordinate system originating in G. An example of this would be:

(20) Dave is behind Jim.

In example (20), F *Dave* is located relative to the ground *Jim* using a coordinate system originating in, and aligned to, Jim. Because Jim's body has an intrinsic front and back, X is oriented so that its front is oriented in the direction of Jim's front. Therefore, the figure can be located toward Jim's back, *behind*.

In the absolute and intrinsic FoRs, only binary relations are described between F and G (Bender & Beller, 2014). Further, no matter where the speaker was who said these statements, they remain consistent. In contrast, the relative FoR is called such, because it adds a ternary entity V (the observer), locates the coordinate system in V, and thus the spatial relationship between F and G is described *relative* to position and orientation of V (Bender & Beller, 2014). The addition of V, however, need not be explicitly mentioned in a statement; V can be only conceptually added to the spatial description. Conceptually adding V makes the statement deictic. For example:

(21) The sun is rising to the right of the house.

In example (21), F *the sun* is located relative to G *the house* using a coordinate system in V, the speaker. Example (21) would be understood differently if the speaker was standing behind or in front of the house. Notice in this sentence, V is not explicitly mentioned. The conceptual presence of V is evident from the origin of the coordinate system being in her or him.

2.3.2.2 The dimensions and directionality of SPACE

Implicit in the FoR taxonomy are two properties of space that, in the case of this research, deserve special attention. First, space has three dimensions. Each dimension is represented by a line called an axis. These axes will be mentioned repeatedly in the remainder of this study. As such, it is helpful to clearly assign which terms will be used to describe which axes. The axes are *transverse, sagittal, and vertical* (see figure 2.2) (Fuhrman et. al. 2011). The transverse axis extends left and right from the origin, the sagittal axis extends front and back, and the vertical axis extends up and down. If a pianist reaches to the right for the high keys, this would be motion along the transverse axis. A car driving forward along a highway is moving along the sagittal axis. And a child jumping on a trampoline represents motion along the vertical axis.

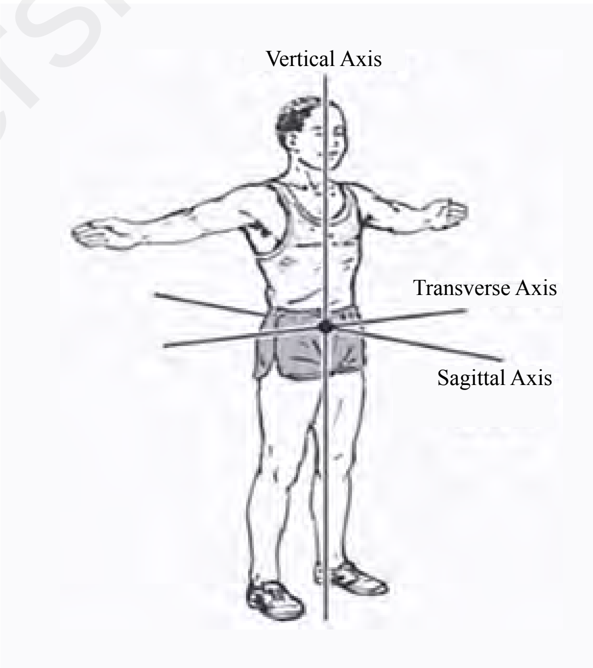

Figure 2.2: Dimensions of space

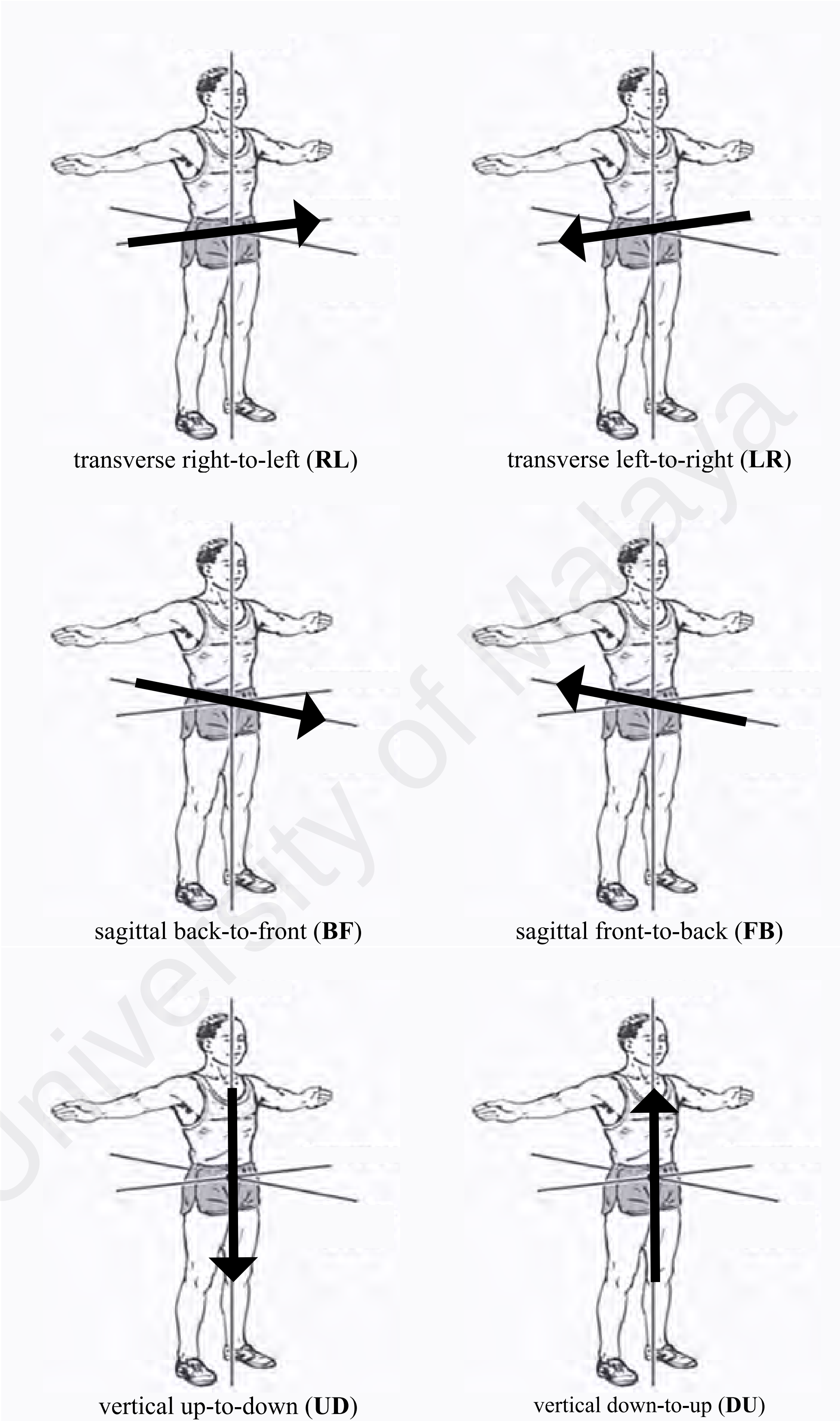

Figure 2.3: The six directions of space

In addition to dimension, space can sometimes have an asymmetric quality, its directionality (mentioned above). Directionality has limited manifestations in space. It makes itself known by the asymmetrical nature of gravity, pulling objects *down* toward earth, and by the intrinsic shape of the human body (Bender & Beller, 2014). Directionality finds much wider application when space is linked with time in the act of motion. Direction is inherent in motion: a pianist can reach *right*, a car can drive *north*, and a child can jump *up*. There are two directions on each axis. In all there are six directions possible in space shown in figure 2.3. That space can have directionality-that it can be asymmetrical-is an important property in metaphorically mapping space onto time.

2.3.3 Metaphoric Space-to-Time Mappings

The three FoR's and the two properties of space just described represent a taxonomy for how people experience and describe space (Bender & Beller, 2014). In other words, it is a conceptual system of the domain of SPACE. But how well do these spatial concepts map to the domain of time? To understand how TIME is metaphorically structured in terms of SPACE, Bender and Beller (2014) sought to find whether languages structure conceptualizations of TIME according to the absolute, intrinsic, and relative FoR's.

2.3.3.1 Mapping FoRs and properties of SPACE onto TIME

After examining thirty empirical studies and eight theoretical accounts, Bender and Beller (2014) found that speakers of language systems virtually universally employ the absolute and intrinsic FoR's to describe TIME in spatial terms. They found no evidence, however, that English or Mandarin (the two language systems of interest to the current study) structure conceptualizations of time according to a relative FoR (Bender & Beller, 2014).

The same basis to identify the usage of a certain FoR in space will be used here to demonstrate the fit of the three FoRs to linguistic data about time. The basis for discerning which FoR is being used is to essentially identify where the origin of the coordinate system (X) is located (Bender & Beller, 2014). However, one key difference between space and time is that while space has three dimensions, time conceptually only has one (Bender & Beller, 2014). Though some may wonder if time may have more dimensions, consider that temporal entities only exist before, during, or after one another, temporal locations only resulting in one conceptual dimension. Therefore, assignment of the orientation of X is limited to *front* and *back*. The two questions in identifying temporal FoR's then are *where does the coordinate system originate?* and *does front point toward the future or the past?* The following examples provide linguistic data to inform the discussion on these temporal FoR's.

(22) The worst is behind me.

(23) We have all summer break ahead of us!

(24) In the weeks that followed the celebration…

(25) We're approaching the end of the year.

(26) Wednesday's meeting has been forward two days.

The absolute FoR in principle places X in the superordinate field outside of the figure (F) or ground (G) (Bender & Beller, 2014). Therefore, an absolute temporal FoR places X on "the arrow of time", the general movement of time from the past toward the future (Bender & Beller, 2014). Because of the futureward progression (motion) of "the arrow of time", the direction *front* is assigned toward the future, with *back* or *behind* assigned pastwards (Bender & Beller, 2014). Periods of time (eons, years, seasons, days, etc.), events (meetings, meals, conferences, classes, etc.), and even the ego (the speaker's present) are located along this line (Bender & Beller, 2014). Examples (22-23) show the absolute FoR explicitly. In (22) F is *the worst*, is located as being behind G is *me*. Since the absolute FoR assigns *behind* pastwards, *the worst* is in the past of *me*. In (23) the F *summer break* is located *ahead*, or in front, of the G *us*. Similarly to (22), since the absolute FoR assigns *front* toward the future, *summer break* is located in the future of *us*.

The intrinsic FoR in principle locates X in G, orienting *front* and *back* according to that entity's intrinsic shape (Bender & Beller, 2014). Temporal entities have a beginning and an end. In the intrinsic temporal FoR, *front* is assigned to the beginning of a temporal entity, with *back* assigned to its end. Examples (24 and 25) represent the intrinsic temporal FoR. In (24) the F *the weeks* are said to *follow* the G *the celebration*, where X originates. Celebrations have a beginning and an end, thus having a metaphoric *front* and *back*. Since X is located in, and is oriented by, G *the celebration*, *front* faces toward the past, with *back* toward the future. This is why the weeks are said to follow the celebration.

The relative FoR differs from the absolute and intrinsic FoR's in that is it describes a ternary relationship (Bender & Beller, 2014). Therefore, in addition to F and G, the relative FoR requires a third entity V, and places X in V (Bender & Beller, 2014). Further, V has to be distinct from G, otherwise the relationship simplifies back into a binary relationship (Bender & Beller, 2014). Bender and Beller found that the relative temporal FoR does not exist in English and Mandarin either linguistically or conceptually (2014). In other words, the relative FoR is not mapped from space to time.

Besides the three FoR's, the dimensionality and directionality of space can also be mapped to time. The *linear* and *directional* properties of time discussed in section 2.3.1 are bridges for mapping these aspects from space and time. First, like space, time also has dimensionality; however, it was just mentioned that unlike three-dimensional space, time is conceptually one-dimensional (Bender & Beller, 2014). One may ask, which axis does this timeline run along? From the evidence of 16 different language systems, Bender and Beller (2014) report that the line of time can be construed along any of the three spatial axes (transverse, sagittal, or vertical). For example, historical timelines often show run left to right. When speaking about the past, people often motion along the sagittal axis. Family trees often arrange the generations (who represent the passing of time) vertically. The important detail, however, is that in all these construals, regardless of which dimension time is aligned to, it is still depicted as a one-dimensional line. To conceive of time, then, is to conceive of a line running between past and future (Bender & Beller, 2014).

Second, like space, time is also directional in nature (Bender & Beller, 2014). In other words, time only moves one way along its line. However, whereas directionality only shows itself in limited, specific cases in space, it is applied far more regularly in time, due to time's inherent asymmetrical property (Bender & Beller, 2014; Fuhrman & Boroditsky, 2010). As mentioned with regard to the absolute temporal FoR, the "arrow of time" originates in the past and points toward the future (Bender & Beller, 2014). Linguistically, STMs describe time as unidirectional; for example, Mandarin describes time running along an up-to-down trajectory, with past events located above the present with future events below (Boroditsky, 2001; Bender & Beller, 2014). This construal is never spoken of in the reverse, with past events being located below the present and future events above (Fuhrman & Boroditsky, 2010). Therefore, it could be said that Mandarin not only orients its conceptual timeline vertically, but also that it construes that timeline moving along an up-to-down (UD) trajectory (Bender & Beller, 2014; Fuhrman & Boroditsky, 2010; Fuhrman et. al., 2011).

The conceptual timeline will serve as the embodiment of the STMs studied in this research. Figure 2.3 illustrates the six possible conceptual timelines. These timelines will be abbreviated throughout the rest of this paper in the following way: *transverse*:

left-to-right (LR) and right-to-left (RL), *sagittal:* back-to-front (BF) and front-to-back (FB), and *vertical:* up-to-down (UD) and down-to-up (DU) (see figure 2.3). Though a single conceptual timeline is unidirectional, two different conceptual timelines can be aligned in diametrically opposite directions. For example, it was observed that English speakers construe time LR, but Hebrew speakers construe it RL.

