Is Left or Right Better? A Branching Direction and the Processing of English Relative Clauses of Thai University Students

Lugsamee Nuamthanom Kimura[1]

บทคัดย่อ

การสอนภาษาอังกฤษสำหรับวิทยาศาสตร์ และเทคโนโลยีในช่วงเวลา 2 - 3 ปีที่ผ่านมา ทำให้ผู้วิจัยเล็งเห็นว่านักศึกษาไทยจำนวนมากมีปัญหาด้านความเข้าใจต่อภาษาอังกฤษเชิงวิทยาศาสตร์ เนื่องจากโครงสร้างประโยคเชิงซ้อน ดังเช่น โครงสร้างอนุประโยค ไบเบอร์ (2006) กล่าวว่า โครงสร้างภาษาแบบอนุประโยคจะพบมากในงานเขียนเชิงวิทยาศาสตร์และเทคนิค และในกลุ่มส่วนขยายคำที่ไม่ใช่บุพบท โครงสร้างอนุประโยคนับเป็นโครงสร้างที่ใช้บ่อยที่สุดในภาษาหลายรูปแบบ เช่น บทสนทนา บันเทิงคดี และงานวิชาการ (ไบเบอร์และอื่นๆ, 1999) บทความวิจัยฉบับนี้มีความพยายามนำเสนอการศึกษาทิศทางการกระจายข้อมูลของโครงสร้างภาษาแบบอนุประโยค และผลกระทบของโครงสร้างดังกล่าวต่อความเข้าใจภาษา ของนักศึกษาภาษาอังกฤษในฐานะภาษาต่างประเทศ มหาวิทยาลัยอุบลราชธานี ประเทศไทย งานวิจัยเรื่องนี้ยังจัดทำขึ้นบนข้อสันนิษฐานหลักที่ว่า โครงสร้างการกระจายข้อมูลในทิศทางขวาง่ายต่อความเข้าใจมากกว่าโครงสร้างการกระจายข้อมูลในทิศทางกลางซึ่งถูกเรียกว่าทิศทางซ้ายในงานวิจัยฉบับนี้ด้วย ดังนั้นหากมีการนำข้อมูลที่คล้ายคลึงกันบรรจุในโครงสร้างอนุประโยคสองทิศทางที่แตกต่างข้างต้น นักศึกษาจะมีโอกาสไม่เข้าใจโครงสร้างแบบแรกน้อยกว่า และไม่สามารถจดจำข้อมูลที่เกิดขึ้นในประโยคหลักเมื่ออ่านโครงสร้างแบบที่สองมากกว่า ทั้งนี้ผู้วิจัยหวังว่าผลการวิจัยจะนำเสนอข้อสมมุติฐานที่ว่าหากผู้สอนภาษามีความเข้าใจในปัญหาของผู้เรียน

[1]อาจารย์ประจำ สาขาภาษาและวรรณคดีตะวันตก คณะศิลปศาสตร์ มหาวิทยาลัยอุบลราชธานี

และลักษณะของสื่อการเรียนการสอน ผู้สอนจะสามารถสร้างสื่อการเรียนการสอนหรือกิจกรรมการเรียนรู้ที่เหมาะสมกับผู้เรียนได้อย่างมีประสิทธิภาพ

คำสำคัญ: ทิศทางการกระจายข้อมูล, ความเข้าใจข้อมูล, นักศึกษาไทยในมหาวิทยาลัย

Abstract

Having taught English for Science and Technology (EST) for several years , the researcher have frequently observed that many of Thai students found the language of scientific thought extremely difficult to understand mainly because of complex sentence structures, such as those in Relative Clauses. As Biber (2006) acknowledges, relative clauses occur quite frequently in scientific and technical writing; and among non-prepositional posmodifiers , they are the most frequently used structure in genres ranging from conversation to fiction and academic texts (Biber et. al, 1999). In this article, attempts have been made to explore a branching direction of English relative clauses and its effect on language processing of Thai English as a Foreign Language (EFL) learners at Ubon Ratchathani University, Thailand. The study was conducted based largely on the hypothesis that the right branching structure would be more easily processed than the center-embedded, also called the left branching in this work. And thus, if similar information is structured in these two different directions, students should display a tendency toward less difficulties understanding the right branching, and hardly retain information in the matrix clause of the center-embedded. Results obtained hopefully illustrated one of the premises that state when teachers tried to understand learners' challenges and the characteristics of their teaching materials, they should be able to determine how to create the best possible materials and learning activities.

Keywords: a branching direction, information processing , Thai university students

1. Introduction

In the past four decades, research in the area of English relative clauses (henceforth RCs) from an L1 (the 1st language) perspective has been associated with a solid body of three major approaches: (1) a description of their structures within and between languages (e.g. Comrie, 1981; Downing, 1981; Keenan 1985); (2) an explanation of their function in discourse (e.g. Fox, 1987; Givon, 1979; Nuamthanom, 2003); and (3) psycholinguistic studies on the comprehension of RCs (e.g. Carrol, 2008; Clancy et al., 1986; Prideaux and Baker 1986). Along the same line, research on L2 (the 2nd language) RC acquisition has also expanded into three major strands: (1) the implicational universals of language (e.g. Doughty, 1991; Hamilton, 1994; Phoocharoensil & Simargool, 2010); (2) the influences of instruction on RC acquisition (e.g. Abdolmanafi & Rezaee, 2012; Croteau, 1995; Gass, 1982); and (3) the cross-linguistic influences on RC second language acquisition (e.g. Isumi, 2003; Liu, 1998; Prentza, 2012). These approaches, either from an L1 or L2 perspective, seem to overlap to a large extent. For instance, any given study may explore the structures of RCs, their functions in discourse, and how they influence language processing. In the current work, however, an emphasis was placed only on the comprehension study of RCs by Thai EFL students in higher education.

