

Language, Cognition, and Bilingualism: Attention to Grammatical Number among Thai and English Speakers

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ABSTRACT

This study investigates the relationship between language and cognition by examining attention to grammatical number among Thai and English speakers within the framework of linguistic relativity. Three comparisons were conducted: 60 native Thai and 60 native English speakers; 30 Thai monolingual speakers and 30 Thai-English bilingual speakers; and 30 Thai-English bilingual speakers at different levels of English proficiency, classified as low, medium, and high, with 10 participants at each level. Participants were at least 20 years old and selected through purposive sampling. Attention to grammatical number was elicited through picture-description tasks. Bilingual participants' English proficiency was assessed using researcher-developed listening and speaking tasks based on sentence-complexity criteria. The data were analysed using descriptive statistics, independent-samples t-tests for the two-group comparisons, the Kruskal-Wallis H test for the three proficiency groups, and regression analysis to examine the relationship between English proficiency and attention to grammatical number. The results revealed that (1) native English speakers exhibited significantly greater attention to grammatical number than native Thai speakers; (2) Thai-English bilingual speakers demonstrated greater attention than Thai monolingual speakers, although the difference was not statistically significant; and (3) among bilingual participants, attention to grammatical number differed significantly across proficiency levels, with higher-proficiency participants demonstrating greater attention than lower-proficiency participants. Regression analysis further indicated a strong positive relationship between English proficiency and attention to grammatical number. These findings provide empirical support for the Linguistic Relativity Hypothesis, suggesting that the relationship between language and cognition extends beyond native language structure to subsequent linguistic experience and second-language proficiency.

Keywords: Linguistic Relativity Hypothesis; Grammatical Number; Bilingualism; Attention; Second Language Acquisition

INTRODUCTION

The Linguistic Relativity Hypothesis, also known as the Sapir-Whorf hypothesis, examines the relationship between language and thought. The key concept is that language influences the cognitive system or thought processes of speakers. Speakers whose languages share similar grammatical structures tend to have similar linguistic worldviews, whereas speakers whose languages have different grammatical structures tend to develop different linguistic worldviews. Prasithrathsint (2006) stated that language and cognitive processes are inseparably related. Humboldt (1988) also argued that concepts cannot arise without language and that individual worldviews are closely tied to the semantic significance of expressions within a speaker's language.

Many researchers, including Aemdit (2015), Athanasopoulos (2006, 2007, 2009, 2011), Barner et al. (2009), Chandharath (2013), Charunrochana (2000), Lucy (1992), Saalbach and Imai (2007), and Thongniam (2017), have attempted to test the Linguistic Relativity Hypothesis to determine whether language influences the cognitive or thought processes of language speakers.

A common issue examined in testing the Linguistic Relativity Hypothesis is the relationship between grammatical categories and the cognitive systems of speakers of different languages.

Previous studies have found both supporting and opposing evidence for the Linguistic Relativity Hypothesis. Examples of studies supporting the Linguistic Relativity Hypothesis include Lucy (1992), who examined the relationship between grammatical number, countability, and classifiers and the cognitive processes of memory, attention, and categorisation in English and Yucatec Maya speakers; Charunrochana (2000), who studied the same relationship as Lucy (1992) in Thai and English speakers; Aemdit (2015), who investigated the relationship between grammatical tense and the cognitive system in English, Japanese, Chinese, and Thai speakers; and Chandharath (2013), who explored the relationship between linguistic honorifics and the cognitive system in Japanese, Thai, and English speakers. However, some studies have challenged the Linguistic Relativity Hypothesis, such as Barner et al. (2009), Li et al. (2009), and Saalbach and Imai (2007). These studies found that participants' behaviour did not align with their linguistic patterns. Specifically, Li et al. (2009) and Barner et al. (2009) reported that speakers of English, Japanese, and Chinese did not differ in their object classification based on shape. In addition, their abilities to distinguish between objects and substances were similar. Likewise, Saalbach and Imai (2007) found that German and Japanese speakers exhibited no significant differences in their object classification behaviour.

As mentioned above, research examining the Linguistic Relativity Hypothesis seeks to determine whether and how language influences speakers' cognitive systems or thought processes. Most of these studies have focused on monolingual participants. However, several studies have examined how a learner's first language (L1) influences the acquisition of English as a second language (L2). For example, Alebaid (2021), Atthaphonphiphat (2015), Timyam (2018), Pappol et al. (2022), Pawabutra and Sutakote (2024), Romero and Manjarres (2017), and Sridhanyarat (2017) have found that first-language interference plays a significant role in learning English. However, first-language interference and linguistic relativity represent different phenomena. While first-language interference concerns the influence of L1 on the learning or use of L2, linguistic relativity concerns the relationship between language and cognitive processes.

While much research on linguistic relativity has focused on monolingual speakers, Thongniam (2017) extended the investigation to bilingualism by examining the influence of grammatical gender on the cognition of Russian-English bilingual speakers in comparison with Russian and English monolinguals. The findings revealed that Russian speakers categorised objects based on grammatical gender more frequently than English speakers. Meanwhile, Russian-English bilinguals categorised objects based on grammatical gender less frequently than Russian monolinguals but similarly to English monolinguals. These findings not only support the Linguistic Relativity Hypothesis but also suggest that bilingual language experience may be associated with cognitive patterns that differ from those of monolingual speakers.

Within the Thai-English context, grammatical number represents a particularly relevant domain for examining the relationship between language and cognition. English grammatical number also poses a significant challenge for Thai learners of English. In English, grammatical number is obligatorily encoded through morphological marking (e.g., the plural suffix *-s*), whereas Thai expresses number through optional lexical means such as classifiers and quantifiers.