2.3.3.2 Evaluating space-to-time metaphors as conceptual metaphors

Above, the basic properties which time and space share were discussed as well as a taxonomy for the conceptual structuring of space. Then it was demonstrated how this taxonomy of space could be metaphorically mapped to time. The resulting mappings can properly be called space-to-time metaphors (STMs). Finally, these mappings will be evaluated based on the five principles of a conceptual metaphor outlined in section 2.2.1. One must remember that conceptual metaphors are essentially, "understanding and experiencing one kind of thing in terms of another" (Lakoff & Johnson, 2003, p. 6). STMs involve understanding TIME in terms of SPACE; so according to this basic definition of metaphor, STMS are indeed metaphoric.

First, STMs will be worded in the format of conceptual metaphors. In section 2.2.2.4, it was reported that (Lakoff & Johnson, 2003) offered the complimentary conceptual STMs: "TIME IS A MOVING OBJECT" and "TIME IS STATIONARY AND WE MOVE THROUGH IT" (p. 42-45). These conceptual STMs provide a good starting point for relating space and time. However, their precision is greatly increased by the discussion in section 2.3 about a robust taxonomy for space-to-time mappings. Rewording these conceptual metaphors from Lakoff and Johnson in terms of that taxonomy renders TIME IS A ONE-DIMENSIONAL LINE WE MOVE ALONG TOWARD THE FUTURE and TEMPORAL EVENTS EXIST ALONG A ONE-DIMENSIONAL TIMELINE AND MOVE PAST US.

First, STMs are conceptual metaphors because they are *ordinary*, commonplace language. Examples (22-26) are not hard to imagine in everyday conversation. Like all conceptual metaphors, STMs' pervasive ordinary-ness shows that they are normal ways of thinking about time.

Second, STMs structure one conceptual domain with a system of terms and concepts borrowed from another conceptual domain. The FoR's described above are a conceptual taxonomy system structure borrowed from space. The FoR's import into time concepts such as, *front* and *back* in order to locate temporal entities. Further, spatial concepts of dimensionality and directionality are imported into time, resulting in terms representing the future and past as *behind* or *ahead, above* or *below*, etc. STMs, then, follow the CMT principle of importing a system of terms and concepts into TIME from SPACE.

Third, STMs perform the conceptual metaphor principle of highlighting and hiding. STMs do not structure all the ways people experience and understand time. As mentioned in section 2.2.2.2, there are other possible conceptual metaphors for understanding time, such as TIME IS MONEY and TIME IS A VALUABLE COMMODITY. These metaphors highlight the limited amount of time one has and the value of time; STMs do not express this experience of time, and therefore hide it. STMs do, however, highlight the temporal locations of events relative to each other or to the speaker as in examples (22-26). STMs also express the passing of time as in (17-18). STMs do fulfill the metaphoric function of highlighting and hiding.

Fourth, STMs have coherence. Coherence was partially addressed in the second principle. FoR's and the two other properties of space provide a coherent system of mappings from space to time. It is important to remember from the initial description on the principle of coherence that not all aspects of the source domain are imported into the target domain. It was discussed that though time shares the property of dimensionality with space, it only has one dimension, and is further not construed as a three-dimensional entity. It was also found that the one-dimensional nature of time consequently rendered the ternary relationship requirement of the relative FoR untenable in the domain of time. Summarizing, neither the three-dimensionality of space, nor the relative FoR were imported into time. As all conceptual metaphors do not map all aspects of the source domain onto the target domain, STMs still qualify as proper conceptual metaphors.

From the evaluation of these four principles of CMT, STMs emerge as genuine conceptual metaphors. The fifth and final principle of CMT states that conceptual metaphors not only reflect, but also shape one's conceptualization of the target domain. This principle can only be evaluated with empirical data (Lakoff & Johnson, 2003). If STMs reflect *and* structure how people experience time, that influence can be measured. An appropriate methodology for measuring that influence will be explicated in sections 2.5, 3.2., and 3.3. The experiment conducted in this study was designed to ascertain the extent to which STMs structure a person's understanding of time.

2.4 Difference between English and Mandarin STM Systems

2.4.1 Universal Descriptions of Time

Because humans have the general construct of the physical body in common with each other, there are at least two aspects of time that are described in approximately the same way across all languages (Evans, 2006). First, the transience of time was observed in all the 30 studies of the 16 languages reviewed by Bender and Beller (2014). In other words, people of all languages describe the "getting later"-ness of time (Bender & Beller, 2014). Second, from these same accounts it was observed that almost all languages preferred the absolute temporal FoR and therefore conceived of time as a 1-dimensional line with a certain asymmetrical orientation (Bender & Beller, 2014). However, the universals of conceptualizations of time end here. As mentioned in section 2.3.3.1 the construal of which axis this timeline is aligned to and which direction this line faces varies by language system. Section 2.3.3.1 stated that there are six possibilities of which way the "arrow of time" can be oriented: LR, RL, BF, FB, UD, or DU (see figure 2.3). Each language system may construe its conceptual timeline in any one of these directions. Further, a language system may have more than one conceptual timeline coexisting. In the discussion of the differences between the STM systems of English and Mandarin, this study will seek to answer the questions, *how many conceptual timelines are there in this language system?* and *in which direction is this language system's timeline(s) construed?*

2.4.2 English STM Timeline Construal

Many examples of STMs have already been given for English. Some which use explicit spatial terms to locate temporal entities will be copied here, as well as some new examples (example 29 taken from Evans, 2006, p. 85).

(27) The worst is behind me.

(28) We have all summer break ahead of us!

(29) In the weeks ahead of us…

(30) You're getting ahead of yourself.

(31) As far back as I can remember…

Examples (27 and 28) were explained in section 2.3.3.1. Here, the relevant observation in each is the spatial description of the temporal location of F. In (27) F, *the worst*, is described as being *behind* G, indicating being in the past of the speaker's present. In (28, 29 and 30) F is *summer break*, *weeks*, and *you* respectively. Each of these is spatially located *ahead* of G, *us*, *us*, and *yourself*. *Ahead* indicates that F is in the future of G. Finally, in (31) G is an implicit *present*, and F is the earliest-most pastwards-memory of the speaker. *Back*, therefore, spatially depicts the past of the speaker. Notice in examples (27-31) that the direction of *future* and the *past* are arranged with future events in *front*, and with past events *behind*. *Back* and *front* are indicative of the sagittal axis. In fact, in English only sagittal spatial terms are used (Bender & Beller, 2014; Boroditsky, 2001). The English language system does not include such statements as:

(32) We have all summer break *below* us!

(33) As far *left* as I can remember…

Arranging the past behind and the future in front also means that English orients its conceptual timeline in a back-to-front (BF) trajectory. Taken together, STMs in English indicate that English has only one conceptual timeline and that it orients this timeline along the sagittal axis in the BF construal (Boroditsky, 2001).

2.4.3 Mandarin STM Timeline Construal

2.4.3.1 *Qián* and hòu

It has been commonly observed that Mandarin describes time both along the sagittal and vertical axis (Bender & Beller, 2014; Boroditsky, 2001; Chen, 2006; Tse & Altarriba, 2008). On the sagittal axis, the spatial words *front* and *back* find equivalent meanings in the Mandarin words *qián* and hòu, respectively. As in English, these spatial terms are also used to describe temporal location (Scott, 1989). Below, an example will first be given of qián and hòu in a spatial statement. Then an example will be given of qián and hòu being used to describe a temporal relationship (taken from Scott, 1989, p. 69-70):

(34) *Hòu* (*back*) in space:

zài. zhuōzihòu-bian zhàn-zhe yī ge lǎoshī

at desk *back* stand-DUR one CL teacher

There is a teacher standing *behind* the desk.

(35) *Hòu* (*back*) in time:

dàxué bìyè de *hòu* yī nián wǒ méi zhǎo-dào gōngzuò.

university graduate DE *BACK* one year I NEG find-VC work

The year *after* I graduated from university I didn't find a job.

(36) *Qián* (*front*) in space:

zài zhuōzi *qián*-bian zhàn-zhe yī ge xuésheng.

at desk *front* stand-DUR one CL student

There is a student standing in *front* of the desk.

(37) *Qián* (*front*) in time:

hǔ nián de *qián.* yī nián shì shénme nián?

tiger year DE *FRONT* one year be what year?

What is the year *before* the year of the tiger?

In the spatial statement (34), F *a teacher* is located *behind (hòu* G *the desk.* In locating the teacher, hòu is used to mean *behind.* In this case, *hòu* describes a *spatial* relationship. In (35) F, *the year*, is located *after*-literally *behind (hòu*-G *graduated from university.* Here hòu is used to describe a *temporal* relationship. Similarly, in (36) F *a student* is *spatially* located *in front of* (qián) G *the desk*. Finally, in (37) F is *the year*, G is *the year of the tiger*, and qián *temporally* locates F *in front of* G. One may wonder why future events are said to be hòu (back or behind) while past events are located qián (in front). Some have argued from evidence such as this that Chinese (Mandarin) construes its sagittal timeline in the front-to-back (FB) orientation (Alverson, 1994; Ahrens & Huang, 2002). Such a FB orientation would be directly opposite to the BF construal of English. However, Yu (2012) with the confident intuition of a native speaker and a thorough categorization of the system of STMs in Mandarin, argues that Mandarin construes the conceptual timeline on the BF orientation, an identical construal to that of English described above (Yu, 2012). According to this account, Mandarin does conceptualize the future in front of the speaker and the past behind. Therefore, Mandarin has a conceptual timeline along the sagittal axis, oriented BF just like in English.

2.4.3.2 Shàng and xìa

Mandarin also uses the vertical spatial terms shàng (*up*) and xìa (*down*) to describe temporal relationships. The vertical construal of time in Mandarin finds varied application. Here are just a few examples (taken from Yu, 2012):

Periods of the day (from Scott, 1989, p. 63)

(38) Shàng - wǔ

SHÀNG-noon

'morning'

(39) Xià - wǔ

XÌA-noon

'afternoon'

(40) Wǎn - shàng

night-SHÀNG

'(in the) evening/(at) night'

In examples (38-40), the periods of the day are located vertically. In example (38), *noon* (*wu*) is functionally G while *up* (*shàng*) locates F which could be thought as a period of time, in this case *morning*. In the course of a day, morning is temporally located in the past of noon. In these compound words, the past is described spatially as being above G. The same case could be made for example (40). *Night* (*wan*) is functionally G, *up* (*shàng*) locates the period of time that comes before night, namely *evening*, which is F. Again shàng (up) here refers to the time in the past of G. Finally, in example (39) xìa (down) locates F, a period of time, after *noon* (*wu*). Therefore, afternoon is described as the time *below* noon. Events below G, therefore, are those in the future of G. In other words, through the STM terms shàng and xìa, the Mandarin "arrow of time" is construed UD.

Before leaving *shàng* and *xìa*, it must be noted that, in general, they serve a function of the English terms *next* and *last*. Consider the following categories of examples:

Inter-months (examples taken from Scott, 1989, p. 64)

(41) shàng ge yuè

SHÀNG GE month

'last month'

(42) xià ge yuè

XÌA GE month

'next month'

Inter-weeks (examples taken from Scott, 1989, p. 64-65)

(43) shàng (ge) xīng-qī

SHÀNG GE week

'last week'

(44) xià (ge) xīng-qī

XÌA GE week

'next week'

Previous instance/next instance (adapted from Scott, 1989, p. 64)

(45) shàng yī bān chē wǔdiǎnzhōng kāi-zǒu le

SHÀNG one CL bus 5 o' clock drive-VC PER

The last (i.e. previous) bus left at 5 o'clock.

(46) Xià yī bān chē wǔdiǎnzhōng jiù kāi le

XÌA one CL bus 5 o'clock then drive PER

The next bus leaves at 5 o'clock.

In examples (41-46), shàng and xìa serve the same temporal location functions of next and last respectively. In (41 and 43) the speaker's present is G, with F, *month* and *week*, is located in the past using shàng (up). As with the periods of the day, here the past is located spatially above the present. Mirroring this pattern is xìa in examples (42 and 44). Month and week here are F temporally located as *next.* In these statements F is in the future relative to G and is spatially described as xìa (below) G. Again, Mandarin STMs shàng and xìa indicate that Mandarin has a vertical UD construal of the conceptual timeline.

An important note is that by roughly indicating *next* and *last*, shàng and xìa mostly describe deictic temporal relationships (Scott, 1989; Tse & Altarriba, 2008). They are deictic in that in that each of examples (41-44) the meaning of F depends on when the speaker says them. In the case of examples (45 and 46), deixis means these statements are only correct at certain times: (i.e. example 46 would be incorrect after ‘5 o’clock’). In examples (41-46) deixis means that the month and week are temporally located relative to the speaker.

In contrast, qián and hòu describe non-deictic temporal sequences. Examples (35 and 37) describe the order of years. In each example, F does not change depending on when the speaker says it. When using qián and hòu in this way, the speaker’s temporal location is irrelevant to the location of F. The discussion in section 5.5 will return to the difference between the usage of shàng/xìa and qián/hòu.

From the above examples one can draw conclusions as to how English and Mandarin STM systems linguistically construe their conceptual timeline(s). English, it seems, has one conceptual timeline oriented BF. Mandarin also construes time BF, but has an additional timeline running UD. These are the construals described by STMs in English and Mandarin. Now a way must be designed to measure if these STMs shape the conceptual reality of English and Mandarin speakers.

2.5 Theoretical Framework for an Implicit Task Experiment

A concise review of the discussion so far will facilitate the development of a clear theoretical framework. So far, it has been discussed that linguistic relativity has essentially two assertions: 1. Language influences thought and 2. Different languages cause difference in thought. Next, five principles of a conceptual metaphor were explained. It was shown how CMT gives rise to and clarifies the assertions of linguistic relativity. Then SPACE and TIME were introduced as key domains for study of conceptualization. Next STMs were explained and were shown through the five principles of CMT to be genuine conceptual metaphors. Then linguistic data from English and Mandarin revealed that English construes time on a BF orientation and Mandarin has both BF and UD construals of the timeline. Lastly, all these factors must be operationalized through a theoretical framework. Such a framework ultimately seeks to design a way to measure the influence of language on thought. In the current study this framework will do so by examining the effect of the difference in construals of time on task performance.