The selection of this topic as an object of focus was due to the researcher's personal interest in the use of grammatical devices in meaningful ways as well as a long-standing observation of students' struggle with complex sentence structures in English. In particular, it has been discovered that many students find the language of scientific thought extremely difficult to access due

mainly to complex sentence structures such as those found in RCs. In retrospect, the researcher now realize that a major cause of the failure regarding this grammatical choice might have been linked to different factors. For example, "the internal structural complexity ascribed to their nature of subordination has presented many formidable challenges of form" (Sadighi & Jafarpur, 1994, 141). It was reported that students had to deal with the syntactic diversity of RCs in English, which covered at least 40 different types (Celce-Murcia & Larsen-Freeman, 1999). The researcher have also observed that students can seldom distinguish the subtle difference between restrictive and non-restrictive RCs, nor understand the pragmatic/discourse functions of this device.

Grammarians and linguists have long accepted that the English RCs contain a complicated information structure and conform to one specific order known as the Noun Phrase Accessibility Hierarchy (NPAH). This hierarchy suggests that some RC structures are more easily processed than others. It declares that RC in (a) is more accessible than (b), which is itself more accessible than (c):

(a) I kicked the girl {who ate my chocolate cake}. (SU)
(b) I kicked the girl {whom the children liked very much}. (DO)
(c) I kicked the girl {whom Sam sent the invitation to}. (OPREP)

Initially introduced by Keenan and Comrie (1977), the Accessibility Hierarchy is influenced by the semantic and grammatical role of the relative pronoun, which is co-referential with the RC head NP (Noun Phrase). In (a), for example, the head NP of the RC '*the girl*' is the subject of the RC verb '*eat*'.In contrast, '*the girl*' in (b) is the direct object of '*like*' and in (c) is the indirect

object of '*send*.' Keenan and Comrie (1979) then organized the semantic and syntactic roles of the relative pronouns, which were responsible for the distribution of RCs, into the following hierarchy:

Figure 1 The Accessibility Hierarchy

Subject (SU)
↓
Direct object (DO)
↓
Indirect Object (IO)
↓
Oblique Object or Object of Preposition (OPREP): I kicked the girl {whom Sam was standing beside}.
↓
Genitive Object (GENO): I kicked the girl {whose sister Sam liked}.
↓
Object of Comparison (OCOMP): I kicked the girl {whom Sam liked more than John}.

Regarding this hierarchy, Keenan and Comrie (1975) made another claim that captured the attention of many called linguists. They observed that when ascending the hierarchy from Subject, the difficulty of understanding, and therefore the difficulty of learning, increased. Consequently, as illustrated earlier sentence (b) is more difficult to understand than sentence (a) but less difficult than (c).

As Marefat and Rahmany (2009) pointed out, Keenan and Comrie's work has inspired many related studies. Among them are the studies that focus on both the position of embedding of the RC, also known as the role of the head noun within the main clause (embeddedness: the center-embedded/left branching vs. the right

branching) and the role of the relative pronoun within the subordinate clause (focus/function: subject relatives vs. object relatives). Importantly, these combinations lead to four basic relative constructions as follows:

Center-embedding, also called left branching in this work

Subject-subject (Ss): the head NP is the subject of the main clause, whereas the relative pronoun is the subject of the subordinate clause.

(d) The man {who speaks Japanese)} is my boyfriend.

Subject-object (So): the head NP is the subject of the main clause, whereas the relative pronoun is the object of the subordinate clause.

(e) The program {which you recommended} was great.

Right Branching

Object-subject (Os): the head NP is the object of the main clause, whereas the relative pronoun is the subject of the subordinate clause.

(f) I saw the man {who speaks Japanese}.

Object-object (Oo): the head NP is the object is the object the main clause, whereas the relative pronoun is the object of the subordinate clause.

(g) I watched the program {that you recommended}.

Based on these combinations, one important claim was made: in the center-embedded or left branching (So, Ss), the whole sentence is more difficult than it is in the right branching (Os, Oo) (Kuno, 1974). This is because the former visually interrupts the flow of information, while the latter does not. This is also known as the Perceptual Difficulty Hypothesis (PDH) proposed by Kuno (1975).

These well-established claims have in turn guided the researcher into conducting action research in the course entitled English for Science and Technology offered for non-English major students from the Faculty of Engineering and Faculty of Science at Ubon Ratchathani University, Thailand. Due to a strong correlation between the internal structural complexity of RCs and associated learning difficulties, the researcher has been very much interested in finding ways to help students overcome this language problem by basically trying to understand the challenges they face. These difficulties could manifest themselves in a well-designed comprehension test. By so doing, this study became one of the first attempts to conduct a systematic investigation of a branching direction (Left--Ss, So and Right--Os, and Oo) and its effect on students' language processing. This type of research has never received adequate attention in Thailand when compared to several other previous works, which mainly involved the acquisition of RCs based primarily on the NPAH and other hypotheses. Throughout the course of this research, the results obtained would contribute not only to an understanding of difficulties encountered by learners of RCs, but also to the teaching of and preparing materials for an EST course in Thailand.