Charunrochana (2000) provided examples of English and Thai sentences illustrating that English grammar requires explicit morphological marking of number through the plural suffix *-s*, whereas Thai does not encode grammatical number on nouns. English marks plurality inflectionally, as in *student* → *students*, thereby distinguishing singular and plural forms.

In contrast, Thai nouns such as นักเรียน ‘student’ remain unchanged regardless of number, with plurality being expressed through numerals or classifiers rather than morphological alteration.

For example:

English: There is a student in the classroom.

Thai: มีนักเรียนหนึ่งคนอยู่ในห้องเรียน

English: There are two students in the classroom.

Thai: มีนักเรียนสองคนอยู่ในห้องเรียน

English: There are many students in the classroom.

Thai: มีนักเรียนหลายคนอยู่ในห้องเรียน

These examples illustrate that English encodes plurality through inflectional morphology, as in *student* → *students*, whereas Thai relies on syntactic and lexical strategies such as numerals *หนึ่ง* ‘one’, *สอง* ‘two’, *หลาย* ‘many’, and the classifier *คน*, which is used for people. This contrast highlights a fundamental typological difference between the two languages in the realisation of grammatical number.

From the perspective of linguistic relativity, this typological distinction may systematically influence how speakers attend to and cognitively process numerical information. Specifically, the obligatory marking of number in English may direct speakers’ attention toward quantity, while the absence of such marking in Thai may result in reduced sensitivity to numerical distinctions. Many previous studies on English grammatical number among Thai speakers, including Jawaut et al. (2023), Ninpanit and Pongpairaj (2016), Siriwittayakorn and Miyamoto (2019), and Watcharapunyawong and Usaha (2013), have found that differences in linguistic structures between Thai and English, particularly in grammatical number, lead to language transfer and the occurrence of linguistic errors. While these studies demonstrate the linguistic consequences of differences in grammatical number between Thai and English, they do not directly address whether such differences are also associated with cognitive processes such as attention.

To analyse the relationship between grammatical number and cognition among Thai and English speakers, the present study focuses specifically on attention as an observable behaviour. Charunrochana (2000) stated that the cognitive system is an abstract concept that cannot be explicitly analysed. Therefore, the cognitive system must be examined through observable behaviours. Friedenberg and Silverman (2006) defined attention as a mental process in which individuals selectively accept certain pieces of information, making them significant. Attention involves choosing to prioritise or focus on one specific aspect among various inputs. Similarly, Groome (2014) described attention as requiring intention or deliberate focus. Attention is a system concerned with the selection and prioritisation of received information.

More recent research has extended the investigation of grammatical number and cognition to bilingual cognition. Recent evidence suggests that the relationship between grammatical categories and cognition may also be observed among bilingual speakers, although the patterns associated with bilingual language experience and L2 proficiency are not necessarily uniform across linguistic domains and contexts. Chi Pech (2024), who investigated Yucatec Maya-Spanish bilingual children within the framework of linguistic relativity, examined cognitive patterns associated with two linguistic domains: number marking and spatial frames of reference. In relation to number marking, the study showed that bilingual cognitive patterns may vary according to the language of assessment. Chen and Faitaki (2025) investigated the effect of the French

grammatical gender system on object perception among English and French monolinguals and English-French and French-English bilinguals. Their findings showed that the French grammatical gender system was associated with object perception, while this effect was independent of L2 proficiency. Chanyeam and Wongthai (2025) examined attention and memory for grammatical number among Thai and English monolinguals and Thai-English bilingual speakers at different levels of English proficiency. Their findings generally indicated that higher English proficiency was associated with greater sensitivity to numerical information, providing further evidence consistent with linguistic relativity in bilingual cognition. Taken together, these recent findings suggest that bilingual language experience may be associated with cognitive patterns, but the role of L2 proficiency may vary depending on the grammatical domain and context examined.

Importantly, Chanyeam and Wongthai (2025) examined this relationship through structured attention and memory tasks. The present study provides a complementary methodological perspective by examining attention to grammatical number through an open-ended picture-description task, in which participants are not explicitly instructed to attend to or report numerical information. This approach allows attention to grammatical number to be observed as it emerges during language production and provides an opportunity to examine whether patterns associated with bilingualism and English proficiency are also evident in less constrained linguistic behaviour.

This methodological distinction is particularly relevant to the investigation of Thai-English bilingual cognition. Thai and English differ substantially in how grammatical number is encoded, providing an informative context for examining linguistic relativity. Comparing monolingual and bilingual speakers, as well as bilingual speakers at different levels of English proficiency, may further clarify whether patterns of attention to grammatical number are associated with bilingual language experience and increasing proficiency in a language that obligatorily marks number.

Thus, it remains necessary to determine whether differences in the grammatical encoding of number between Thai and English are associated with differences in speakers' attention to numerical information, and whether bilingualism and English proficiency are associated with such patterns of attention.

Accordingly, this study investigates attention to English grammatical number among Thai and English speakers within the framework of linguistic relativity through three comparisons: (1) native Thai and native English speakers, (2) Thai monolingual speakers and Thai-English bilingual speakers, and (3) Thai-English bilingual speakers at different levels of English proficiency.

Based on these comparisons, the study addresses the following research questions:

- RQ1: Is there a difference in attention to English grammatical number between native Thai and native English speakers?
- RQ2: Is there a difference in attention to English grammatical number between Thai monolingual speakers and Thai-English bilingual speakers?
- RQ3: Does attention to English grammatical number differ among Thai-English bilingual speakers at different levels of English proficiency?