A person's construal of the conceptual timeline is shaped by her or his language's linguistic STMs (See section 2.2.1 and 2.4). CMT would claim that STMs-being conceptual metaphors-should shape not only the way one understands time, but also interacts with it. Therefore, the STMs' construal of a conceptual timeline should manifest itself in congruent action. An implicit task which primed a certain construal of the conceptual timeline (e.g. LR or UD), and then measured response times, could measure genuine conceptualizations (Bender & Beller, 2014; Boroditsky, 2001; Fuhrman et. al., 2011). *Implicit* refers to a task whose participants are unconscious that a certain construal is being primed. The first principle of CMT (see section 2.2.1) claims that conceptual metaphors are so ordinary, their effect on conceptualizations is unconscious (Lakoff & Johnson, 2003). If participants are conscious of employing a certain construal of time, their actions would reflect a conscious decision, not their unconscious conceptualization (Boroditsky, 2001). Therefore, to measure the unconscious construal of time, one must prime and measure that construal implicitly.

By comparing the response times of participants to different construals of the timeline (e.g. LR and UD), an implicit task can measure the extent to which STMs shape conceptualization of time. If the response times are overall faster (shorter) for a certain construal, they would indicate it is a genuine representation of the participants conceptual timeline. If this genuine construal was congruent with the STMs in that language, it would indicate that STMs do *shape* one's construal of the conceptual timeline. By extension such a bias would confirm assertion one of linguistic relativity that language influences thought. However, in order to confirm assertion two of linguistic relativity, one would need to additionally find differing overall biases between two language groups where the STMs in each language diverge.

2.5.1 Experimental Paradigm of Boroditsky 2001

The above framework structures the design of the current study's experiment. However, the specifics of the experiment design are positioned in an ongoing academic discussion. Therefore, before explicating the detailed experiment of the current research, previous empirical studies of English-Mandarin STMs will be reviewed. Their results, key issues, and developments in the experiment design will be discussed. The developments in the line of research shape the final methodology of this study

In 2001, Boroditsky began an academic discussion on the strength of linguistic relativity between Mandarin and English conceptualizations of time using STMs. Her experiment design approximately operationalized the reasoning in section 2.5.1. She observed the difference in STMs between English and Mandarin. She simplified this difference by saying English had a horizontal conceptual timeline, and Mandarin had a vertical timeline (Boroditsky, 2001). 26 English speaking and 20 Mandarin speaking students participated in her experiment (Boroditsky, 2001). Each participant was tested individually in front of a computer (Boroditsky, 2001). The procedure of the experiment randomly primed each participant for a horizontal or a vertical timeline many times (166 total trials) (Boroditsky, 2001). The trial asked participants true/false questions (Boroditsky, 2001). The computer measured the time it took each participant to answer (response time, henceforth RT) (Boroditsky, 2001).

She compared the RTs of the English and Mandarin speakers. She found that Mandarin speakers were overall faster to respond when primed vertically than horizontally (Boroditsky, 2001). Contrasting this, the English speakers were faster when primed horizontally than vertically (Boroditsky, 2001). She took these findings to confirm the assertions of linguistic relativity (Boroditsky, 2001).

2.5.1.1 Controversy

The first problem with Boroditsky's study occurred before the experiment was conducted. She observed correctly that Mandarin has a vertical timeline. However, she did not incorporate the *horizontal* (*sagittal* BF) timeline in Mandarin. Therefore, she predicted a vertical bias for her Mandarin speaking group. However, Tse and Altarriba (2008) have pointed out that because Mandarin has both vertical *and* horizontal timelines, the results should have shown no bias for one axis or the other.

A second problem was raised when other researchers replicated her experiment, but not her results (Chen, 2006; January & Kako, 2007; Tse & Altarriba, 2008). Even Boroditsky herself failed to replicate her findings using the original experiment design (Boroditsky, Fuhrman, & McCormick, 2011). Such failed attempts cast doubt on the test-retest reliability of her experimental design.

Another critique was the lack of accounting for the influence of writing direction (Chen, 2006). Traditionally, Mandarin was, and in some places still is, written from top to bottom-though now outside Taiwan it is mostly written horizontally (Chen & O'Seaghdha, 2013; Fuhrman et. al., 2011). However, English is exclusively written from left to right (Chen & O'Seaghdha, 2013; Fuhrman & Boroditsky, 2010). Some researchers have argued that writing direction is a significant influence on a person's mental spatialization of time, and some experimentation seems to confirm the presence of an effect (Chen et. al., 2013; Chen & O'Seaghdha, 2013; Fuhrman et. al., 2011). Therefore, writing direction could have conceivably caused the bias observed in the Boroditsky (2001) results (Chen, 2006). As mentioned in section 2.1.4, writing direction is considered a cultural artifact, not a linguistic element (Fuhrman et. al., 2011). Therefore, the influence of writing direction would not be evidence for linguistic relativity, but rather a confounding variable.

2.5.1.2 Developments in experimental paradigm

Boroditsky was part of a study in 2011 which improved on her original experiment paradigm (Fuhrman et. al.). The new experimental procedure was still implicit in nature but was improved in four ways. First, she accounted for writing direction by only including participants who reported having no exposure to vertically arranged text (Fuhrman et. al., 2011). Thus, both the Mandarin and English speaking participants had only been exposed to horizontal text (Fuhrman et. al., 2011). Therefore, any vertical bias among the Mandarin speakers could not be caused by previous exposure to vertical text (Fuhrman et. al., 2011).

Second, the new experimental paradigm primed timelines along all three axes. The reader may have been confused why Boroditsky (2001) primed timelines only along the vertical and *horizontal* axes. In section 2.3.2.2, three axes were described: *vertical*, *sagittal*, and *transverse*. Section 2.4 demonstrated that English and Mandarin speakers describe time along the sagittal axis, and not along the transverse axis. In 2001, Boroditsky conflated the sagittal and transverse axes into one *horizontal* plane. Boroditsky realized her mistake and the new 2011 experiment included all three axes from space (see figure 2.2). In other words, she parsed the *horizontal* plane into the *transverse* and *sagittal* axes.

Third, the new experiment incorporated the asymmetrical nature of time. In the original design, both UD and DU orientations of the conceptual timeline were aggregated as *vertical*. Likewise, LR and RL orientations were aggregated as *horizontal* (Fuhrman et. al., 2011). Section 2.4.3.2 showed how Mandarin construes time UD, and not DU. Likewise, both English and Mandarin construe time BF and not FB. In the improved experiment, each of the six possible orientations for time was primed and measured separately (LR, RL, BF, FB, UD, DU) (Fuhrman et. al., 2011). Together, the parsing of the horizontal axis and the additional aspect of direction allowed the updated experiment to measure all possible construals for the conceptual timeline.

The final improvement was to make the task non-linguistic (Fuhrman et. al., 2011). This may seem counterintuitive as the experiment aims to determine the influence of linguistic means on thought. However, the goal is not to measure the linguistic form, but the strength of the conceptualization itself, and find whether that conceptualization aligns with the linguistic forms. It may be difficult to imagine the exact procedure of a non-linguistic task equipped to prime construals of conceptual timelines. The exact details of this non-linguistic experiment will be explained in the methodology sections 3.2 and 3.3, since this is the experimental design used by the current study. For the current discussion, it is important only to realize that the non-linguistic nature of the task served to make the priming further less in the consciousness of the participants (Fuhrman et. al., 2011).

These improvements in experiment design brings it more in line with the rationale in section 2.5. Thus, the new experimental design was more truly able to measure the influence of STMs on conceptualization of time.

The results of the new experiment again seemed to confirm that STMs do shape one's construal of the conceptual timeline. Because all six orientations were primed in turn, finding a bias in RTs involved comparing them not between axes, but between opposite directions on each axis (i.e. comparing UD with DU, BF with FB, and LR with RL) (Fuhrman et. al., 2011). In the new experimental design, Mandarin speakers showed a bias for the UD orientation (Fuhrman et. al., 2011). Additionally, both English and Mandarin speakers had the shortest RTs when primed LR (compared with RL). The LR bias was she attributed to the LR writing direction used in both languages (Fuhrman et. al., 2011). These results were again taken to confirm the assertions of linguistic relativity.

2.6 Reasons for Current Study

The current study is concerned with evaluating the two assertions of linguistic relativity, that language shapes thought, and that different languages shape differences in thought. Because the experimental design of Fuhrman et. al. (2011) measures this influence (see section 2.5), that design will be implemented in the current study. The experiment used here will also be an implicit non-linguistic task and will measure RTs.

Because of the confirmatory results of the 2011 study, one may wonder if the current study is necessary since it seems to be repeating the same experiment as Fuhrman et. al. However, the current study has the following valuable contributions to the ongoing discussion of linguistic relativity through STMs in English and Mandarin.

First, a different prediction will be made from that of Fuhrman et. al. 2011. Essentially, based on the BF construals of Mandarin and English (section 2.4), it will be predicted that both groups will respond fastest when primed for the BF orientation. Also, when Fuhrman et. al. 2011 predicted English and Mandarin speakers would show bias for a LR construal, they did so from the basis of the LR writing direction used in both languages. Because of this study's focus on the question of linguistic relativity, it will not make a prediction for the LR construal. However, both transverse construals (LR and RL) will still be primed and measured. The motivation for measuring the LR and RL construals is due to a concern of Bender and Beller (2014). One shortcoming of implicit tasks, they report, is they do not allow participants to freely express all possible construals of time (Bender & Beller, 2014). Fuhrman et. al. (2011) also primed and measured all six possible orientations of time, even if they made no prediction. Their motivation for doing so was because it "allow[ed] [them] to capture how time is spatialized in three-dimensional space" (Fuhrman et. al., 2011, p. 1309). The current study will seek to overcome the shortcoming reported by Bender and Beller (2014) by measuring the transverse axis. This will allow participants to demonstrate how they construe the conceptual timeline in any of the possible orientations.

Second, the current study is unique from all past studies in that all participants in both language groups will be from the same country and culture: Malaysia (Bender & Beller, 2014). This difference provides the current study an advantage on two levels. As mentioned in section 2.5.1.1, other implicit task studies of English-Mandarin have rendered varied results (Bender & Beller, 2014). This difference in results could possibly be due the fact that for Chinese speakers in past studies, "no two studies were conducted with the same language community" (Bender & Beller, 2014, p. 369). The probability of differing construals of the conceptual timeline is increased when speakers come from different countries, even if they use the same language system. Additionally, past studies which compared English and Mandarin speakers took them from different cultures and countries. The English speakers were almost exclusively from the United States of America and the Mandarin speakers were from various East Asian countries: Taiwan, China, Hong Kong, etc. (Bender & Beller, 2014). Besides writing direction, the potential extraneous variables of the culture gap between the United States and these Asian countries could have conceivably altered the data. Therefore, since in this study participants in both the English and Mandarin testing groups come from the same country, ethnicity, and culture, cultural differences are inherently accounted for.

Finally, further empirical data is needed to evaluate the two assertions of linguistic relativity. In the words of Lakoff and Johnson, "What is needed is still more empirical research that seeks converging evidence and is gathered by using different empirical methods of inquiry" (2003, p. 248). Lest one think that the findings of studies since this 2003 statement have been sufficient for this evaluation, one should know that Chen and O'Seaghdha (2013) echoed that cry for more empirical data a decade later. This study will provide such empirical data.

CHAPTER 3: METHODOLOGY

3.1 Theoretical Framework

The goal of the current research is to measure the influence of language on thought. The challenge is to make that influence measurable. Section 2.5 described a theoretical framework which operationalizes this by substituting response times (henceforth RTs) for *influence*, STMs for *language*, and orientation of conceptual timelines for *thought.* Summarized here are the key elements involved in the experiment design of this study.

First, English and Mandarin are the languages of interest for this experiment. Therefore, two testing groups, English and Mandarin, are needed. Second, the experimental task will be implicit, with the participants unaware that a certain construal of time is being primed. Each of the six possible construals of the conceptual timeline will be primed (see figure 2.3). RTs will serve as the implicit measurement, and the task will be non-linguistic, further guaranteeing that participants will activate an *unconscious* construal of time. Third, the RTs of one construal will be compared with the others. If the primed construal is congruent with the STMs in a participant's primary language, temporal reasoning should be cognitively easier, resulting in faster RTs (Fuhrman et. al., 2011). Such a bias would indicate that STMs do influence conceptualizations of time. By extension, this effect would confirm the assertion that language influences thought.

Mentioned earlier, the current study has designed its experiment after that of Fuhrman et. al. (2011). Their experiment prompted participants to reason about the temporal order of visual stimuli. To input their answer, participants pushed one of two computer keys indicating *earlier* and *later*. The keys were arranged in turn on each axis and in both directions (i.e. all six construals in figure 2.3) (Fuhrman et. al., 2011). By aligning the keys with each construal, the experiment forced participants to think about time in that direction (Fuhrman et. al., 2011).

3.2 Experiment Materials

The current experiment took place in a quiet study room with a cleared desk. This was the location used for 32 out of the 35 participants. Three participants were tested at two other similar locations. Each participant was tested individually. See Appendix B for pictures of the testing environments and apparatus. The experiment program was run on a MacBook Pro with a 2 GHz Intel Core I7 processor and a 15-inch (38.1 cm) 2880 x 1800 Retina display.

The input device for the experiment was a joystick connected to the computer. In the original experiment in Fuhrman et. al. (2011) a colored keypad was used with directions indicated by different colored keys a few centimeters away from each other. It is hard to see how pushing buttons centimeters apart could adequately prime a construal of the conceptual timeline. Therefore, for the present experiment, a joystick was selected for the input device because it takes larger and more deliberate movement to operate. Therefore, it should more nearly simulate a mental timeline along each axis than simply pushing keys. This joystick was clamped down to the table on the right or left of the computer depending on the right or left-handedness of the participant.

The experiment was programmed and run using OpenSesame. This software has millisecond-accurate logging time for responses. This is a critical feature, because the key dependent variable in the hypothesis is the RTs of participants. Text for the instructions were black on a white background. The resolution of the experiment program was 1024x720 pixels displayed full-screen.

In total, 87 pictures were used as visual stimuli for the experiment. These pictures were clustered into 29 sets of three (see Appendix D for examples of trial pictures). One set of pictures would show a single subject or event at three different temporal points. The scale of the time between these temporal points varied from milliseconds to minutes to hours to months to years to generations. For example, one set displayed a candle burning. One picture showed it mostly unmelted. In the second picture, it was half-melted. The third picture in this cluster showed the same candle as just a stub. Burning a candle would only take a few minutes. In contrast, another set of pictures shows a man holding a clay pot in his hands. The second picture shows it in mid-air falling to the ground. In the final picture, it is smashed across the pavement. All but one set of pictures were shown in full color.