II. Literature Review

Definitions of Relative Clauses

Definitions of RCs have emerged in a variety of ways, depending on the purpose of each research project. Keenan and Comrie (1977), for example, gave a semantically- based, syntax-free definition of RCs so that they could explore a large number of languages for typological studies. This definition generally identifies the RC as any clause that modifies a noun phrase. To elaborate

more on this definition, Leech and Svartvik (2002) provide the following for the English RCs:

> The term relative clauses is used for various types of sub-clauses which are linked to part or all of the main clause by back-pointing elements, usually relative pronouns (*wh*-pronouns: *who, whom, whose, which, that* and *zero*). The principal function of a relative clause is that of post-modification in a noun phrase, where the relative pronoun points back to the head of the noun phrase (The Antecedent). (p. 285)

In a similar manner, Amornwongpeeti (2013) define RCs as adjectival subordinate clauses that start with a *wh*-pronoun, *that*, and *zero*. Consider how these definitions work in the following example:

(h) Insert: The boy works at the Chinese restaurant.
Matrix: The boy studies hard.
Result: The boy {who works at the Chinese Restaurant} studies hard.

As seen here, the result of the combination of the matrix and the insert is: "*The boy {who works at the Chinese restaurant} studies hard.*" The Insert is the sentence which is made into the RC: "*The boy works at the Chinese restaurant*." The Matrix is the structure in which a noun phrase has been expanded: *The boy studies hard*. The part "*who works at the Chinese restaurant"* is called an RC and is introduced by a relative pronoun. A relative pronoun is a word that replaces a noun phrase in an insert sentence (as "*who"* replaces *"the boy"*) and at the same time connects the insert to the matrix as a marker. In English, there are generally five relative pronouns or markers: *that, which, who, whom, whose,* and a choice of these markers are mostly controlled by semantic features (Celce-Murcia &

Larsen-Freeman, 1999). For instance, whereas 'who' and 'whom' are restricted to human head nouns, 'which' is limited to inanimate antecedents.

Restrictive and Non-restrictive Relative Clauses

Grammarians and linguists of the English language have long devoted much attention to the distinction between the two major types of RCs, namely, the defining or restrictive and the non-defining or non-restrictive (Stockwell et al., 1973; Comrie, 1981; Amornwongpeeti & Pongpairoj, 2013). Let us now consider examples of restrictive and non-restrictive RCs:

(i) The boy {who works at the Chinese restaurant } studies hard.

(j) The boy{,who works at the Chinese restaurant, } studies hard.

In each of the above sentences, the same cluster of words makes up the RC. However, while the former is not set off by a comma, the latter is.[2] The punctuation distinction, in fact, mirrors deeper dissimilarities between the two. In other words, the same cluster of words in (i) and (j) may manifest completely different functions in discourse.

On the one hand, the function of "*who works at the Chinese restaurant*" in (i) is to identify the head noun 'the boy,' which identifies one boy among others. The RC, inserted into this sentence (i), helps make the referent clear and provide more specific meaning to the matrix sentence: "*The boy studies hard*." The RC that behaves in this way, to identify or to restrict the meaning of the head noun, is known as a restrictive RC (Wasow, Jaeger, & Orr, 2011). In contrast, the RC in (j) does not perform the

[2] This distinction manifests itself in spoken language in pauses before and after the insert and lower intonation for the insert (Arts & Mcmahon, 2006).

function of identifying the head NP 'the boy,' whom the writer assumes can be easily identified. This is because it may have been mentioned before in the previous context, it may be the only boy who engages in the situation in which (j) occurs, or the writer assumes the listener knows which boy is the topic of discourse. Information contained in this RC type, typically, gives extra information, which does not establish the reference of the head noun. The clause that behaves in this way is usually called a non-restrictive RC.

Furthermore, many RCs, both active and passive forms, can be shortened or reduced. This eventually results in the appearance of various kinds of reduced RCs in English (Stowell, 2005). The formation of reduced RCs includes the relative pronoun + *BE* deletion, which is possible with both restrictive and non-restrictive RCs. The relative pronoun + *BE* deletion works only when the relative pronoun is next to a form of *BE*. Progressive and participle phrases usually materialize as a result of this kind of reduction. Sentence (k) demonstrates this reduction:

(k) An apple {hanging on the tree} looks delicious. (progressive phrase) Another example of RC reduction is with so called semi-transitives (e.g. *have, resemble, cost, weigh*), where the deletion of the relative pronoun is accompanied by changing the verb to participial form. Sentence (l) below demonstrates this kind of reduction:

(l) He sent me cake {decorated with pink roses} and a package {weighing 200 pounds}. (participle phrase)

In this example of double RC, the 1st RC *"decorated with pink roses"* is the reduced passive form of *"which was decorated with*

pink roses," and the 2nd one *"weighing 200 pounds"* arises from its full form *"which weighs 200 pounds.*"

Related studies on the comprehension of English RCs from L1 and L2 Perspectives

Despite their complex internal structure, RCs have drawn the interest of scholars, researchers, and educators from all over the world. In particular, the comprehension and production of RCs have been under study in a number of experiments in the fields of child and adult psycholinguistics, as well as first and second language acquisition (e.g. Amornwongpeeti, 2013; Friedmann & Novogrodsky, 2004; Gass, Behney, & Plonsky, 2013; Kidd & Bavin, 2002; Phoocharoensil & Simargool, 2010; Thongyai, 2013). Interestingly, a common thread uncovered in these works were the similarities indicating that both children and adults were better or faster at processing and producing subject relatives such as the one in (m) than object relatives as found in (n). The following examples were taken from Brandt, Kidd, Lieven & Tomasello (2009, p. 540):

(m) the dog {that chased the cat} (subject relatives)

(n) the dog {that the cat chased__} (object relatives)

In these cases, (m) is easier than (n) because the distance between the filler or head NP (*the dog* in (m)) and gap (signified by underscores in the same sentence) is closer than the distance between the filler (*the dog* in (n)) and the gap in (n). Therefore, when reading (n), *'the dog'* must be held in memory longer than (m) with intervening materials (*that the cat*) before the word '*chased*' is read.