CONCEPTUAL FRAMEWORK

The conceptual framework of the present study is grounded in the Linguistic Relativity Hypothesis, which proposes a relationship between linguistic structures and speakers' cognitive processes. Given the differences between Thai and English in the encoding of grammatical number, the study examines whether attention to grammatical number differs across three comparisons: (1) native Thai and native English speakers, (2) Thai monolingual speakers and Thai-English bilingual speakers, and (3) Thai-English bilingual speakers at different levels of English proficiency. Attention to grammatical number is operationalised through an open-ended picture-description task, in which participants are free to select the elements of the pictures they consider important to describe without being explicitly directed to attend to numerical information. The content selected for description is therefore used as an observable indicator of participants' attention to grammatical number. The findings are interpreted within the framework of linguistic relativity to determine whether patterns of attention to grammatical number are associated with differences in grammatical- number encoding, bilingualism, and English proficiency. The conceptual framework of the study is illustrated in Figure 1.

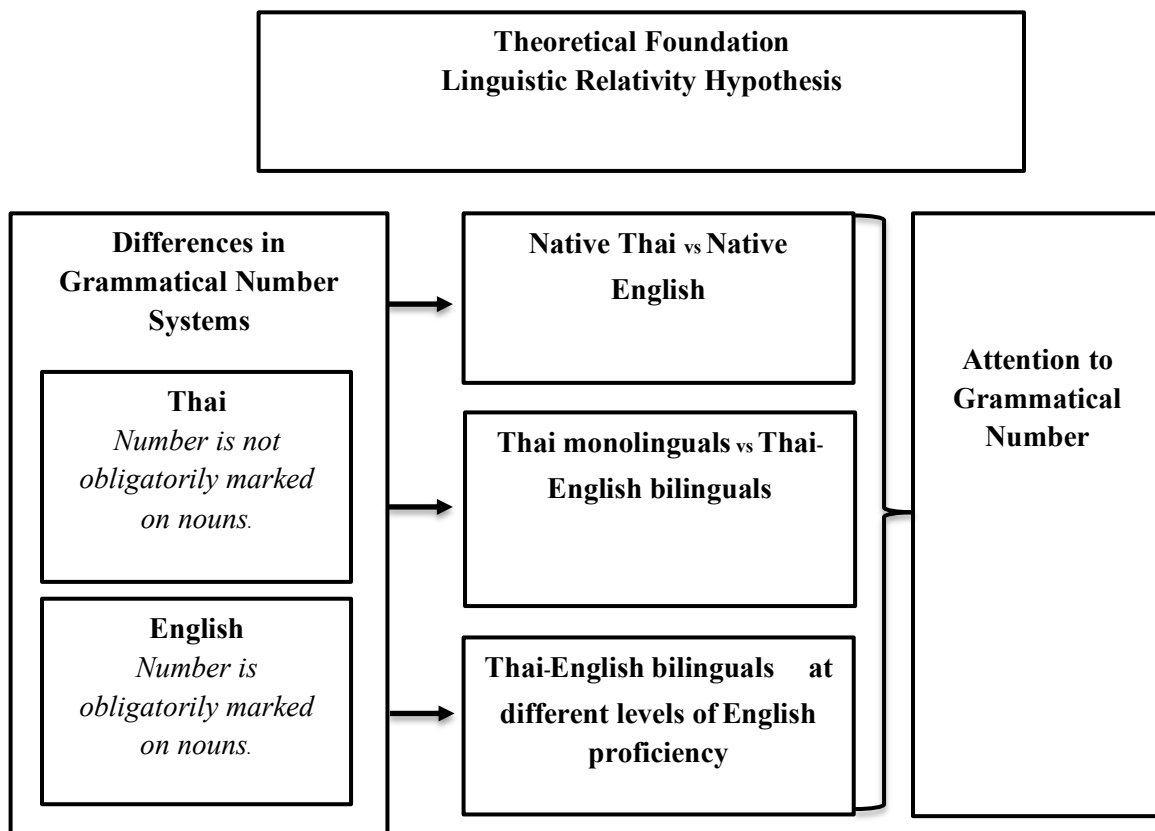


FIGURE 1. Conceptual framework of the relationship between language and attention to grammatical number

METHODOLOGY

Data were collected from Thai and English speakers to compare cognitive behaviour related to attention to grammatical number across three speaker comparisons:

1. Native Thai speakers and native English speakers
This comparison involved 60 native Thai speakers and 60 native English speakers who were not categorised according to bilingualism or second-language proficiency.
2. Thai monolingual speakers and Thai-English bilingual speakers
This comparison involved 30 Thai monolingual speakers and 30 Thai-English bilingual speakers.
3. Thai-English bilingual speakers at different levels of English proficiency
This comparison involved 30 Thai-English bilingual speakers at different levels of English proficiency, categorised into three groups: high, medium, and low proficiency, with 10 participants in each group.

Participants were selected using purposive sampling. All participants were required to be at least 20 years old. For bilingual participants, the researcher used custom-made sentence-based language proficiency tests to assess listening and speaking skills. The tests consisted of eight sentences for listening and eight parallel sentences for speaking, developed to represent the eight levels (Levels 0–7) of syntactic complexity in the revised D-Level scale proposed by Covington et al. (2006), ranging from simple sentences to sentences containing multiple complex structures. Each correctly completed item was awarded one point, giving a maximum score of eight for each skill. The listening and speaking scores were then combined and divided by two to obtain an overall proficiency score ranging from 0 to 8. Based on the overall scores, the bilingual participants were categorised into three English proficiency groups: low (0–3), medium (4–5), and high (6–8), with 10 participants in each group.

The instrument used to collect cognitive behaviour data related to attention consisted of three picture-based attention tasks focusing on grammatical number. Picture-description tasks were selected as they allow naturalistic elicitation of attention without explicitly directing participants to focus on numerical features. These three pictures were reviewed by three Thai experts with specialised knowledge in the relationship between language and cognition to assess their suitability for use in the attention task. All three experts considered the pictures appropriate for use in the study, and no modifications were recommended.