3.3 Experiment Structure

The experiment began with instructions describing the trial loop. The instruction frames are shown in Appendix C. The researcher also was available at this point to answer any questions the participant may have. Next the participant completed a practice block of 10 trials. Once the instructions and procedure were clarified with the participant, he/she began the six experimental blocks.

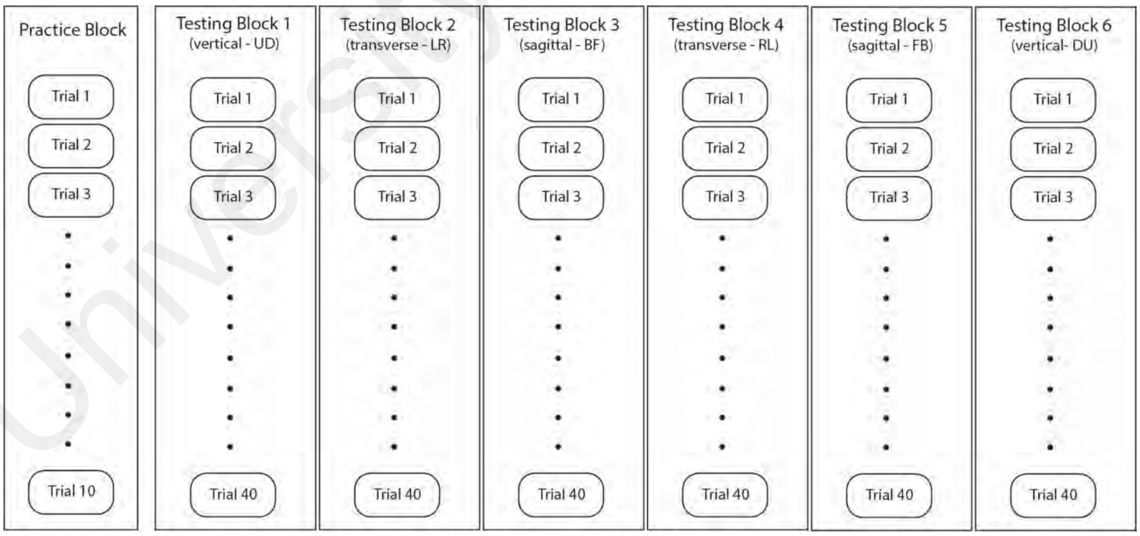

Figure 3.1: Experiment structure

Each trial began as a blank screen with a black fixation cross in the center to direct attention to where the first picture would appear. The fixation cross remained until the participant pressed the joystick trigger button. Once the trigger was pressed, the first picture was displayed randomly from the pool of temporal sequences. This first picture was always the temporal *mid-point* of an event (e.g. a half-burned candle). The first picture would be displayed for 1500ms (1.5 seconds). Then a second picture from the same temporal sequence replaced the first picture. The second picture depicted a point in time *before* or *after* the temporal mid-point (e.g. an unburned candle). This second picture would remain on screen until the participant responded by leaning the joystick one of two predetermined directions. At the beginning of the experiment, the participant was instructed to respond to the second picture with the correct answer as fast as possible. After the participant leaned the joystick in the appropriate direction, the trial would finish, the RT would be logged, and the next trial would begin. The average trial took less than 5 seconds in total.

It is important to note that nothing in the pictures themselves conceptually has to do with the orientation of time, that is that the pictures were not designed to prime a certain conceptualization of time. For example, a set of pictures about a vase falling *downward* is not intended to correspond to a participant's thinking that time is on a downward trajectory. The pictures (visual stimuli) simply prompted the participant to reason whether the second stimuli portrayed a time *before* or *after* the mid-point. The direction of leaning the joystick is what forced the participants to think along a particular spatial orientation of time.

The orientation of the joystick was determined by the current experimental block. Each participant completed all 6 experimental blocks, each with 40 trials. For each block, the joystick was oriented in line with one of the six possible construals of the conceptual timeline (see figure 2.3). The directions of *before* and *after* were marked by a colored sticker on the joystick. Therefore, within each experimental block there were only two allowed response directions (e.g. in block 2, only *left* and *right* were allowed as answers). And in each experimental block only one of these two directions was correct. After completing all the trials in each block, a frame displaying ‘End of block’ appeared. The next frame contained instructions about the orientation of the subsequent block. The participant was then prompted to press the trigger when they were ready to begin that block.

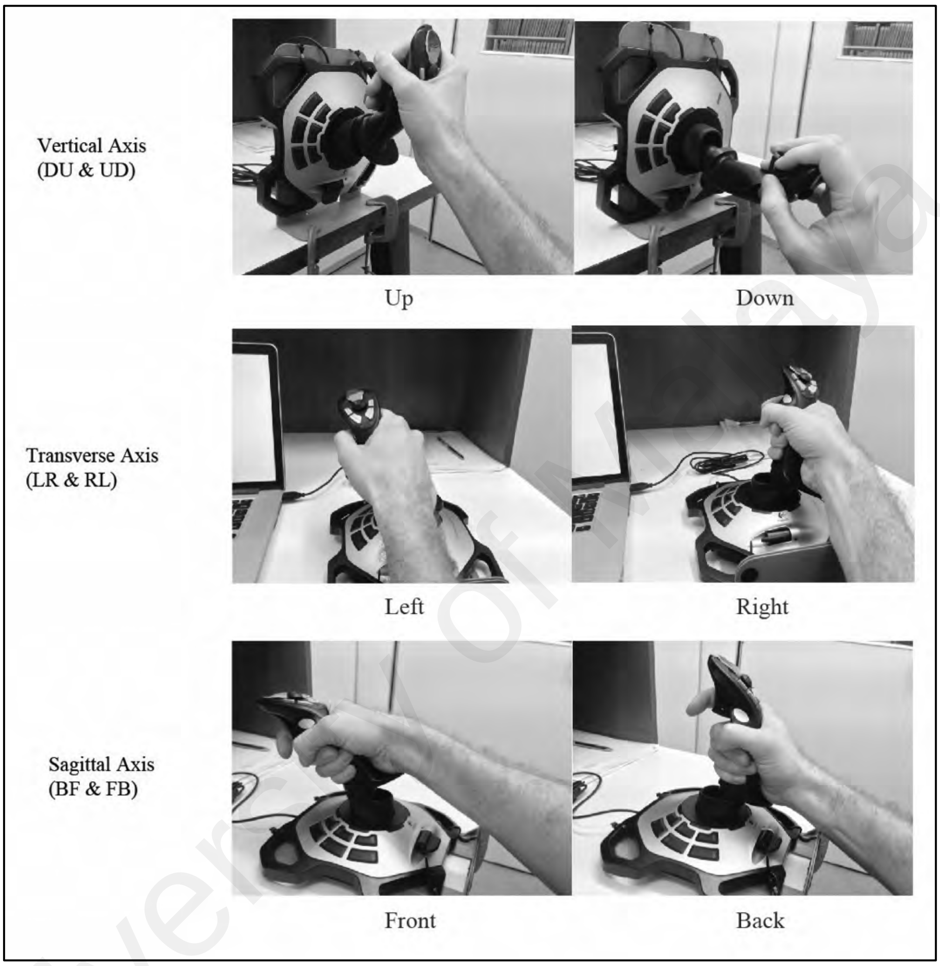

Figure 3.2: The six joystick orientations

The order of the 6 blocks was arranged so that a participant would never experience opposite orientations back-to-back (e.g. if Block 1 the joystick was in the UD orientation, Block 2 would not be DU). This provision was made so that participants would not have extra confusion from experiencing two consecutive blocks with the exact opposite orientation, possibly affecting their response times.

The order of the blocks was counterbalanced across participants in order of participation. More detailed description of the counterbalancing design of this experiment can be found in section 5.3.1.2.

Including the practice block, each participant completed a total of 250 trials over the course of whole experiment, taking roughly 21 minutes. All participants completed the experiment between 6 March and 15 March, 2017. For students, who constituted most of the participants, this is considered quite early in the semester, so assignments and exams were much fewer than later in the semester. The experiment took place any time between 9am and 8pm. All participants were compensated for their participation MYR 15.

3.4 Participants and Questionnaire

3.4.1 Linguistic Background of Participants

Participants for both the English and Mandarin testing groups came from a convenience sample of Chinese Malaysian university students. One was a student at INTI International college, one a recent graduate of HELP University, and the remaining 32 were students at University Malaya. Finally, one participant was a young working professional in the Klang Valley area. All participants were aged 18-25.

In section 2.6 it was claimed that using participants from a single country and culture gives the current study a unique advantage over past studies in the Mandarin-English STM discussion. First, the main reasons for this advantage will be briefly reviewed. Then the potential challenges of using such participants will be addressed.

In past studies, the Mandarin speaking participants came from China, Taiwan, Hong Kong, Singapore, etc. At the same time, the English speaking participants came from the United States. Being from different countries, these testing groups represent two distinct cultures. As mentioned in section 2.1.4, it has been noted that *cultural* factors may influence a person's conceptualization of time (Boroditsky & Ramscar, 2002; Chen & O'Seaghdha, 2013; Fuhrman et. al., 2011; Tse & Altarriba, 2008). As mentioned in section (2.1.4), linguistic relativity's assertions concern the influence of *language* on thought. It is therefore critical to eliminate confounding variables on thought. For example, time is often experienced in physically spatialized ways, such as the direction of the layout of calendars or the alignment of a lunch queue (Boroditsky & Ramscar, 2002; Tse & Altarriba, 2008). Therefore, participants coming from different cultures could have exposure to varying non-linguistic spatializations of time. Results from previous studies, therefore, have greater potential to be influenced by such cultural factors. However, the participants in the current study share the same Malaysian Chinese ethnic and cultural background. Having common cultural background between language groups, many of these possible confounding variables are inherently accounted for in the present study. This advantage of using Malaysian Chinese participants, however, brings two challenges: they are non-native speakers and they are multilingual.

3.4.2 Potential Challenges of Using Malaysian Chinese Participants

First, Malaysian Chinese are not considered to be native speakers of either English or Mandarin (Yamaguchi & Deterding, 2016). In past studies, the participants have been native English speakers from the U.S. and native Chinese speakers from China, Taiwan, Hong Kong, etc. (Boroditsky, 2001; Chen, 2006; Chen & O'Seaghdha, 2013; Fuhrman et. al., 2011). Malaysian Chinese speak Malaysian Mandarin (MM) and Malaysian English (ME) (Yamaguchi & Deterding, 2016). Therefore, it could be argued that using Malaysian Chinese participants makes the results of the current study incomparable with those of past studies. By extension, it could be argued that the results of the present study can only be generalized to ME and MM, and not to Standard English and Standard Mandarin (Standard Mandarin is also called Putonghua). However, such concerns are only justified in areas where the standard languages differ from the Malaysian versions.

The current study is only concerned with *STMs* in each language, not the languages in general. Therefore, if ME and MM do not differ in their usage of STMs from the standard versions of each language, the current study can use Malaysian Chinese participants and still compare the results with those of past studies.

Studies of English in Malaysia have revealed some striking differences between ME and Standard English. Yamaguchi and Deterding report that differences include simplifying standard English in pronunciation and in grammar (2016). The grammatical differences include dropping articles and tense markers (Yamaguchi & Deterding, 2016). Another difference is mismatching count and non-count terms (e.g. *staffs* and *stationeries*) (Yamaguchi & Deterding, 2016). Besides these differences, most other discrepancies regard the localized phonology of ME (Yamaguchi & Deterding, 2016). Such differences are far from conceptual metaphors such as STMs. There have been no observed differences in the usage of STMs between ME and Standard English. Since the current study is only concerned with the effect of STMs on conceptualization, the proceeding results are plausibly comparable with past studies which used native English speakers.

Next, MM does not differ from Standard Mandarin in STMs. Because of the countries' close history, unique attributes of MM are often shared by Singaporean Mandarin. These two differ in several ways from Standard Mandarin. Again, one distinction is the phonology of the language. Malaysian Mandarin is more tonally flat than Standard Mandarin (Cushman & Wang, 1988). Lexicon is another area of difference. There are even unique words to describe time (Times dictionary of Singapore Chinese, 1999). However, there are no recorded differences between MM and Standard Mandarin in the usage of STMs (Miles et. al., 2011).

ME and MM may be different from Standard English and Mandarin. However, both ME and MM use the same systems of STMs as their Standardized cousins. Therefore, the results of the current study are comparable to those of previous studies.

3.4.3 Questionnaire Design

The second challenge of testing Malaysian Chinese speakers is that they are multilingual-they understand and use several languages (often both Mandarin and English). Therefore, a concern is that their proficiency in their primary language may be less discrete from their proficiency in their secondary language. In past studies, English speakers were monolingual and the primary language of Chinese bilinguals was unquestionably Mandarin. As mentioned in section 3.4.2, for some Malaysian Chinese, their primary language is English, and for others it is Mandarin. However, often, the level of fluency between their primary and secondary language is less distinct. The challenge using Malaysian Chinese participants then is to identify those with either Mandarin or English as their distinct primary language. Such participants exist as it has been observed that for some Malaysian Chinese, English can be their first language (Yamaguchi & Deterding, 2016). It is certainly true that for some Malaysian Chinese, Mandarin is their primary language.

To address the challenge of clearly identifying two distinct language groups, a linguistic background questionnaire was created (See Appendix A). The questionnaire asked participants which language they considered their first (or primary) language. Next, the participants were asked to rate their proficiency for each language they knew in five categories: *reading*, *writing*, *speaking, listening*, and *overall*. This proficiency was rated on a scale of 1 to 5 (1 being not proficient at all and 5 being completely proficient). Self-rated proficiency was also used in past studies (Fuhrman et. al., 2011; Tse & Altarriba, 2008). The participants were also asked the age at which they began to acquire each language. Finally, the questionnaire asked participants' exposure to vertical writing direction. There were many mediums listed in which Mandarin text could be arranged vertically or horizontally (e.g. books, magazines, newspapers, television and movies). For each medium, participants were instructed to mark whether they most often read/write Mandarin text in the vertical or horizontal direction.

3.4.4 Participant Selection Criteria

145 questionnaires were returned and sorted. Of the 145 respondents, only 35 were selected and invited to participate in the experiment. There were 16 English speakers and 19 Mandarin speakers included in the experiment.