Several more strategies have been offered as an explanation for RC processing (e.g. Gass, Behney, & Plonsky, 2013; Leech, 1983, MacWhinney & Pleh, 1998; and MacWhinney, 1995). Studies by Prideaux & Hogan (1993)'s and Prideaux & Baker (1986)'s are among those that discussed different strategies such as

“markedness,” closure, and bracketing as important concepts to aid language users in comprehending sentences that contain subordinate clauses. Consider , for example, how the closure strategy plays a role in language processing. The term “closer” refers to the tendency that clauses are considered as complete when they meet certain criteria (Bever, 1970). Following are examples from Williams (1994):

(o) John {**,** worried he was late**,**} rushed out.

(p) He rushed out.

In (o), the readers tend to treat *"John worried he was late"* as a complete clause based on the assumption that it contains a subject, verb, and object, the basic syntactic requirements of a transitive clause. However, when encountering "*rushed out*," the readers have to reread the clause and reinterpret the grammatical roles originally assigned to its members. As the example shows, the insertion of *"worried he was late"* makes the sentence more difficult to read than the example in (p), and thereby it is more cumbersome for readers to establish closure. This is to emphasize that a non-interrupted clause allows early closure than an interrupted one. As Bever (1970, as cited in Marefat and Rahmany, 2009) added, language users normally expect a given linguistic unit to be in its usual, unmarked, canonical form, and any noun-verb-noun corresponding to subject-verb-object (the NVN strategy) will be easier to process than the same sequence corresponding to other grammatical structures.

Attempts to examine the comprehension of English RCs have been widened to include other language environments, such as in English as a Second Language (ESL) and EFL contexts. For instance, Schumann (1978) studied ESL learners and their understanding of the four types of RCs (Ss, Os, So, Oo). The findings

showed that learners tended to use the Os and Oo more often than the Ss and So because they were easier. As explained by Schuman, it is plausible that the subjects in his work could have had more chances to encounter the Os and Oo types in their daily conversation. In a similar vein, Park (2000) investigated the syntactic difficulty of RCs by analyzing errors and avoidance strategies used by 10 Korean learners of English based on the Perceptual Difficulty Hypothesis (PDH), Noun Phrase Accessibility Hierarchy (NPAH), and Parallel Function Hypothesis (PFH). The findings interestingly pointed to the difficulty of center embedding (or left branching), which suggested an order of difficulty as follows: Ss (the most difficult), So, Os, and Oo (the least difficult). More recent studies, such as those of Kidd and Balwin (2002) and Phoocharoensil (2009), also confirmed Park's tendency when it was reported that learners' development of English RCs began early with the right branching, then moved on to its center-embeded/left branching counterpart.

Lastly, Fox and Thompson's (1990) corpus-based analysis should be worth discussing mainly because, unlike other previous comprehension studies, it offers the animacy of the head noun (whether the head nouns are humans and animals or concrete objects and abstract entities) as another factor affecting comprehension of the RC in English. Examining more than 400 RCs in spoken English discourse, Fox and Thompson highlighted crucial discourse aspects of subject and object relatives that were neglected in other experimental studies. On the one hand, subject relatives were found to provide *new* information about and characterize inanimate and animate main clause objects (e.g. *I got something that is extremely large*). On the other hand, object relatives were mostly employed to ground (to locate a noun phrase's referent by relating it to a referent whose relevance is clear) inanimate entities in discourse (e.g. *the car that I bought was*

in blue color). It largely occurred with inanimate, non-human main clause subjects whose referents were *new* in discourse. By being linked to given referents, "the new inanimate entities are made relevant to the ongoing discourse" (Fox and Thompson, 1990 : p 300). Additionally, the corpus analysis revealed that object relatives were frequently employed with inanimate heads (*the bicycle*) and pronominal RC subjects (*she*) (e.g., *the bicycle that she rented had a flat tire*.)

III. The study

As noted earlier in an extensive review of literature, psycholinguistic studies on the comprehension of RCs in the Thai context were found to be quite limited, and therefore deserve a great deal of additional attention. In this work, the two branching RC directions (Left vs. Right) played the most significant role as they served as a stepping stone for important hypothesis testing. Firstly, as pointed out by Kuno's (1974), in the center-embedded or left branching (Ss, So), the whole sentence is more difficult to process than it is in the right-branching (Os, Oo) counterpart. Secondly, the object relatives (So and Oo) have been proven to be harder than the subject relatives (Ss, Os) in comprehension and production as well as across different populations: adults (e.g. Gennari and MacDonald, 2009), typically-developing children (e.g. Arnon, 2009), and patients with language breakdown (e.g. Garraffa and Grillo, 2008). Focusing on these, several concerns have been raised: if a similar degree of meaning is manipulated in the left and right directions, (1) would the four combinations of RC types yield any significant difference in terms of students' language processing? And (2) if the same condition is applied, would there be different

outcomes concerning the retention of information in the matrix clause?

Research Questions

Responding to the above concerns, the research question-- *Does a branching direction of English relative clauses affect students' language processing?*-- was extensively explored.