Participants were instructed to describe each picture within a time limit of two minutes. They were given the option to either describe or omit any elements of the pictures and to provide as much or as little detail as they deemed appropriate. The content selected by the participants for description was therefore used as an observable indicator of their attention. During the data collection process, the researcher sought permission to audio-record the participants' descriptions. Prior to the description task, the researcher provided the following instructions to the participants:

“Let’s imagine that you are the only person who has seen these three pictures. Suppose your friend would like to see these pictures but has not seen them. You need to describe the pictures to your friend. You may choose to describe or omit any elements of the pictures, and you can provide as much or as little detail as you wish. You may also stop describing the picture once you have mentioned what you consider to be the important aspects. However, please ensure that each picture description does not exceed two minutes.”

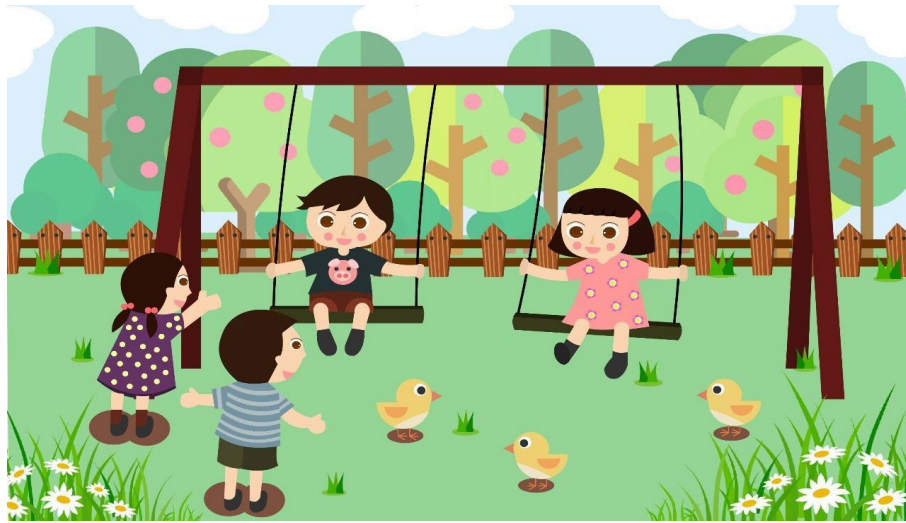


FIGURE 2. The first picture used for collecting cognitive behaviour data related to attention

Figure 2 is a practice picture. The participants are required to describe the picture within two minutes, but data collected from this picture are not included in the analysis. The practice picture is used to familiarise participants with the task without explicitly revealing the specific focus on grammatical number before they proceed to Figures 3 and 4, which are used to examine attention to grammatical number.



FIGURE 3. The second picture used for collecting cognitive behaviour data related to attention

Figure 3 is used to examine attention to grammatical number. Participants are required to describe a birthday party scene within two minutes. The picture contains various elements that allow participants to refer to quantities, such as three people, two cats, five gift boxes, three balls, four balloons, two windows, and one cake. The researcher evaluates whether participants refer to numerical information in their descriptions. Each instance of correctly referring to a quantity is awarded one point.



FIGURE 4. The third picture used for collecting cognitive behaviour data related to attention

Figure 4 is also used to examine attention to grammatical number. Participants are required to describe a meeting scene within two minutes. The picture contains various elements that allow participants to refer to quantities, such as five people, two laptops, two bags, and one potted plant. The researcher evaluates whether participants refer to numerical information in their descriptions. Each instance of correctly referring to a quantity is awarded one point.

Statistical analyses were conducted to examine the three comparisons addressed in the study. Independent-samples t-tests were used to compare attention to grammatical number between native Thai and native English speakers and between Thai monolingual and Thai-English bilingual speakers. The Kruskal-Wallis H test was used to examine differences in attention to grammatical number among Thai-English bilingual speakers at different levels of English proficiency. Simple linear regression was used to examine whether English proficiency predicted attention to grammatical number among Thai-English bilingual speakers. Statistical significance was set at $p < .05$.

DATA ANALYSIS AND RESULTS

The data were analysed using descriptive statistics, independent-samples t-tests, the Kruskal-Wallis H test with post hoc pairwise comparisons, and simple linear regression. The results are presented in the following order:

1. Attention to grammatical number among native Thai speakers and native English speakers
2. Attention to grammatical number among Thai monolingual speakers and Thai-English bilingual speakers
3. Attention to grammatical number among Thai-English bilingual speakers at different levels of English proficiency

ATTENTION TO GRAMMATICAL NUMBER AMONG NATIVE THAI SPEAKERS AND NATIVE ENGLISH SPEAKERS

In this section, the researcher presents the results of the comparative analysis of attention to grammatical number between native Thai speakers and native English speakers. Data were collected from 120 participants, categorised according to their native language: 60 native Thai speakers and 60 native English speakers. Without considering status or second-language proficiency, native Thai speakers had a mean attention score of 4.27, whereas native English speakers had a mean score of 18.67. To provide a clearer comparison, the data are presented in Figure 5.

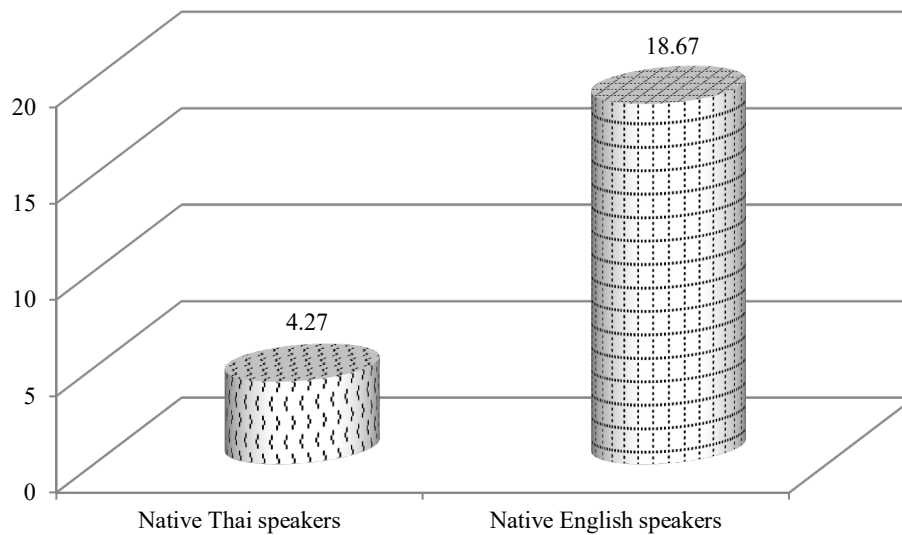


FIGURE 5. Mean scores for attention to grammatical number among native Thai speakers and native English speakers