Only those who had 5 out of 5 in *overall* proficiency in one language were selected to participate. The participants selected for the English and Mandarin testing groups marked 5 out of 5 proficiency in their respective primary languages (English group mean proficiency in English = 5, SD = 0; Mandarin group mean proficiency in Mandarin = 5, SD = 0). Thus, selected participants were confident of their proficiency in their primary language, whether English or Mandarin.

Because Malaysian Chinese are often multilingual, it was also important to examine their proficiency in their second language. For the English group 25% of participants recorded no proficiency in Mandarin (4 out of 16). The other participants selected for the English group had significantly less proficiency in their second language of Mandarin than in English (mean Mandarin proficiency = 3.58, SD = 0.79). Similarly, the Mandarin group also had markedly less proficiency in their second language of English than in Mandarin (mean English proficiency = 3.89, SD = 0.57). The participants of both testing groups were selected, because they marked a significant difference between their primary and their secondary language. The amount of difference is comparable to those of prior studies (Fuhrman et. al., 2011, p. 1316).

Participants were also selected based on their exposure to vertical writing direction. Of the selected participants, eighteen out of nineteen Mandarin speakers and twelve out of sixteen English speakers reported having no exposure to writing direction at all in any medium. Only one Mandarin participant reported exposure to vertical writing direction, and this was only in one out of the seven mediums (television and movies). Three English speakers marked exposure to vertical text in books. However, these three participants reported very low proficiency in reading Mandarin text. Because those with some exposure to vertical reading/writing had poor proficiency in reading/writing Mandarin, it is unlikely that they would be significantly affected it. In all, the majority of English speakers and essentially all of the Mandarin speakers had little to no exposure to the vertical writing and reading direction. As should be clear from these explanations, even for the exceptions, the exposure to vertically arranged Mandarin text is negligible and therefore would not systematically influence their performance in the experiment.

Fuhrman et. al. selected participants based on their proficiency and exposure to vertical text in a similar way (2011). Selecting participants through this questionnaire plausibly isolates the influence of STMs alone on the participants' conceptualization of time. After the selection process, the 35 remaining participants were then divided into the English and Mandarin testing groups.

3.5 Prediction

As mentioned in section 2.4.3.2, English has only one BF construal, while Mandarin has two: BF and UD. Therefore, it will be predicted that English speakers will have the shortest RTs when primed for the BF construal. It will also be predicted that the Mandarin group will be fastest when both the BF and the UD construals are primed.

The second assertion of linguistic relativity is that different language systems should cause a difference in thought. Therefore, one more level of prediction must be made concerning the difference in construals of timelines *between* the Mandarin and English. Both languages have STMs for the BF construal. They differ in that Mandarin has an additional, vertical UD construal of the conceptual timeline. Therefore, both groups should have similar RTs for the BF construal, but the Mandarin group should have faster average RTs than the English group when primed UD.

This study seeks to measure the influence of *linguistic* STMs on construals of the conceptual timeline. As mentioned in section 2.6, the current study has a different prediction from Fuhrman et. al. (2011). In that study it was predicted that English and Mandarin speakers would show bias for a LR construal of the conceptual timeline (Fuhrman et. al., 2011). They based this prediction on the LR writing direction used in both languages. Further, no prediction was made regarding the sagittal axis (BF and FB). It was argued that Mandarin and English had conflicting arrangements of time along the sagittal axis (Fuhrman et. al., 2011). Though both languages use BF STMs, it was observed that written text is arranged FB. Text one *has* read (past) is farther from a person on the page (more *front*), while text one *will* read (*future*) is closer to him or her (Fuhrman et. al., 2011). Thus, they argued there was no clear prediction for the sagittal axis (Fuhrman et. al., 2011). However, text written on a page is not considered to be FB, but UD (Bender & Beller, 2014; Bergen & Chan Lau, 2012; Chen & O'Seaghdha, 2013; Chen, Friederich, & Shu, 2013; Fuhrman et. al., 2011). Fuhrman et. al. themselves consider written text on a page to run UD, not FB (2011). In fact, the vertical writing direction is why Fuhrman et. al. (2011) only selected participants with no exposure to vertical writing direction. Therefore, written text does not conceivably conflict with the influence of BF STMs on one's conceptualization of time. Therefore, this study finds BF STMs a firm basis on which to base its predictions.

Since no prediction is being made for the LR or RL construals, it may seem unnecessary to measure responses for them. The motivation for measuring these construals is due to a concern of Bender and Beller (2014). One shortcoming of implicit tasks, they report, is they do not allow participants to freely express all possible construals of time (Bender & Beller, 2014). Fuhrman et. al. (2011) primed and measured all six possible orientations of time, even though they made no prediction for the BF or FB construals. Their motivation for doing so was it "allow[ed] [them] to capture how time is spatialized in three-dimensional space" (Fuhrman et. al., 2011, p. 1309). Put simply, measuring all six construals allows for all responses. The current study will seek to overcome the shortcoming reported by Bender and Beller (2014), so it will also measure the transverse axis. This will allow participants to demonstrate how they construe the conceptual timeline in any of the possible orientations.

CHAPTER 4: RESULTS

The experiment generated quantitative data in the form of response times. To understand the results, the experimental design needs to be translated into statistically meaningful terms. Analyzing the two language groups separately, there was one independent variable and one dependent variable. The independent variable was the orientation of the joystick. Thus, this was manipulated by the researcher to measure difference in the dependent variable. The dependent variable was the RTs of the participants. Each participant generated 240 response times (40 trials per experimental block and 6 experimental blocks). The RTs were averaged by block, by language group.

4.1 Data Preparation for Analysis

Before analysis, incorrect answers and extreme outliers were removed from the data set. This study is interested only in the times of the correct responses, because incorrect responses cast doubt on whether the participant understood the prompt. Therefore, the incorrect responses were removed. These constituted only 8% of the total responses. In addition, extreme outliers in the data (those RTs over 10 seconds) were removed from analysis. These constituted only 7 responses total (out of the 8400 recorded). These outliers skewed the distribution starkly and it was deemed that any response over 10 seconds incorporated more complex mental processes than the simple STMs conceptualizations which the experiment was designed to activate and measure.

With the cleaned data, ANOVAs were run to compare the means (average RTs) of the experimental blocks within each language group. Tukey's HSD was used as a post hoc test to separate the results into distinct comparisons between certain blocks. There are two output values for "Difference" in each ANOVA table. One value summarizes the raw data, which is scaled in milliseconds. The other value summarizes the data after it is log-transformed.

Log transformation is necessary because response time data is not normally distributed but is almost always positively skewed. In temporal reasoning tasks like the experiment in this study, most responses to visual stimuli take less than one second. But some responses take up to five or more seconds. Therefore, most of the response times cluster around one second, with infrequent responses scattered among much longer RTs, skewing the distribution. Comparing means from such a distribution often generates misleading conclusions. To make the data normally distributed, one common method is to log transform it. The "Difference (Log)" columns in tables 4.1-4.4 list the value of the difference after it has been log transformed. Because these values summarize normally distributed data, the experimental analysis draws its data from these values.

The "Difference (Raw Data)" columns in tables 4.1-4.4 list the raw data in the originally recorded millisecond scale. Figures 4.1-4.4 also display block means in milliseconds. It is easier to understand the proportional difference between the testing block means in milliseconds than in log-milliseconds. The figures also are visually intuitive when set to the scale of milliseconds. However, one must keep in mind that because these raw data are not normally distributed, the results shown in these graphical plots and tables are not quite accurate. One must test the hypothesis using the log-transformed data, because they are normally distributed.

The pertinent values to test the hypothesis are the values of "Difference (Log)" and "p-adjusted" in tables 4.1-4.4. "Difference (Log)" describes the gap between the means of two testing blocks (joystick orientations). The bigger the value of "Difference", the bigger the disparity between the average RTs of two orientations. Examining the ANOVA output tables, one finds a value in the "Difference (Log)" column for every comparison. However, whether each difference is a real (statistically significant) difference depends on the value in the "p-adjusted" column.

4.2 Reported Results

To test the two essential assertions of linguistic relativity, two sets of statistical comparison must be conducted. First, the different testing blocks will be compared within each language group. The results of these comparisons will determine whether STMs in each language shape participants' conceptualizations of time. Second, the overall response times will be compared between language groups, both with pooled blocks and block-by-block.

4.2.1 Results Comparing Blocks within each Language Group

4.2.1.1 English group results

On the vertical axis, the English speaking group showed a large bias for the DU construal (-554ms, -0.40log), and this effect was significant ($p < .00$). A similar, but smaller bias was observed for the transverse RL construal (-185ms, -0.13log), and was also significant ($p < .00$). Finally, a bias was also detected for the sagittal FB construal (-122ms, -0.11log); this bias was also significant ($p = .00$).

Table 4.1: ANOVA English group mean RTs

Compared construals	Difference (Raw Data)	Difference (Log)	P-adjusted
UD-DU	-554ms	-0.40	.00
LR-RL	-185ms	-0.13	.00
BF-FB	-122ms	-0.11	.00

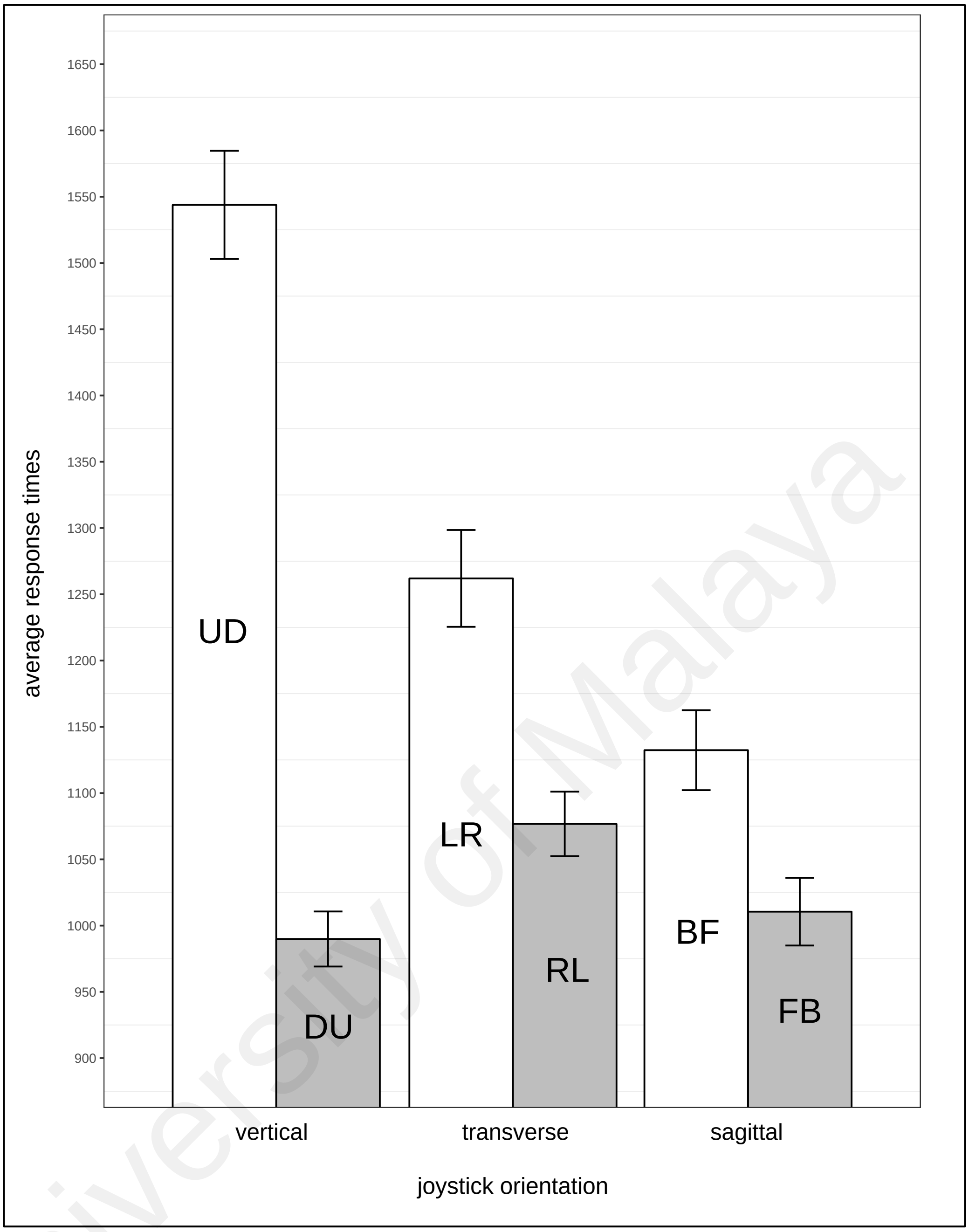

Figure 4.1: English group results

4.2.1.2 Mandarin group results

The Mandarin speaking group also showed a large bias on the vertical DU construal (-461ms, -0.34log), and was significant (p < .00). However, no bias was detected for either of the transverse LR or RL construals (-83ms, -0.06log, p > .05). Finally, the sagittal axis also revealed no bias for either BF or FB construal (-86ms, -0.07log, p > .05).