Test and Participants

Test

The major research tool in this study was the comprehension test of twenty-four sentences containing 4 different RC types (both restrictive and non-restrictive). All items were initially divided into two groups: the center-embedded (or left branching) and the right branching. To reveal difficulties experienced by language learners concerning these two branching directions, an attempt was made to control the degree of information presented in both of the main and subordinate clauses (Refer to Appendix I for the comprehension test). Particularly, in the case where the relative pronoun was the subject of the subordinate clause (Ss, Os), the information was manipulated to convey similar meaning in the left and right structures. In the same way, when the relative pronoun performed the object function of the subordinate clause (So, Oo), a similar degree of information was presented in both directions. The test eventually contained 4 RC groups, and each group comprised six sentences: five simple RCs and one double RC. Double RCs were also included as they were intended to help confirm an expectation that a heavy load of information, especially in the subject position of the main clause, is most likely to interrupt the flow of information in discourse, and thus imply a decrease in readability of the text (Clark and Harviland, 1977, as cited in Kanprachar & Kimura, 2014).

The information found in these 4 RC types were later used as responses to different kinds of wh-questions: namely who, when, where, which, and what happened/what do people think. For an item classification, the first group was called the Ss (centered-embedded or left branching), while the second one was named the So (centered-embedded or left branching). Similarly, the third group was known as the Os (right branching), whereas the last one was named the Oo (right branching). Below is a summary of the four groups of test items:

Group 1: *five* Ss and *one* Ss double relative clauses
Group 2: *five* So and *one* So double relative clauses
Group 3: *five* Os and *one* Os double relative clauses
Group 4: *five* Oo and *one* Oo double relative clauses

All of these items were initially created by the researcher and proof read by a native speaker of English to make sure that the left and right branching RCs appearing in the test carried similar meaning. Here, it is also worth mentioning that the construction of the test started from the right branching group (Os, Oo), in which half of the RC data was attached to the predicate nominal of a copular clause (e.g., *my cousins are the girls {who speak Japanese}*), while the rest was found to modify the object of a transitive clause (e.g., *someone shot the guy {whom I kicked last night}*).

When creating the left branching items, on the other hand, the predicate nominal of a copular clause had to move into the subject position of the main clause (e.g., *the girls {who speak Japanese} are my cousins*). Similarly, the nominal modified by an RC in the object of a transitive clause also moved into the subject position of the main clause. In this circumstance, the voice in the matrix clause was changed from active into passive (e.g., *the guy {whom I kicked} was shot last night*). Designing the test in this way

was intended to help ensure that the RC data in this work were made parallel to the preponderance of early and later RCs usage (the predicate nominal of a copula clause and the object of a transitive clause) by children in L1 natural speech (Diessel & Tomasello, 2005). This was assumed to be suitable for L2 experimental participants with low language proficiency in this work. The tenses were also kept to the present and past simple, with the head nouns being both inanimate and animate. However, all of the subjects in the object relatives (So, Oo) were pronominal--*I* and *you*--to conform to the natural occurring RC data found in L1 actual communication (Fox and Thompson, 1990).

Participants

Seventy-two Engineering and Science major students participated in this research. They enrolled in the English for Science and Technology (EST) course offered in the 1st semester of the academic year 2014. To ensure reliability in this study, the participants' language proficiency was partially controlled. In other words, all of them received C- to C+ grades in their pre-requisite course known as Academic English. Prior to this course, they had all completed the other two basic English courses — Foundation English I & II — all of which were offered by Thai English teachers. As an initial step, the participants were classified into four groups according to the four types of RC construction (left branching: So, Ss, and right branching: Oo, Os). Therefore, four groups of 18 students took four different RC tests: the 1st group with the Ss, the 2nd group with the So, the 3rd group with the Os, and the 4th group with the Oo.

Procedure

As mentioned earlier, to test how the two RC branching directions could influence learners' understanding of the sentence and their ability to retain information in the matrix clause, learners were required to answer five wh-questions: *who, when, where, which*, and *what happened/what do people think*, based on the four types of RC. Below is an example of one set of questions which appeared in the test:

(q) Ss: The girls {who speak Japanese} are my cousins.
Os: My cousins are the girls {who speak Japanese}.
Question: Who are the girls?

Based on (q), the participants' ability to comprehend and memorize information in the main clause was measured by the 'who' interrogative sentence. During the test, each group of participants followed the same process as follows. First, they had 30 seconds to read each relative clause sentence, which was projected on the screen. Then, they had another 10 seconds to read the question directly related to the sentence previously shown. Finally, students were allowed an additional 20 seconds to write down their answers to the question posed. Each group took less than 10 minutes to finish all of the six sentences in each RC group. The figure below summarizes the procedure outlined above:

Figure 2: Steps for completing the test

Group 1: 18 students **6 Ss RCs** 30 seconds to read the sentence 10 seconds to read the question 20 seconds to write the answer	Group 3: 18 Students **6 Os RCs** 30 seconds to read the sentence 10 seconds to read the question 20 seconds to write the answer
Group 2: 18 students **6 So RCs** 30 seconds to read the sentence 10 seconds to read the question 20 seconds to write the answer	Group 4: 18 Students **6 Oo RCs** 30 seconds to read the sentence 10 seconds to read the question 20 seconds to write the answer

This section may be summarized as follows: a total of 72 students had to complete the 24 test items intended to reveal difficulties concerning the internal structural complexity of English RCs. It also should be noted that careful consideration was taken to compare the test results of Group 1 & 2 with those of Groups 3 & 4 to determine any possible problematic branching direction.