Figure 5 illustrates the distribution of attention scores for grammatical number among native Thai and native English speakers without distinguishing between bilingual status or second-language proficiency. Native Thai speakers had attention scores ranging from 0 to 9, whereas native English speakers had scores from 10 to 27. An independent-samples t-test was then conducted to compare attention to grammatical number between the two groups. The results are presented in Table 1.

TABLE 1. Comparison of attention to grammatical number between native Thai and native English speakers

Comparison	Native Thai speakers		Native English speakers		<i>t</i>	<i>p</i>	95% CI	Cohen's <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
Native Thai vs Native English speakers	4.27	2.603	18.67	4.689	-20.798	< .001	[-15.775, -13.025]	3.80

As shown in Table 1, native Thai speakers had a mean attention score of 4.27 (SD = 2.603), whereas native English speakers had a mean score of 18.67 (SD = 4.689). Welch's independent-samples *t*-test showed a statistically significant difference in attention to grammatical number between the two groups, $t(92.206) = -20.798$, $p < .001$, 95% CI [-15.775, -13.025], with a large effect size (Cohen's $d = 3.80$).

ATTENTION TO GRAMMATICAL NUMBER AMONG THAI MONOLINGUAL SPEAKERS AND THAI-ENGLISH BILINGUAL SPEAKERS

This section presents a comparison of attention to grammatical number between Thai monolingual speakers and Thai-English bilingual speakers. Data were collected from 60 participants: 30 Thai monolingual speakers and 30 Thai-English bilingual speakers whose first language was Thai. The analysis examined whether attention to grammatical number differed between the two groups.

Thai monolingual speakers had a mean attention score of 3.67, whereas Thai-English bilingual speakers had a mean score of 4.87. The data are presented in Figure 6.

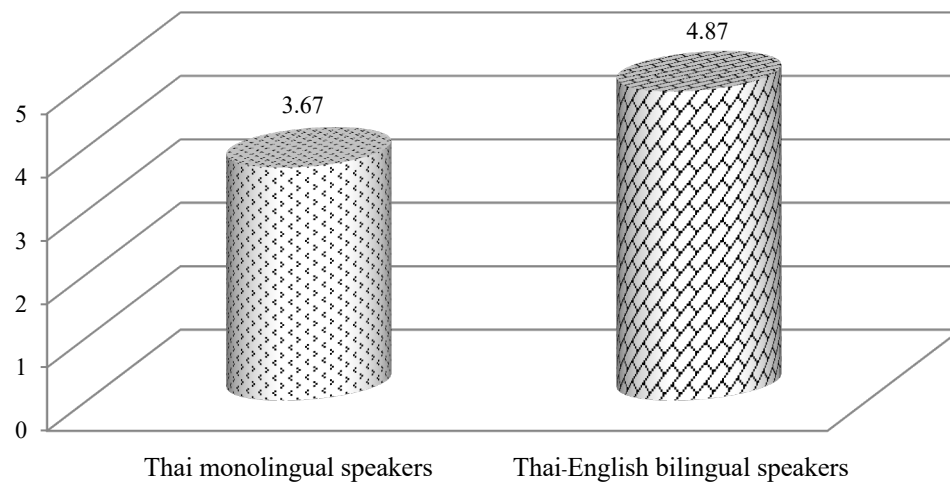


FIGURE 6. Mean scores for attention to grammatical number among Thai monolingual speakers and Thai-English bilingual speakers

Figure 6 illustrates the distribution of attention scores for grammatical number among 30 Thai monolingual speakers and 30 Thai-English bilingual speakers. Thai monolingual speakers had attention scores ranging from 0 to 8, whereas Thai-English bilingual speakers had scores ranging from 0 to 9. An independent-samples *t*-test was then conducted to compare attention to grammatical number between the two groups. The results are presented in Table 2.

TABLE 2. Comparison of attention to grammatical number between Thai monolingual speakers and Thai-English bilingual speakers

Comparison	Thai monolingual speakers		Thai-English bilingual speakers		<i>t</i>	<i>p</i>	95% CI	Cohen's <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
Thai monolingual speakers vs Thai-English bilingual speakers	3.67	2.279	4.87	2.801	-1.820	.074	[-2.520, 0.120]	0.47

As shown in Table 2, Thai monolingual speakers had a mean attention score of 3.67 (SD = 2.279), whereas Thai-English bilingual speakers had a higher mean score of 4.87 (SD = 2.801). An independent-samples *t*-test indicated that the difference in attention to grammatical number between the two groups was not statistically significant, $t(58) = -1.820, p = .074$, 95% CI [-2.520, 0.120], Cohen's $d = 0.47$. Although the bilingual speakers demonstrated a higher mean attention score than the monolingual speakers, the observed difference did not reach statistical significance.