Table 4.2: ANOVA Mandarin group mean RTs

Compared construals	Difference (Raw Data)	Difference (Log)	P-adjusted
DU-UD	-461ms	-0.34	.00
LR-RL	-83ms	-0.06	.16
BF-FB	-86ms	-0.07	.07

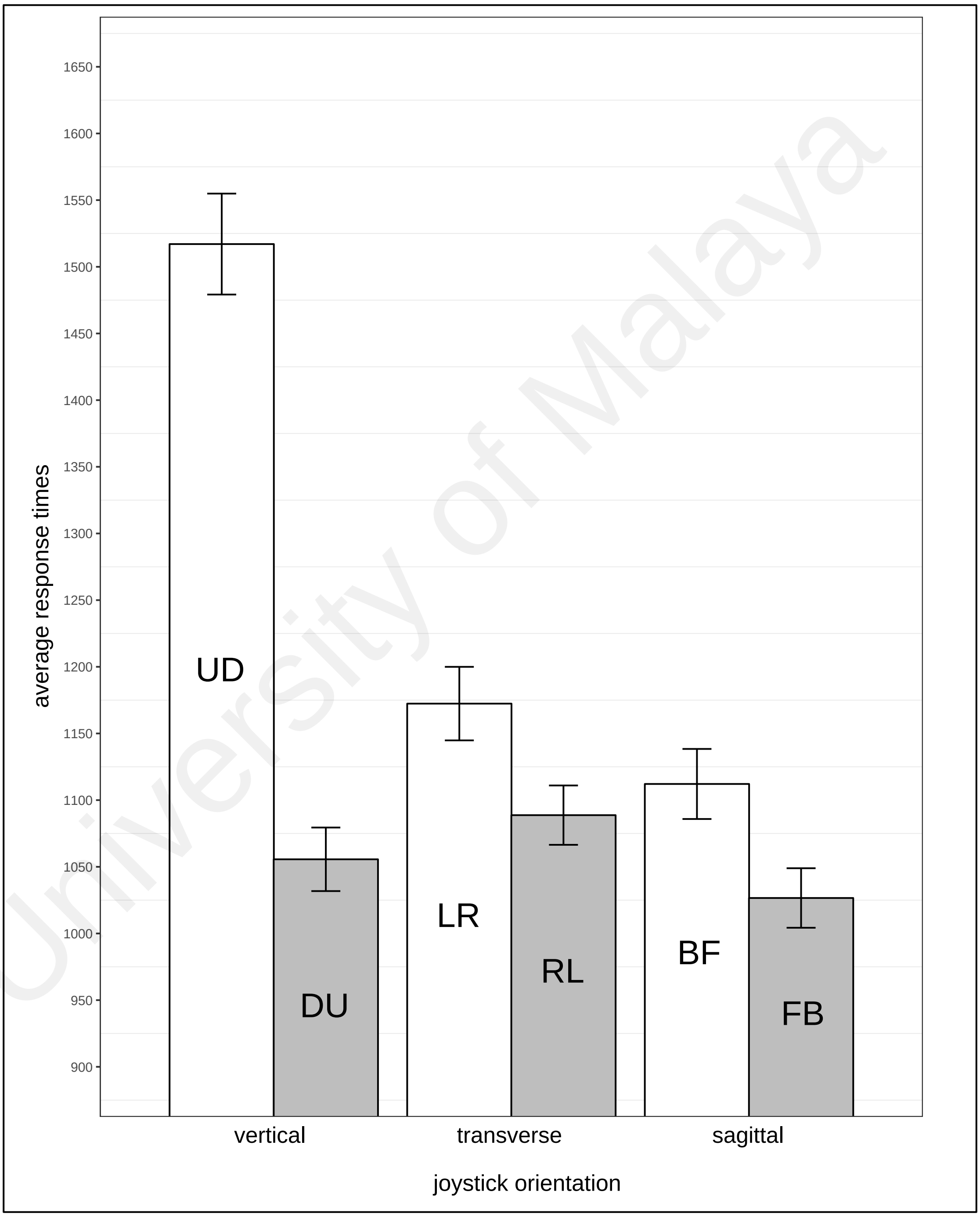

Figure 4.2: Mandarin group results

4.2.2 Results Compared between Language Groups

The Mandarin and English speaking groups did not differ significantly in the mean RTs of pooled experimental blocks (-7ms, -0.00log, $p > .05$) (table 4.3 and figure 4.3). This means the overall performance of the two language groups was statistically equal. When comparing mean RTs block-by-block, the two groups again did not differ significantly in any testing block (all $p > .05$) (table 4.4 and figure 4.4).

Table 4.3: ANOVA comparing language groups with pooled blocks

	English Mean RT	**Mandarin Mean RT**	**Difference (Raw Data)**	**Difference (Log)**	**p-adjusted**
Mandarin-English	1167ms	1160ms	-7ms	-0.00	.86

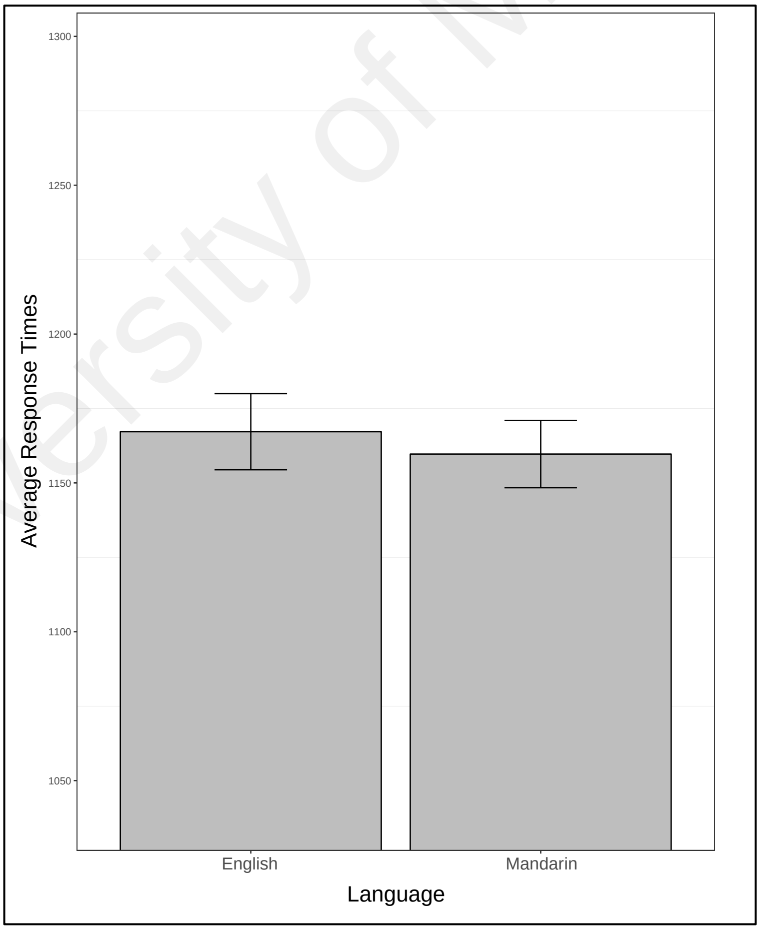

Figure 4.3: Language group means with pooled blocks

Table 4.4: ANOVA comparing language groups block-by-block

Primed construal	English Mean RTs	Mandarin Mean RTs	Difference (Raw Data)	Difference (Log)	P-adjusted
UD	1544ms	1517ms	-26ms	-0.01	1.00
DU	990ms	1056ms	65ms	0.05	0.81
LR	1262ms	1172ms	-89ms	-0.06	0.62
RL	1077ms	1089ms	12ms	0.02	1.00
BF	1132ms	1112ms	-20ms	-0.01	1.00
FB	1011ms	1027ms	16ms	0.03	0.99

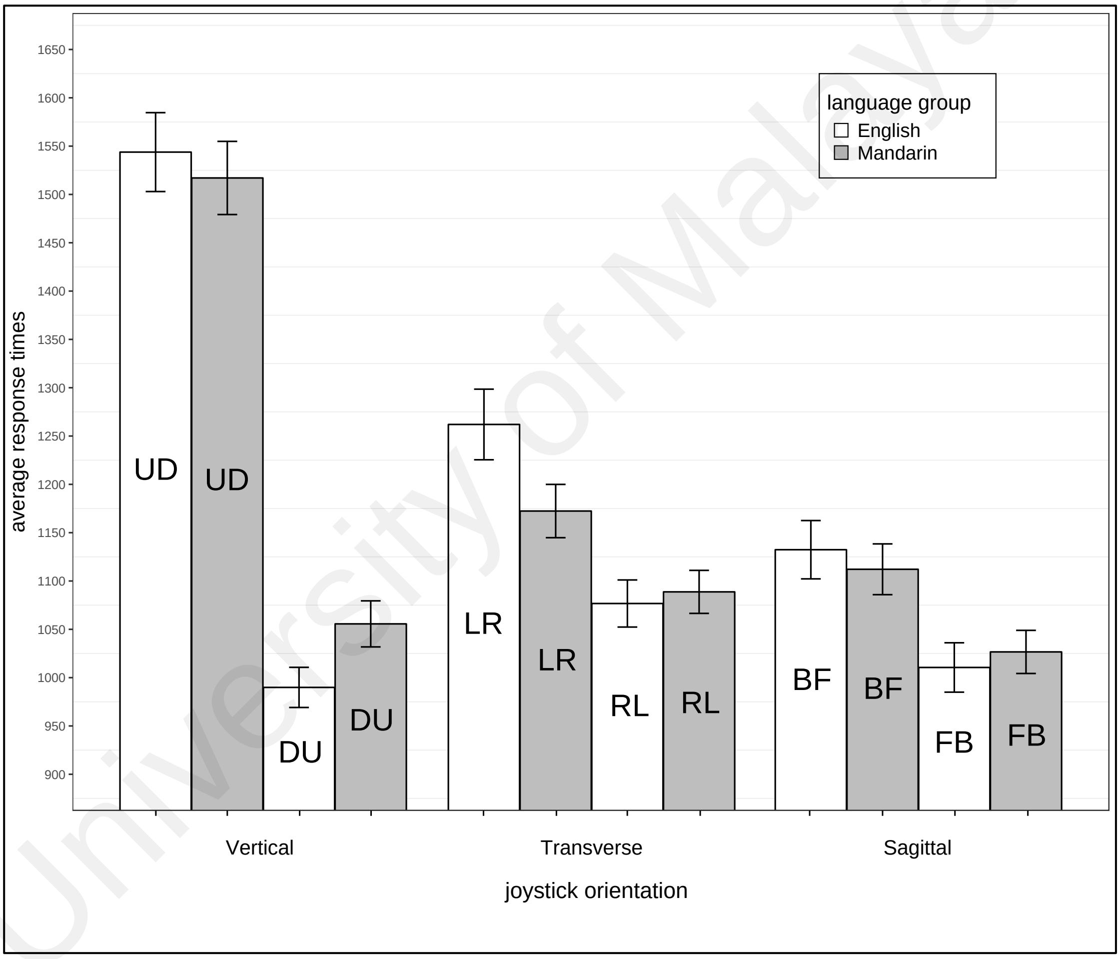

Figure 4.4: Comparing language groups by block RTs

4.3 Results Summary

Table 4.5 shows the biases predicted for each language along each of the three axes. The results and their implication will be explained in the discussion chapter.

Table 4.5: Summarized results ("-" indicates "no difference")

Language and axis	Predicted bias	Observed bias
English Vertical	-	UD
English Transverse	-	RL
English Sagittal	BF	FB
Mandarin Vertical	UD	DU
Mandarin Transverse	-	-
Mandarin Sagittal	BF	-
English-Mandarin Vertical	English - & Mandarin UD	English ≈ Mandarin

CHAPTER 5: DISCUSSION

In the last chapter, the results were simply reported in terms of statistical significance. Here they will be interpreted in terms of their theoretical ramifications. To what extent do these data confirm the two assertions of linguistic relativity? The results will be interpreted through the lens of each assertion in turn. First, the results will be analyzed within each language to see if STMs shape construals of the conceptual timeline.

5.1 Mandarin Results

As mentioned in the section 3.5 of the methodology chapter, the sagittal STMs (*qián* and *hòu*) in Mandarin predict that Mandarin speakers would conceptualize time BF. However, the average RTs of BF and FB did not show a statistical difference (see section 4.2.1.2, table 4.2, and figure 4.2). This lack of observable effect indicates that BF STMs in Mandarin seem not to shape a BF construal.

Along the transverse axis, there was no prediction from STMs, but writing could plausibly predict a LR construal. Although the current study is concerned exclusively with the influence of STMs on conceptualization of time, some previous studies have indeed found a measure of influence from writing direction (Chen et. al., 2013; Chen & O'Seaghdha, 2013; Fuhrman et. al., 2011). Since the Mandarin speaking participants of the current study reported exclusive exposure to LR writing direction, it is possible that a bias would appear for this construal. However, again average RTs for the LR and RL showed no statistically significant difference (see table 4.2, figure 4.2, and section 4.2.1.2). Thus, it seems likely that writing direction had no significant effect on the Mandarin participants' conceptual timeline.

In contrast to the sagittal and transverse axes a drastic effect appeared along the vertical axis. As explained in section 2.4.3.2, Mandarin vertical STMs (*shàng* and *xìa*) suggest an UD construal. Thus, it was predicted that the Mandarin group would show a bias for UD. However, the RTs revealed a large bias for the DU (461ms difference). This result on the vertical axis is the most difficult result to explain and will be further discussed in conjunction with the results from the English speaking group.

5.2 English Results

The only clear prediction for the English speaking participants was for the sagittal BF construal. English STMs like example 23 lead to this prediction "We have all summer break *ahead* of us!" However, instead there was a significant bias for FB construal (see section 4.2.1.1, table 4.1, and figure 4.1). This effect is unexpected and will be discussed below.

As with the Mandarin speakers, there was no *linguistic* prediction for the transverse axis. However, writing direction could predict the LR construal. Some previous studies found English writing direction also exerts some influence on thought (Chen et. al., 2013; Chen & O'Seaghdha, 2013; Fuhrman et. al., 2011). The current study, however, detected a significant bias for the RL construal. This effect will also be discussed with the other unexpected effects below.

Finally, while there was no prediction for it, the largest effect for the English speaking group was found on the vertical axis. This group, like the Mandarin group, showed a large definite bias for the DU construal. Surprisingly, the bias for the English group was even *larger* than that of the Mandarin group (554ms difference for the English speaking group).

5.3 Evaluation of Assertion #1

The results of the current experiment conflict with the first assertion of linguistic relativity. The participants' conceptual timelines do not seem to conform to the STMs used in Mandarin or English. Mandarin predicted a bias for both the BF and UD construals. However, there was no significant bias for BF, and instead of an UD bias, there was a DU bias. From English STMs, the only prediction was for BF. However, instead of BF, English speakers showed bias for the FB construal. In addition, two significant, but unpredicted biases were detected in the English group results for the RL and DU construals. All these data taken together reveal that the participants did not think in conformity with the STMs in their first language. By extension, it seems that STMs did not influence the participants' conceptualization of time.

As the results stand, they are difficult to explain by theory. When faced with similar reversed effects, other English-Mandarin STM studies have concluded they stood contrary to the first assertion of linguistic relativity (January & Kako, 2007; Tse & Altarriba, 2008). However, this conclusion does not explain the significant and even strong biases found in the current results. Therefore, before defaulting on a null-hypothesis conclusion, it is important to consider other possible factors for these unexpected results.