Data Analysis

The data collected in this research were analyzed using both quantitative and qualitative methods. Quantitatively, responses to the comprehension test previously described were assigned a score of 1, 0.5, and 0 for all simple RC test items since they only

required a two- or three-word phrasal answer (e.g. *J-Town restaurant*). A score of 0.25 was added when grading responses to double RCs because answers at a sentential level were required (e.g. *they were kidnapped by a homeless guy*). A higher score represents a more accurate performance. Participants' responses were assigned a score of 1 if they were essentially correct (e.g. *August 15*). Changes that did not affect the content of the target answer were disregarded (e.g. changes in tense, number, or definiteness). A response earned a score of 0.5 if it included half of the information needed (e.g. *August*). A response was given a score of 0.25 if it contained a partially correct answer which covered less than 50 % of the information needed (e.g. *kidnapped*). Lastly, a score of 0 was recorded if the participant did not respond, or provided incorrect information (e.g. *school*-nothing is related to the fact that *the boys were kidnapped*). The total scores of each participant in the four RC groups were then added up and calculated to arrive at the mean. And to find out if the four groups were statistically different, a one-way ANOVA was conducted, with the sentence type (Ss, So, Os, Oo) as the between group variable.

And since the ANOVA showed a significant effect, pairwise comparisons (the Scheffe test) were applied to see whether there were any significance differences between any pair. A t-test was also performed on the mean of the center embedded/left branching and the right branching RC to determine if there were significant differences between the two groups, so that a conclusion could be drawn as to which direction was more likely to hinder language processing. As a final step in the quantitative analysis, those who received a score lower than half of the total were designated as failing the test. The participants who had a score higher than 50 % were identified as passing the test (Berk, 1996).

Qualitatively, incorrect responses (the score of 0) by the participants, who both passed and failed the test, underwent an error analysis. Analysis of the particpants'erroneous responses is useful because it allows for the identification of any aberrant processing strategies the participants may have used to interpret the test sentence. To complete the error analysis, the type of error made was grouped into different categories, including the misuse of head noun, part of the RC information, or verb phrase in the RC clause as their answers. However, only major tendencies were selected for a descriptive report in this paper.

IV. Results

Table 1 below provides an overview of the participants' performance in the comprehension test. The results indicate the number of those who passed the test in the 1st two groups (Ss, So) was clearly disproportionate when compared to the last two categories (Os, Oo). The same holds true with those who failed the test.

Table 1 The number of students who passed and failed the test

The four basic constructions	The percentage (%) of students who passed	The percentage (%) of students who failed
Ss	16.66 %	83.33%
So	11.11%	88.88%
Os	83.33 %	16.66%
Oo	33.33 %	66.66 %

More specifically, the number of participants in the Os and Oo who passed the test was significantly greater than that in the Ss and So. It was also seen that while the majority of students in the Os group

(83.33%) passed the test, less than half of the participants in the Ss, So, and Oo (16.66%, 11.11%, 33.33%) could do so. In the below table, readers will observe the mean of each RC pattern:

Table 2 The mean for correct scores of each RC type

Correct Scores	Mean	Std. Deviation	N
Ss	1.97	1.02	18
So	1.76	0.84	18
Os	3.55	0.78	18
Oo	2.47	0.89	18

As seen above, the mean for the four patterns was: 1.97 for the Ss, 1.76 for the So, 3.56 for the Os, and 2.47 for the Oo respectively. Each group, moreover, differed from the others as revealed by the one-way ANOVA ($F(3, 68) = 14.45$, $p=0.00^*$). According to these variations in mean, participants received the lowest mean score in the So group; the highest mean was recorded in the Os category. This is an indication that the So was more likely to cause tremendous difficulties among the participants; whereas the Os appears to be the easiest of all. Also importantly, the means listed in Table 2 illustrate an apparent order of difficulty encountered by the participants as follows:

So > Ss > Oo > Os.

As the order shows, the So was found to be the most difficult to understand, followed by the Ss, then the Oo and finally the Os. Reflecting on the means of these 4 RCs also posed another interesting question: whether or not the effect of 'embeddedness' (left vs. right branching) was greater than that of the focus/function (subject vs. object relatives).

Recall that the participants' performance on subject embedded RCs — (Ss (Mean=1.97), So (Mean=1.76) — results in a mean of 1.86 between them. Likewise, the mean of their performance on object embedded RCs (Os (Mean=3.55, Oo (Mean=2.47) is 3.01. The difference between the two means is 1.15. Also, the mean of the participants' performance on subject focus RCs (Ss (Mean=1.97, Os (Mean=3.55) is 2.76. The mean of their performance on object focus RCs (So (Mean=1.76, Oo (Mean=2.47) is 2.16. Therefore, the difference between the two means is 0.64. A comparison of the two mean differences (1.15 & 0.64) shows that embeddedness (1.15) carries a greater weight than focus (0.64), implying that embeddedness (left vs. right branching) would be a better predictor of learning difficulties faced by L2 learners than the focus (subject vs. object relatives). Looking closely at the embeddedness, the t-test was applied to the mean scores of the subject embedded (or left branching RCs) and the object embedded (or right branching RCs) to determine if the two groups were significantly different:

Table 3 The t-test results of the means of the Ss+ So and Os+Oo groups

Branching Direction	N	Mean	Std. Deviation	t-test	Sig
Left					
Ss+So	18	1.86	0.69	-5.47	0.00*
Right					
Os+Oo		3.01	0.52		

*P<0.05

Table 3 shows that the mean of the right branching (3.01) was significantly higher than the one obtained for the left branching

(1.86), a good indication that the object embedded RCs (or right branching) were less likely to interrupt language comprehension.

As previously stated, since the ANOVA revealed a significant effect of the 4 RC types (F (3, 68)= 14.45, p=0.00*), pairwise comparisons were performed afterwards and showed that difference between the Os and Ss (p=1.58*), the Os and So (p=1.79*), and the OS and Oo (p=1.08*) were significant. In other words, the participants performed best on the comprehension test of the Os RCs, as their scores were significantly higher than those obtained from the Ss, So, and Oo tests. In order to take a closer look at this apparent tendency, the participants' answers were reviewed. And not surprisingly, after reading the Ss and Os in (r), different outcomes were found:

(r) Ss: The girls **{**who speak Japanese**}** are my cousins.
Os: My cousins are the girls **{**who speak Japanese}.
Question: Who are the girls?