ATTENTION TO GRAMMATICAL NUMBER AMONG THAI-ENGLISH BILINGUAL SPEAKERS AT DIFFERENT LEVELS OF ENGLISH PROFICIENCY

This section presents an analysis of attention to grammatical number among Thai-English bilingual speakers at different levels of English proficiency. A total of 30 participants were classified into three proficiency groups based on their English listening and speaking proficiency: high, medium, and low, with 10 participants in each group. The analysis examined whether attention to grammatical number differed across the three levels of English proficiency.

The results revealed that Thai-English bilingual speakers with high English proficiency had the highest mean attention score ($M = 8.00$), followed by those with medium proficiency ($M = 5.00$) and low proficiency ($M = 1.60$). The mean attention scores across the three English proficiency groups are presented in Figure 7.

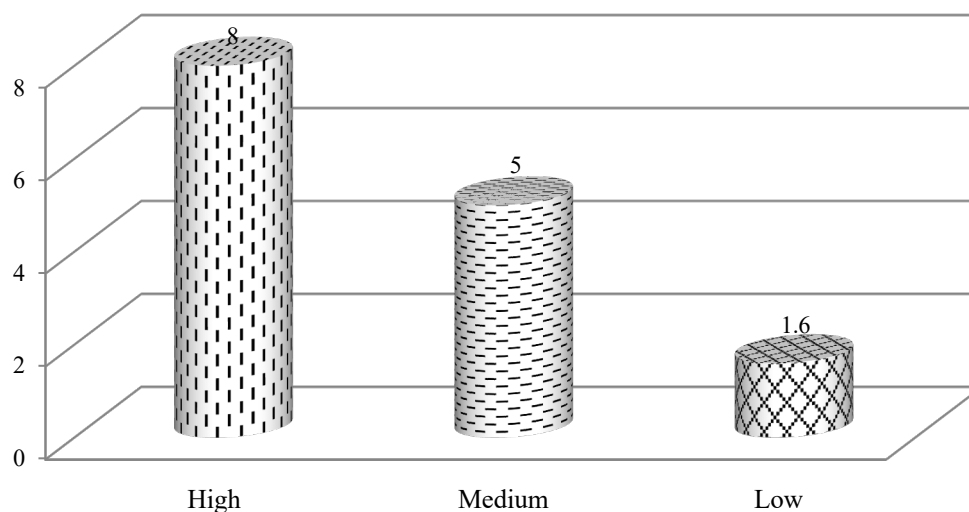


FIGURE 7. Mean attention scores for grammatical number among Thai-English bilingual speakers at different levels of English proficiency

Figure 7 illustrates the attention scores for grammatical number among 30 Thai-English bilingual speakers at different levels of English proficiency, with 10 participants in each group. Attention scores ranged from 7–9 in the high-proficiency group, from 4–6 in the medium-proficiency group, and from 0–3 in the low-proficiency group. As the assumption of normality was not met for all proficiency groups, a Kruskal–Wallis test was conducted to examine differences in attention to grammatical number across the three English proficiency levels. The results showed a statistically significant difference among the three groups, $H(2) = 26.091, p < .001$.

Post hoc pairwise comparisons were subsequently conducted using Mann–Whitney U tests with a Bonferroni-adjusted significance level of .0167. The results showed statistically significant differences between all three proficiency groups. The medium-proficiency group had significantly higher attention scores than the low-proficiency group, $U = 0.00$, $Z = -3.824$, $p < .001$, $r = .86$. The high-proficiency group also had significantly higher attention scores than the low-proficiency group, $U = 0.00$, $Z = -3.824$, $p < .001$, $r = .86$, and significantly higher scores than the medium-proficiency group, $U = 0.00$, $Z = -3.832$, $p < .001$, $r = .86$. These results indicate large differences in attention to grammatical number across the three English proficiency levels. The results of the pairwise comparisons are presented in Table 3.

TABLE 3. Pairwise comparisons of attention to grammatical number across English proficiency levels

Comparison	<i>U</i>	<i>Z</i>	<i>p</i>	Effect size (<i>r</i>)
Low vs. Medium	0.00	−3.824	< .001	.86
Low vs. High	0.00	−3.824	< .001	.86
Medium vs. High	0.00	−3.832	< .001	.86

Note. Pairwise comparisons were conducted using Mann–Whitney U tests with a Bonferroni-adjusted significance level of $\alpha = .0167$.

A linear regression analysis was subsequently conducted to examine the association between English proficiency level and attention to grammatical number among Thai-English bilingual speakers. English proficiency level was positively and significantly associated with attention to grammatical number, $F(1, 28) = 252.988$, $p < .001$. The model explained 90.0% of the variance in attention scores ($R^2 = .900$, adjusted $R^2 = .897$). English proficiency level was a significant positive predictor of attention to grammatical number ($B = 3.200$, $SE = .201$, $\beta = .949$, $t = 15.906$, $p < .001$, 95% CI [2.788, 3.612]). Thus, each one-level increase in English proficiency was associated with an estimated 3.20-point increase in attention score. The results of the regression analysis are presented in Table 4.

TABLE 4. Linear regression analysis predicting attention to grammatical number from English proficiency level

Predictor	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	95% CI for <i>B</i>
Constant	−1.533	.435	—	−3.528	.001	[−2.424, −.643]
English proficiency level	3.200	.201	.949	15.906	< .001	[2.788, 3.612]

Note. $R = .949$, $R^2 = .900$, adjusted $R^2 = .897$, $F(1, 28) = 252.988$, $p < .001$

To further illustrate the positive association between English proficiency level and attention to grammatical number, the relationship between the two variables is presented graphically in Figure 8.