5.3.1 Accounting for the Observed Significant Effects

When the results of an experiment do not follow any expected pattern, inspecting plausible confounding factors may give insight into the cause for the unexpected patterns. This study will now consider aspects of the experiment and the participants which could have conceivably interfered with these results. There are three distinct variables which could plausibly have affected the results: writing direction, experimental factors, and linguistic factors.

5.3.1.1 Writing direction

The potential influence of writing direction deserves special attention. It has been repeatedly mentioned that past studies have attributed difference in timeline construals to one's familiarity with writing direction (Section 2.5.1.1). Indeed, several studies have reported results which seem to confirm its influence (Fuhrman et. al., 2011; Chen, 2006). In English and Mandarin, a LR writing direction is quite common. Traditional Mandarin, text was written UD. If familiarity with these writing directions would precondition a certain construal of the conceptual timeline, one would predict that both the English and Mandarin groups would show a bias for the LR construal and, for Mandarin, an additional bias for UD. A glance at table 4.5 reminds that the biases ran directly contrary to these predictions. The English group showed a RL bias; the Mandarin group had no bias for either LR or RL, but did have a bias for DU instead of UD. In short, these results indicate no influence from writing direction.

5.3.1.2 Experimental factors

In any repeated-measures experiment, researchers say there are at least two factors that may interfere with the participants' performance, thereby generating misleading results: boredom effects and practice effects (Field, 2009). Boredom effects can muddy an experiment's results by a trend of slower RTs as the experiment continues. In the current experiment, participants encountered a total of 250 trial sequences. Though each trial only took 2-6 seconds, the total time the participants concentrated on the experiment was roughly 21 minutes. It should be noted that this experiment was actually shorter than that of Fuhrman et. al. (2011) (37% shorter). Boredom effects predict that participants would experience growing latency in RTs due either to boredom or to fatigue during the 21 minutes of the experiment (Field, 2009). Thus, the first few blocks would have been faster, with the later blocks becoming slower and slower. Since this study's analysis involves comparing block RTs, boredom effects could present a serious problem if they are present in the current data.

On the other hand, practice effects are a contrasting danger in repeated-measures experiments. The first time a participant encounters an experimental trial sequence, she or he is learning what to expect. But as they repeat the same trial sequence structure, they become increasingly familiar with the exercise, consequently responding faster and faster (Field, 2009). Practice effects are manifested in increasingly faster RTs as the experiment goes on. Practice effects run directly counter to boredom effects. Again, these effects can have significant influence on the results of an experiment. Fortunately, counterbalancing is a simple way to minimize the influence of both practice and boredom effects.

The current experiment was counterbalanced by reversing the order of the experimental blocks for half of the participants (see table 5.1). All odd-numbered participants encountered experimental block 1, then 2, then 3 etc., while all even-numbered participants first encountered block 6, then 5, then 4, etc. By counterbalancing, the influence of both practice and boredom effects were effectively minimized.

Table 5.1: Counterbalanced block orders

Order	Odd-numbered participants	Even-numbered participants
First	Block 1 – UD	Block 6 - DU
Second	Block 2 - LR	Block 5 - FB
Third	Block 3 - BF	Block 4 - RL
Fourth	Block 4 - RL	Block 3 - BF
Fifth	Block 5 - FB	Block 2 - LR
Sixth	Block 6 - DU	Block 1 - UD

5.3.1.3 Linguistic factors

Another possible interfering factor in the results of this experiment is the participants' multilingual nature. Section 3.4.1 provided the linguistic background for the participants in this experiment. Though the questionnaire and selection process sought to form testing groups with distinct primary and secondary languages, could it be that participants' secondary languages influenced their conceptualization of time?

Most participants in the English group had some proficiency in Mandarin as their secondary language. Using Mandarin vertical STMs could possibly have given these English speakers the additional Mandarin UD construal. However, their proficiency in Mandarin clearly did not shape their conceptualization since a strong bias was found for the opposite DU construal (see table 4.2). Likewise, those in Mandarin group were mostly somewhat proficient in English as their secondary language. As discussed earlier, English STMs only construe the BF conceptual timeline, matching that already construed by Mandarin STMs. Therefore, the only conceivable interference English proficiency could have on the Mandarin group would be to reinforce the BF construal. As discussed in section 5.1, however, there was no bias for the BF construal found for the Mandarin group. In short, the participants' partial proficiency in their secondary language did not predict the results observed.

In review, the analysis thus far has concluded that the results demonstrate no influence of language on conceptualization. First, in each language group, several significant biases were found, but none of the predicted biases were found. The significant biases followed no prediction based on STMs. These results lead to the conclusion that the STMs in English and Mandarin did not shape the participants' construals. This by extension answers a definite "no" to whether linguistic relativity could be observed among Malaysian Chinese speakers of English and Mandarin.

However, this explanation still leaves unaccounted for the unexpected biases observed. To attempt to explain them, the above sections sought if either writing direction, experimental factors, or proficiency with a secondary language influenced the results.

However, all these extraneous factors were shown to have no significant effect on construals of the conceptual timeline.

5.4 Evaluating Assertion #2

Up to this point, the discussion has concerned the results ramifications for the first assertion of linguistic relativity. RTs for construals were compared within each language group. As explained, the results show no influence of STMs on conceptualizations on time. In the more general terms of linguistic relativity, it was shown that language does not shape thought. However, before leaving the discussion of these results, one must consider their ramifications of the second assertion of linguistic relativity. Do the two groups show a difference in bias for certain construals? Figure 4.3 illustrates a comparison of English and Mandarin RTs with pooled blocks and figure 4.4 compares them block by block.

Table 4.3 and figure 4.3 reveal no difference between Mandarin and English when pooling RTs from all blocks. This indicates that one group was not overall faster in the experimental trials than the other. However, the by block results in table 4.4 are more insightful. In section 3.5 it was predicted that the Mandarin group would have a bias for the UD construal which would not be found among the English group. Looking at the *p-adjusted* values for UD on table 4.4 reveals no difference in RTs between English and Mandarin. Stepping back to look at general pattern in figure 4.4, the language groups showed no difference in any of the six possible construals for time. This is actually quite shocking. The biases found in each language group were unexpected and unexplained by any of the factors discussed above. Yet somehow the language groups showed parallel RTs in each block. In short, both languages showed unpredictable biases, but in exactly the same ways.

5.4.1 Possible Explanation for Similarity in Group Results

Such a similarity between the groups' results implies that something outside of Mandarin and English STMs has significant influence on Malaysian Chinese conceptualizations of time. Whatever that interfering factor may be, the current results suggest it is common to Malaysian Chinese regardless of their primary language. It must also run counter to any patterns predicted by STMs in Mandarin or English.

One possibility is that the Malaysian Chinese mind does not have wholly discrete categories for each language they use. Many of the participants also could speak the Malay language as well as several dialects of Chinese. It is possible that their conceptualization of time, as well as other categories, is influenced by all these languages. However, it seems unlikely that these tertiary languages could account for the biases observed. Dialects in Chinese often are differentiated from Mandarin only by pronunciation, a few set phrases, and a few extra words. Often, they do not diverge from Standard Mandarin on such a fundamental level that would affect STMs. Malay STMs have not been studied or catalogued, so it is impossible to say whether they run counter to those in Mandarin or English. However, most of the current participants marked being significantly less proficient in Malay and in the Chinese dialects. This lack of proficiency reduces the chances of the plausible influence of these languages on the speaker's conceptualization of time. Since Chinese dialects do not differ with regard to STMs, and since the participants' proficiency in the tertiary languages was significantly poorer than their Mandarin or English, it is reasonable to conclude that these other languages did not significantly or systematically alter the results.

5.5 General Discussion

In summary, when the biases for construals were compared within each language group, they defied the pattern predicted by STMs in English or Mandarin. Thus, they contradicted the first assertion of linguistic relativity. When results were compared between the language groups, no difference emerged. Though Mandarin and English speakers talk about time differently, they seem to think of it in the same ways. This lack of difference runs contrary to the second assertion of linguistic relativity. Taken together, the results here indicate that language does not shape thought and that different language systems do not cause differences in conceptualization. The *within* and *between* language comparisons, therefore, deny the two core assertions of linguistic relativity.

Chapter 2 discussed how the theoretical framework, as well as the experimental design for the current study were adapted from a string of other studies testing the assertions of linguistic relativity through STMs. As such, that larger council of Mandarin-English STM studies may give insight into the results encountered here. In return, the results of the current study add information to that larger discussion.

One question raised by Tse and Altarriba (2008) was regarding the difference in use between the Mandarin qián/hoù and shàng/xìa metaphors. As mentioned in section 2.4.3.2, shàng and xìa regularly describe deictic sequences anchored in the speaker's present. Qiàn/hoù most often describe a temporal order not relative to the present (Scott, 1989; Tse & Altarriba, 2008). In other words, Qiàn/hoù are mostly used to describe non-deictic time. The task in Boroditsky's 2001 and 2011 experiments, as well as the current experiment causes participants to reason about the order of non-deictic temporal sequences (Tse & Altarriba, 2008). The shàng/xìa metaphor, however, demarks times relative to the speaker (such as '*last* week' in example 43) (Scott, 1989; Tse & Altarriba, 2008). Because in the current experimental procedure participants were prompted to respond to the temporal order of events not relative to oneself, the shàng/xìa UD construal may not have been activated. Considering this, the current study may have dropped the predicted bias for the Mandarin UD construal. However, none of the studies after Tse and Altarriba (2008) addressed this issue. Perhaps the deictic nature of shàng and xìa was considered unproblematic to the experimental design. However, it seems that Mandarin STMs may be more complex than the simple examples considered thus far. Therefore, to accurately test STMs influence on thought, future studies should strive for a deeper understanding of the normal usage of shàng/xìa in Mandarin. Using the knowledge of the meaning of shàng/xìa, future research should then evaluate if changes to the experimental design are necessary.

5.5.1 Scope and Limitations of the Current Study

One must keep the results of the current study in perspective of its limitations. First, The sample size for the experiment was a total of 35 participants, and was split into two language groups of 16 and 19 participants. This sample size is enough to conduct inferential statistics; however, the larger sample sizes of previous studies gives them increased statistical *power*. In other words, larger studies have more confidence that their results reliably reflect the general population their sample was taken from.

Secondly, although many cares were taken to make the language groups as distinct in proficiency as possible, it is still possible that the multilingual nature of Chinese Malaysians affected the results in unpredictable ways. As discussed before, the similarity of the results between the two language testing groups may indicate a multilingual psyche common to Malaysian Chinese students that influences thought more deeply than one's first language.

Finally, the current sample was taken from a single age group of 18-25 year-olds. To generalize results to all Malaysian Chinese people, it would be imperative to take sample from other age groups as well, especially older age groups, who have often settled more into their first language.

5.5.2 Suggestions for Future Research

Clearly the Mandarin-English STM discussion is not finished. More empirical data must be collected before linguistic relativity can be reliably demonstrated through STMs. The current study joins those which have found no effect in their replications of Boroditsky's experimental paradigm (Chen, 2006; January & Kako, 2007; Tse & Altarriba, 2008; etc.). In order to confirm the assertions of linguistic relativity, fulfilled predictions must become the majority of the data. However, further experimentation must also be improved by adapting experimental design to account for enlightening linguistic insights like that described in section 5.5.

Future research must gain a deeper and more realistic grasp of both the nature, the usage patterns, and the frequency of STMs in English and Mandarin. Previous studies spawning from Boroditsky's (2001) seminal inquiry have subsumed the same understanding of the usage of STMs in English and Mandarin as that original paper. However, as was discussed in section 5.5, there were potential flaws in the original understanding of Mandarin vertical STMs. Therefore, her experiment, designed around such a misunderstanding, would not have accurately measured the effect of Mandarin vertical STMs on her participants' conceptualizations of time. In addition, according to a corpus study reported in Chen (2006), Mandarin vertical STMs are used about two-thirds less frequently than Mandarin sagittal STMs. Therefore, it could be argued that even if the experiment design activated a vertical mental timeline, the bias observed should be proportionately smaller. The true nature and usage of space-to-time metaphors in each language must be understood clearly before an amended hypothesis can be tested.

To understand the nature of STMs in Mandarin, future research must investigate in depth the cognitive models for Mandarin STMs by interviewing native speakers, particularly native speaking linguists. Native speakers, due to their intuitive understanding of the meaning of STMs in Mandarin, could help enlighten the research of non-native speakers. In combination with a clearer understanding of the nature of Mandarin STMs, a corpus analysis of discourse and writing is recommended to capture the actual usage of Mandarin STMs.

The current understanding of the usage of English STMs must also be bolstered before gaining confidence that methodologies are accurately activating conceptualizations of time shaped by English STMs. First, a comprehensive taxonomy of English temporal phrases and STMs is recommended. Then, using this taxonomy, future research should conduct a corpus analysis of English discourse and writing, to find the actual usage frequency of English STMs. Using the percentage of frequency of STMs, the experimental paradigm and predictions should be adjusted.

CHAPTER 6: CONCLUSION

This study began by introducing the two assertions of linguistic relativity: language shapes thought, and cross-linguistic variation causes difference in thought. Then it was shown that linguistic relativity is a question that naturally arises from conceptual metaphor theory. This study chose to focus on space-to-time metaphors both because SPACE and TIME are fundamental to human experience, and because it could adopt conceptual frameworks from previous studies, namely Fuhrman et. al. (2011). It was demonstrated that English and Mandarin STMs describe time in differing construals.

6.1 Language Did Not Shape Conceptualization

The underpinning goals of this study were to evaluate the two assertions of linguistic relativity by measuring the influence STMs have on timeline construals. An experiment was adapted from Fuhrman et. al. (2011) in order to measure response times to an implicit temporal-reasoning task. However, the results were surprising, neither rejecting the null hypothesis, nor confirming the null hypothesis straightforwardly. One prediction from STMs was unfulfilled, because no bias was found (Mandarin BF). Two biases were revealed which were not predicted by STMs (English RL and DU). There were even two biases construed directly opposite to what was predicted (Mandarin DU and English FB). In order to explain these unexpected effects, several extraneous variables were considered: writing direction, experimental factors, and linguistic factors. However, none of these explained the pattern of bias observed. In the end, though the results are still unexplainable, the simplest conclusion is that STMs in English and Mandarin did not shape participants' construals of the conceptual timeline.