Upon encountering the (Os), most participants had no problems writing *"your cousin."* An answer of "*my cousin*" to the question posed was also accepted. However, the participants had more comprehension problems with sentences like (Ss), for which they produced incorrect, incomplete, or unexpected answers. These responses surely deviated from the target norm. Examples included "*my, the girls speak Japanese,* or *she speaks Japanese,"* instead of the expected responses -- "my cousin or 'your cousin."

Similar difficulties were also observed when *wh*-pronouns were the objects of the RCs, even though the means of the So and Oo were not significantly different. The following examples illustrate this point:

(s) So: J-Town restaurant {, which you recommend,} is where Sam usually
has lunch at.

Oo: Sam usually has lunch at J-Town restaurant {, which you recommend.}

Question: Where does Sam usually have lunch?

After reading the So sentence, there had been a tendency for the participants to give inaccurate information as in "*J, restaurant, or town,*" instead of "*J-town restaurant*." When interacting with the Oo type, however, the participants could answer the question without showing many signs of not remembering what was said in the main clause. Regarding the pairwise comparisons, it was found that they revealed a significantly greater mean for the Os than the Oo. This tendency, to a certain degree, would suggest more difficulties attached to the object relatives in which the relative pronoun is the object in the subordinate clause. However, the same tendency does not hold true for the center-embedded or left branching RCs. At this point, it should be noted that reviewing the test's responses could lead to another observation regarding double RCs. The results show that most of the participants failed to provide answers to the sentences containing double RCs (those containing two RCs, also refer to (l) for the example of this RC type) in both branching directions. This might be an indication that the participants did not understand the whole sentence with double RCs, no matter in which direction the RCs moved.

The general tendencies reported earlier would therefore imply that the position of *wh*-pronoun (focus) might in itself be insufficient, or carry less weight, as an indicator of learning difficulties or challenges experienced by language learners. Specifically, the processability of RCs was decidedly prone to a RC branching direction (embeddedness), regardless of whether its head

noun appeared in the subject or object position. In order to gain a complete understanding of how the participants processed the two RC branching directions, in addition to looking at their correct responses, an analysis of erroneous answers might provide a clearer picture of what went wrong in the minds of the participants. Recall that erroneous responses were analyzed qualitatively to identify any major emerging tendency in the data collected. It may also be beneficial to reiterate that when all the responses assigned an O mark were examined, it was found that a much larger number of errors fell into the center-embedded/left branching group, whilst those in the right branching were kept to a minimum. The analysis interestingly showed that the left branching RCs led mostly to no responses, a phenomenon that confirmed the fact that participants had a hard time retaining information described in the main clause. The following table will illustrate this point:

Table 4 Common errors made by the participants in two different branching directions

Center-embedded/left branching	**Right branching**
1. No responses	1. The use of subjects of the main clause
2. The use of verb phrase in the RCs	2. The use of verb phrase in the RCs
3. Creating a new piece of information	3. No responses

And in instances where answers were given in response to the left branching RCs, errors were related to the overuse of

information in the verb phrase of the subordinate clause (e.g. "*picking pears*"). This particular bit of information seemed distant from what was expected as a target answer, which could instead be found in the main clause, either in the subject or object position. More surprisingly, pertaining to the same left branching RCs, the participants exhibited a strong inclination to create a new piece of information out of the materials presented in the test item (e.g. *"teachers at school,"* out of *"an evening class at the school where I teach"*). In contrast, the analysis of erroneous responses found in the right branching RCs indicated that the participants tended to rely on the subject of the main clause as their answers, the position in which some required answers could be found. One final remark should be made here: in examples of both right and left RC directions, the participants were likely to remember information found in the first part of the sentence (or point of departure), whether or not it would yield the desired response.

V. Discussion

Overall, the findings emerging from the present study seem to support the hypothesis that affirms the tendency of RCs in the left direction to interrupt the flow of information in the matrix clause. However, the hypothesis that suggested there are more difficulties related to object RCs than the subject ones lacked substantial corroboration. The findings also were largely in line with previous works such as those of Kuno (1970) and Kidd and Bawin (2002). According to Kuno, the left-branching (Ss and So) was more difficult to process compared to the right branching ones mainly because it appears between the subject and the main verb, overturning the normal order of SVO. Kuno (1975) goes on to assert that processing center embedded RCs is perceptually more demanding than right branching RCs since it interrupts visual

processing. Kidd and Bawin (2002) also found evidence that learners of English tended to use the right-branching RCs more often than the left-branching ones mainly because they were a lot easier to process. This tendency was also confirmed by the results of the current work where the means of RC moving towards the end of the sentence were significantly higher than those of the RCs occurring in the initial portion of the sentence.

The likelihood of a better performance on a comprehension test regarding the Os and Oo structures finds further support in the tenets of *Processability Theory* as outlined in Gass, Behney, and Plonsky (2013). Processability Theory, in its simplest formulation, proposes that production and comprehension of L2, or second language forms, can happen only if they can be handled by the linguistic processor (Pieneman & KeBler, 2012). To understand how the processor works, a person may need to rely on several processing mechanisms, one of which is known as "*canonical order strategy*." This posits that "strategies that separate linguistic units require greater processing capacity than strategies that involve a direct mapping onto surface strings" (Gass, Behney, & Plonsky, 2013, p. 253). In the current work, since the Ss and So RCs manifest themselves between the linguistic units of the subject and the verb in the basic syntactic ordering of SVO, they demand greater processing capacity by the learners if compared to the Os and Oo, where RCs appear after the final element of the SVO. Look at the following examples:

(t) So: The man {whom you met} is my teacher.