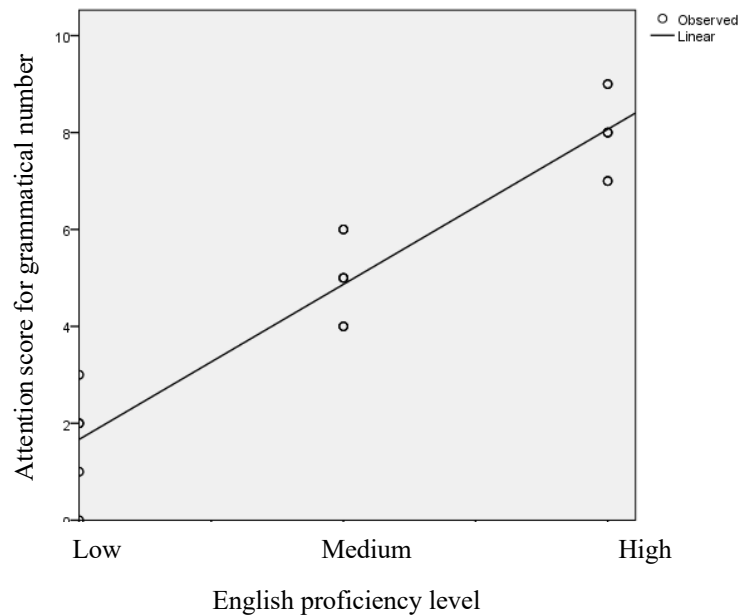


FIGURE 8. Relationship between English proficiency level and attention to grammatical number among Thai-English bilingual speakers

As shown in Figure 8, attention scores increased with English proficiency level. The upward linear trend indicates a strong positive association between the two variables, consistent with the regression results reported in Table 4. Thai-English bilingual speakers with higher levels of English proficiency tended to demonstrate greater attention to grammatical number than those with lower levels of English proficiency.

DISCUSSION

The findings of this study provide empirical support for the Linguistic Relativity Hypothesis, suggesting that language influences speakers' cognitive processes not only through their native language but also through subsequently acquired languages. The results of this study show that 1) native English speakers exhibit significantly greater attention to grammatical number than native Thai speakers, 2) Thai-English bilingual speakers demonstrate descriptively greater attention to grammatical number than Thai monolingual speakers, although the difference is not statistically significant, and 3) Thai-English bilingual speakers with higher English proficiency demonstrate significantly greater attention to grammatical number than those with lower proficiency.

The following excerpt illustrates a typical description of Figure 3 produced by a native English speaker:

"This picture looks like a birthday party. There are three people at the party. The mother is holding a cake for her daughter. The father is sitting at the table with his daughter. There are five presents, and the daughter looks very happy. There are two cats: one is playing with a ball, while the other is sleeping. The room is beautifully decorated, with four balloons and three stars. There are three balls on the floor and a framed photograph of the three family members on the dresser."

As illustrated in the description of Figure 3 above, native English speakers typically refer explicitly to grammatical number in their descriptions, whereas most native Thai speakers do not explicitly indicate number when referring to the nouns depicted in the picture. The following excerpt presents a typical description of Figure 3 produced by a native Thai speaker:

Thai:

“พ่อ แม่ และลูกสาวอยู่ในงานวันเกิด ลูกสาวหน้าตาน่ารักกำลังรอเค้กวันเกิดที่แม่กำลังนำมาให้ มีกล่องของขวัญอยู่บนโต๊ะ ได้โต๊ะมีแมวกำลังนอนหลับ และมีลูกบอลอยู่บนพื้น ในห้องตกแต่งด้วยลูกโป่ง ทุกคนดูมีความสุขมาก”

English:

There are a father, a mother, and a daughter at the birthday party. The cute daughter is waiting for the cake that the mother is bringing to her. There is/are present box/boxes on the table. A cat/cats is/are sleeping under the table. There is/are ball/balls on the floor. The room is decorated with balloon/balloons. Everyone looks/look very happy.’¹

As illustrated in the example above, native Thai speakers demonstrated significantly lower attention to grammatical number than native English speakers. This finding supports the Linguistic Relativity Hypothesis and aligns with previous studies, such as Charunrochana (2000), who studied the relationship between grammatical number and the cognitive systems of Thai and English speakers. The study found that language can influence speakers’ cognitive systems or thought processes. English speakers, whose language marks grammatical number, paid greater attention to number than Thai speakers. The present findings also align with Gordon (2004), who studied numerical cognition among speakers of Pirahã, an indigenous language of the Amazon. Pirahã speakers use a “one-two-many” system of counting. The study found that numerical cognition was affected by the limited counting system in the language. Performance with quantities greater than three was remarkably poor. Pirahã speakers could perform tasks involving small quantities, but their accuracy declined significantly as the number increased. These findings revealed that a limited inventory of number terms may constrain exact numerical cognition, although approximate quantity perception remains intact.

In the context of bilingualism, the analysis of data categorised by bilingualism in this study suggests that a second language is associated with speakers’ cognitive systems, aligning with Athanasopoulos (2009, 2011), who found that the cognitive systems of bilinguals differ from those of monolinguals. The results revealed that Thai-English bilingual speakers had a higher mean attention score than Thai monolingual speakers, although the difference was not statistically significant. Moreover, analysis based on second-language proficiency showed that Thai-English bilingual speakers with higher proficiency in English demonstrated significantly greater attention to grammatical number than those with lower proficiency.

Interestingly, the performance of Thai-English bilingual speakers reflects the interaction between two linguistic systems. The intermediate pattern observed among bilingual Thai-English speakers suggests that cognitive processes are not fixed but are associated with linguistic experience. The strong positive association between English proficiency and attention to grammatical number ($R = .949$) further indicates that second-language proficiency is closely associated with cognitive sensitivity to grammatical number. Similarly, Athanasopoulos (2006, 2007) suggested that increased proficiency in a second language leads to cognitive patterns that

¹ Thai does not obligatorily mark number on nouns or verbs, so references may be ambiguous between singular and plural. In translating into English, number must be specified. When a single referent is clearly identifiable, the singular form is used. However, when multiple referents are present, both singular and plural forms are provided to reflect the original ambiguity.

are more closely aligned with that language, indicating that language experience significantly shapes cognition.