6.2 Different Languages Did Not Shape Difference in Conceptualization

Further, when the response times of the two language groups were compared with each other, there was no statistical difference between their results in any respect. Therefore, the findings suggest that differing systems of STMs did not cause different conceptualizations of time. In short, language seemed not to influence thought and different language did not shape a difference in thought. Both core assertions of linguistic relativity are contradicted by these data.

Taken with those studies which also found no influence of language on thought, this study poses a challenge to the reliability of the experimental paradigm of Fuhrman et. al. (2011). January and Kako (2007) also observed an unexpected vertical bias in their English speaking group. They considered the effect evidence that Boroditsky's (2001) experimental paradigm is unreliable and therefore cannot be used as a measure for linguistic relativity. Tse and Altarriba (2008) also questioned that the original experiment could produce reliable and repeatable results. The (2001) experiment was improved upon in Fuhrman et. al. 2011. However, the results of this current study not only conflict with those of Fuhrman et. al. (2011), but even produced a pattern unexplainable either by STMs or writing direction. More experimentation is needed to confirm the reliability of the Fuhrman et. al. (2011) experimental paradigm.

To move the discussion forward regarding the influence of English and Mandarin STMs on the conceptualization of time, a richer and native speaker-like intuition of STMs and the real data of their usage is needed. Few studies have conducted corpus analyses of STMs (Chun, 1997; Chen, 2006). A more realistic understanding of STMs in English and Mandarin could perhaps explain the results observed here.

6.3 A Final Word

It continues to be a challenge to find convincing empirical evidence for the assertions of linguistic relativity. When seemingly conclusive data is presented, it is not long before a second study produces contradictory data from the same experimental paradigm, or before the conceptual paradigm of the original study is challenged. Further, due to the intimate ties between language and culture, it is very difficult to separate the influence of language on thought without intervening cultural factors, such as writing direction. An added difficulty is the great need for native intuition of each language under examination and experimentation. Working with a language foreign to the researcher often results in erroneously designed experimentation. If linguistic relativity is to be demonstrated in a convincing way to the broader linguistic community, all these challenges must be addressed and overcome. More empirical data must be collected by isolating the influence of space-to-time metaphors on one's concept of time. If one can account for all these challenging factors, one can be more certain that any effect measured would be due to genuine linguistic relativity.

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APPENDIX A: QUESTIONNAIRE

QUESTIONNAIRE

<u>Language Background 语言背景</u>

Please list the languages and dialects you can communicate in and details about your proficiency and exposure to each. No need to be humble. Just be realistic.
请列出您会的语言和方言，以及其熟练程度和体验。

If you know less than five languages or dialects, please leave the remaining spaces blank. (For example, if you know 4 languages or dialects, you do not need to fill out Language #5 or #6 or any of the information associated with each)
如果您知道少于五种语言或方言，请将其余的留空。（例如，如果您会四种语言或方言，您无需填写“语言#5”）

Language 语言 #1: ____________________

1. **Level of Proficiency** (1 not fluent at all; 5 completely fluent)
   熟练程度 （1 – 完全不流利；5 – 完全精通）
   - Overall 整体能力: **1 2 3 4 5**
   - Speaking 口语能力: **1 2 3 4 5**
   - Listening 听力能力: **1 2 3 4 5**
   - Writing 写作能力: **1 2 3 4 5**
   - Reading 阅读能力: **1 2 3 4 5**
2. **Age of Acquisition** (How old were you when you first started learning this language?)
   语言习得的年龄 （您在几岁的时候开始学习这门语言？）
   ____
3. **How You Learned this Language** (circle all that apply)
   您如何习得这门语言（请圈选任何适用的）
   - I was taught it through class in school
     我在学校课程中习得此语言
   - I speak it with family at home
     我在家里用此语言和家人沟通
   - I speak it often with friends
     我经常用此语言和朋友沟通
   - I hear/see it in Digital Media (movies, dramas, radio)
     我从数字媒体中看到/听到 （电影、戏剧、广播等）
   - I use it in social media (whatsapp, facebook, etc.)
     我在社会媒体中用此语言（WhatsApp、Facebook 等）

Language 语言 #5: ____________________

1. **Level of Proficiency** (1 not fluent at all; 5 completely fluent)
   熟练程度 （1 – 完全不流利；5 – 完全精通）

   - Overall 整体能力: **1 2 3 4 5**
   - Speaking 口语能力: **1 2 3 4 5**
   - Listening 听力能力: **1 2 3 4 5**
   - Writing 写作能力: **1 2 3 4 5**
   - Reading 阅读能力: **1 2 3 4 5**

2. **Age of Acquisition** (How old were you when you first started learning this language?)
   语言习得的年龄 （您在几岁的时候开始学习这门语言？ ）
   ____

3. **How You Learned this Language** (circle all that apply)
   您如何习得这门语言（请圈选任何适用的）

   - I was taught it through class in school
     我在学校课程中习得此语言
   - I speak it with family at home
     我在家里用此语言和家人沟通
   - I speak it often with friends
     我经常用此语言和朋友沟通
   - I hear/see it in Digital Media (movies, dramas, radio)
     我从数字媒体中看到/听到 （电影、戏剧、广播等）
   - I use it in social media (whatsapp, facebook, etc.)
     我在社会媒体中用此语言（WhatsApp、Facebook 等）

Which of the languages above (if any) would you consider your first/primary language?
您认为上述哪一种语言（如有）是您的第一语言/主要语言？

____

If you know more than five languages, please list the remaining languages here
如果您知道五种以上的语言，请在这里将其余的列出

____

Chinese Writing direction (only applicable for Mandarin and Chinese dialects (Hokkien, Cantonese etc.))
中文书写的方向（仅适用于标准中文和中文方言（福建话，广东话等））

Chinese characters are typically arranged either horizontally or vertically (in columns). For example 汉字书写的排列一般只有横向的或竖直的:

我好大学生 (Horizontal 横向的)	我 好 大 学 生	(Vertical 竖直的)

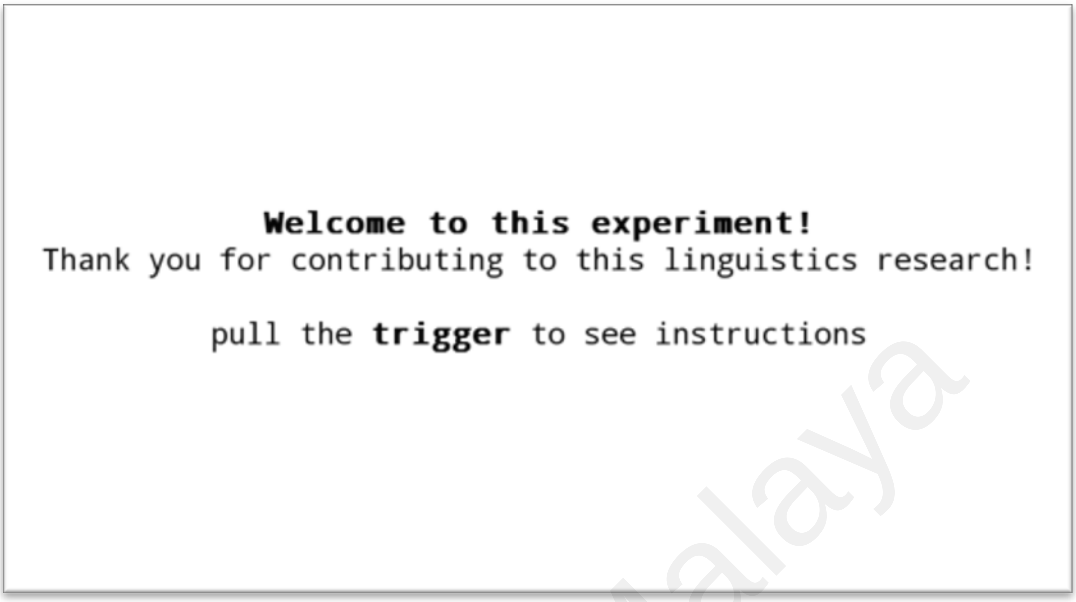
When you read/write Chinese in the following media, is it most often in the vertical or horizontal direction (please circle one)?
在以下所述的媒体中，您所读或写的中文汉字最常见的汉字排列是横向的还是竖直的？（请圈一个）

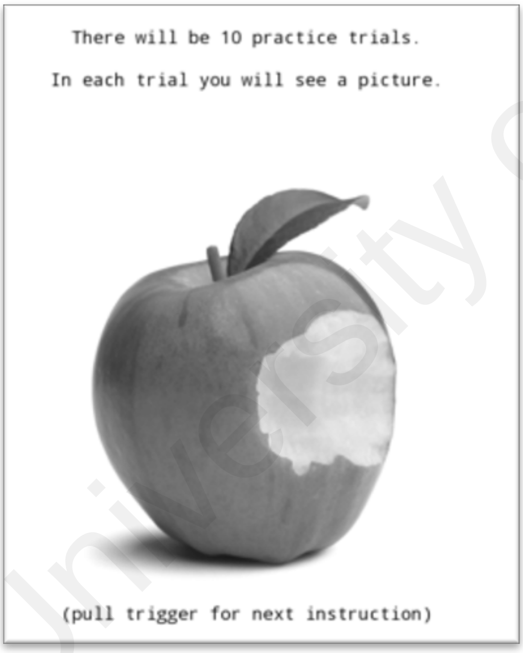
1. Books 书籍	Horizontal 横向的	Vertical 竖直的
2. Magazines 杂志期刊	Horizontal 横向的	Vertical 竖直的
3. Newspapers 报纸	Horizontal 横向的	Vertical 竖直的
4. Internet-based text 互联网上的正文	Horizontal 横向的	Vertical 竖直的
5. Typing 打字	Horizontal 横向的	Vertical 竖直的
6. Writing Chinese by hand 手写汉字	Horizontal 横向的	Vertical 竖直的
7. Television or Movies 电视节目或电影	Horizontal 横向的	Vertical 竖直的

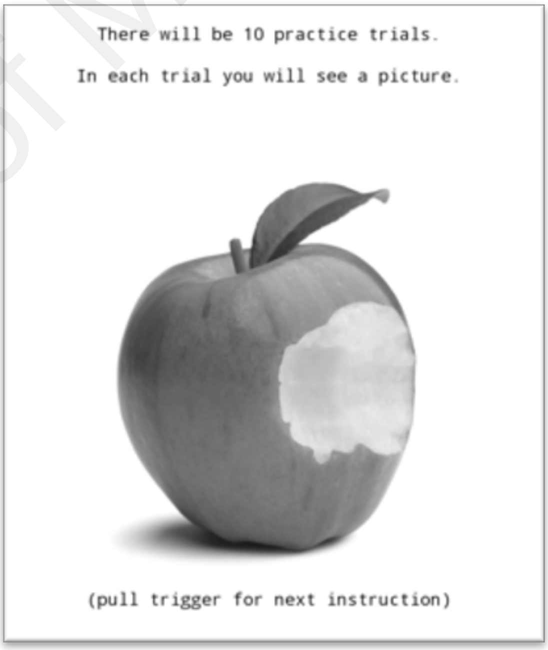
Thank You!
谢谢您

APPENDIX B: EXPERIMENT ROOM AND APPARATUS

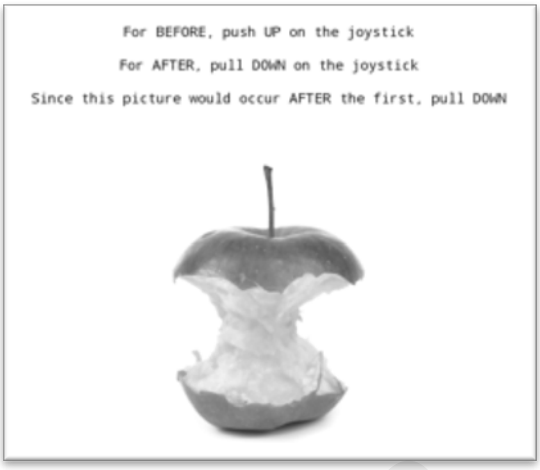
APPENDIX C: EXPERIMENT INSTRUCTIONS



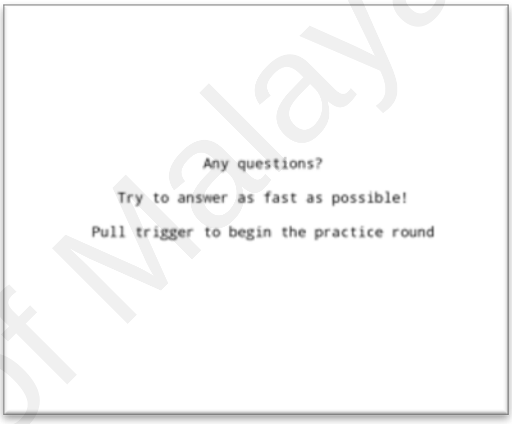


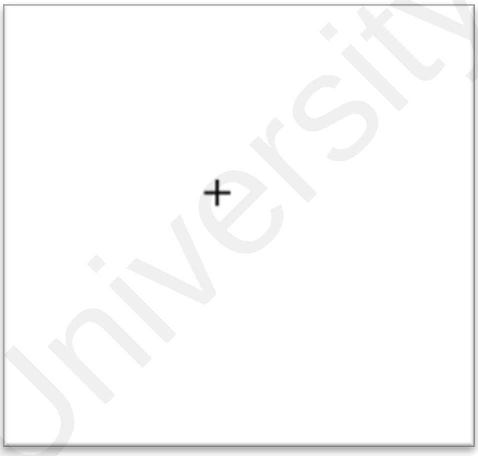



Then you will see a different picture of the same object.
Did this picture happen before or after the firt picture?
(pull trigger for next instruction)


For BEFORE, push UP on the joystick
For AFTER, pull DOWN on the joystick
Since this picture would occur AFTER the first, pull DOWN


You finished the practice run.
Any questions?
Next you will perform the actual experiment.
Pull trigger to continue.


Any questions?
Try to answer as fast as possible!
Pull trigger to begin the practice round


+


Blok 1
vertical axis
UP is BEFORE
DOWN is AFTER
pull trigger to begin

APPENDIX D: EXAMPLE TRIAL PICTURE SETS