Moreover, the results of this study align with Aemdit and Prasithrathsint (2016), who investigated the Linguistic Relativity Hypothesis by analysing the relationship between English tense and the concept of time among Thai-English bilingual speakers. They focused on grammatical tense because English possesses this grammatical category, whereas Thai does not. They found that Thai-English bilingual speakers with higher English proficiency tended to perform better on a time-memory task than those at basic and intermediate proficiency levels.

Similarly, the present findings are consistent with Thongniam and Prasithrathsint (2020), who studied the influence of grammatical gender on Russian speakers' cognition in comparison with that of Thai speakers, using an object-categorisation task. Russian possesses grammatical gender, whereas Thai does not possess this grammatical category. They found that Russian speakers categorised objects on the basis of grammatical gender, while Thai speakers categorised objects primarily on the basis of size and shape. Moreover, their findings highlighted the importance of considering bilingualism in studies testing the Linguistic Relativity Hypothesis. These studies provide further evidence of the relationship between language and cognition, not only through the native language but also through subsequent linguistic experience or acquired languages.

However, the present findings differ from studies reporting contrasting or non-significant evidence for linguistic relativity, such as Barner et al. (2009) and Saalbach and Imai (2007). These contrasting findings may reflect differences in the grammatical or linguistic features examined, the languages compared, and the cognitive tasks employed across studies. Such variation may contribute to the different patterns of findings reported in research on linguistic relativity.

A crucial contribution of this study is the distinction between obligatory and optional linguistic encoding. In English, grammatical number is obligatorily marked on countable nouns, requiring speakers to consistently encode numerical distinctions during language production. This repeated encoding may foster habitual attentional patterns, directing speakers' attention toward quantity-related features even in non-linguistic contexts. In contrast, Thai does not obligatorily mark number on nouns, allowing speakers to omit numerical information. The results of this study show that Thai speakers demonstrated significantly lower attention to grammatical number than English speakers, consistent with differences in the obligatory encoding of number in the two languages.

In this sense, obligatory grammatical number marking in English may serve as a cue that consistently directs attention to numerical distinctions. These linguistic patterns may lead English speakers to be more sensitive to quantity-related information (Majid et al., 2020). In contrast, Thai speakers, whose language does not have obligatory grammatical number marking, may rely more on contextual and pragmatic cues when interpreting quantity, resulting in different attentional priorities. This explanation aligns with Boroditsky (2001), who suggested that language functions as a cognitive tool that guides attention toward specific aspects of experience. This interpretation is consistent with the view that language may influence cognition indirectly through attentional processes rather than directly shaping conceptual representations (Friedenberg & Silverman, 2006; Groome, 2014).

Overall, the present study highlights the dynamic interaction between language structure and cognitive processing across different speaker groups. These findings suggest that linguistic experience plays an important role in shaping attentional patterns. Importantly, the findings suggest that bilingualism alone does not sufficiently account for differences in attention to

grammatical number. Rather, second-language proficiency appears to be an important factor, as bilingual speakers with higher English proficiency demonstrated significantly greater attention to grammatical number than those with lower proficiency.

The findings of the present study contribute to ongoing discussions regarding the plasticity of cognitive systems in multilingual contexts. The observed gradient pattern among bilingual speakers suggests that cognitive processing is adaptable and can be shaped by linguistic experience. This has important implications not only for theories of linguistic relativity but also for our broader understanding of cognitive flexibility. Rather than viewing cognition as a fixed system determined early in development, the results support a dynamic perspective in which cognitive patterns can be reorganised in response to changing linguistic environments.

Beyond its theoretical contribution to linguistic relativity, the present study may also have practical implications for the teaching of English to Thai learners. The findings highlight the importance of recognising structural differences between Thai and English, particularly grammatical number, which is obligatorily marked in English but not in Thai. They also underscore the importance of considering learners' levels of English proficiency in instructional contexts. Such considerations may inform greater attention to grammatical number in English instruction for Thai learners.

Despite these findings and contributions, several limitations should be acknowledged. First, the use of picture description tasks may not fully capture unconscious attention behaviour regarding grammatical number. The two-minute oral description task may partly reflect differences in verbal fluency, task performance, or descriptive style rather than cognitive attention alone. Future research could incorporate methods such as eye-tracking or reaction-time measures to provide more direct evidence of attention behaviour and control for differences in participants' verbal output. Second, the relatively small sample size, particularly in the bilingual proficiency groups, may limit the generalisability of the findings. Third, individual differences such as cognitive style, educational background, and frequency of language use were not controlled for and may have influenced the results.

Future research may also explore whether similar effects can be observed with other grammatical categories, such as tense, aspect, or classifiers, particularly in languages with different typological characteristics. Longitudinal studies would be particularly valuable in examining how changes in second-language proficiency over time are associated with changes in cognitive processing. Additionally, investigating the role of context, such as whether bilingual speakers are operating in an L1 or L2 environment, may provide further insights into the dynamic nature of linguistic relativity.

CONCLUSION

In conclusion, this study provides empirical evidence supporting the Linguistic Relativity Hypothesis by demonstrating differences in attention to grammatical number among Thai and English speakers. The findings reveal a clear contrast between native English and Thai speakers and highlight the role of linguistic experience, showing that Thai–English bilingual speakers at different levels of English proficiency exhibit markedly different attentional patterns. These findings suggest that the relationship between language and cognition extends beyond native language structure to subsequent linguistic experience and second-language proficiency. The findings may also have practical relevance to the teaching of English to Thai learners by

highlighting the importance of structural differences between Thai and English and learners' levels of English proficiency. Overall, the study underscores the importance of both linguistic structure and language experience in shaping cognitive patterns and offers valuable insights into the relationship between language and thought.

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