Oo: My teacher is the man {whom you met}.

It was observed here that the So posed more comprehension difficulties than the Oo for the participants in this study. This is in

part because the participants have to rely on the RC that separates a linguistic unit of subject (*the man*) and the main verb (*is*) in the So to help them identify the head NP. This will subsequently impose a burden on working memory and ultimately disrupt comprehension, depleting the limited memory capacity of readers. Conversely, by putting the RC at the end of a sentence (Oo), the main clause is keep intact without undue interruption by the RC.

The basic word order of English familiar to most speakers is SVO. The RC is a device of post-modification using relative pronouns that may, under certain circumstances, be omitted. Consequently, the RCs located between the subject and verb of the matrix sentence seem to block the flow of information in the main clause, which in turn imposes difficulties in language processing. This commonly occurring phenomenon, furthermore, might be linked to a concept involving a cognitive strategy called *Closure*. Closure then may be added to the explanation why the left direction is readily associated with reduced comprehension. Closure is defined by Prideaux and Baker (1986) as "the tendency speakers of English have to consider clauses as complete once they have met certain semantic and syntactic requirements" (William, 1994, P 48). Consider this example from William:

(u) John {,worried he was late,} rushed out.

In this sentence, readers are likely to consider "*John worried he was late*" as a complete clause since it contains a subject, verb, and object--the basic grammatical requirements of a transitive clause. Hence, upon encountering "*rushed out,*" readers must reread the clause and reinterpret the syntactic role originally assigned to each word.

This complication similarly occurs when RCs come between the subject and the main clause. In the test sample below, the

clause "*The boy was born on August 15*" is interrupted, and therefore is not an easy task for readers to establish closure for this particular sentence.

(v) The boy **{**who is picking pears} was born on August 15.

To avoid violating this cognitive constraint and facilitate comprehension, RCs should follow the last NP or final element of a sentence in the right direction. This kind of structure ensures that the RC does not block the construction of the basic SVO pattern. It would conform, moreover, to the *Maxim of End Weight*: "put heavy or complex constituents at the end of a clause or sentence" (Leech, 1983, as cited in Nuamthanom, 2003. p 232).

The analysis of data in this work also revealed the hierarchy of difficulty as follows: So, Ss, Oo, and Os. The most difficult structure was the So and the Os was the easiest. This seems to be at variance with previous work such as that of Park (2000), who found the order of difficulty to be Ss (the most difficult), So, Os, and Oo (the least difficult) . However, the finding obtained in this research may appear closer to Park's in the sense that center embedding is more difficult than the right branching. The hierarchy of difficulty observed in this work also runs counter to the prediction of the NPAH, which posits that the direct object relatives (So, Oo) are more difficult than the subject relatives (Ss and Os). In contrast to the NPAH, participants in the Oo group were likely to outperform those in the Ss one. The order of difficulty in this work should therefore be accounted for by reference to other theories such as the NVN strategy proposed by Bever's (1970, as cited in Marefat and Rahmany, 2009). This strategy states that the Os and Oo RCs are easier than Ss and So RCs since they are not interrupted and can thus be processed by the NVN (Noun Verb Noun) strategy. Among these four RC types, based on this strategy, the So should

be the most complex structure since it carries the V V sequence with little indication of the roles of the associated nouns. The following example will illustrate this point:

(w) So: The man whom you met is my teacher.
N Pron. V V N
Ss: The girls **{**who speak Japanese**}** are my cousins.
N V N V N
Oo: My teacher is the man whom you met.
N V N Pron. V
Os: My cousins are the girls **{**who speak Japanese}.
N V N V N

In common with the So, the Oo type contains the N Pron. sequence, which could make it more difficult than the Os since the second Pron. may block the noun-verb-noun, corresponding to the subject-verb-object common form.

Identifying the So as the most difficult RC type in this work can also be explained by the Perspective Shift Hypothesis proposed by MacWhinney and Pleh (1998). This hypothesis asserts that the unmarked processing tendency of speakers and listeners is to see themselves as actors in the world. Therefore, if the process of perspective sharing of the actors is violated by interruption, a breakdown in communication will occur. In English, since the perspective expressed by a clause generally is taken from its subject, it is costly to shift perspective within a sentence (MacWhinney, 2005). In the So sentence examined earlier (w), comprehending this RC type requires two perspective shifts, the highest number of shifts among the four RC structures. First, readers have to make a shift from the perspective of the matrix subject (*the man*) to the subject of the RC (*you*), and then make another shift from the perspective of the subject of the RC (*you*) back to the matrix subject (*man*) after the RC is processed.

The final interpretation which will be offered here is still based on a close relationship between left branching RCs and processing difficulties. In this case, the RC introduced out of context in the subject position of this study's main clause would appear *new* for the readers since it was not relevant to any materials in the sentence. Structuring information in this way thus violates the *given-new* strategy introduced by Clark and Haviland (1977, as cited in Kanpracha and Kimura, 2014). These scholars said research indicates that readers read more easily if each sentence starts with (or at least contains) what they know (*given/old*) and proceeds to what they do not know (what is *new*). Thus departures from the *given-new* strategy decreases the readability of the text.

VI Conclusion

The current study has measured the comprehension of center-embedded/left branching RCs and its right branching counterpart of Thai EFL learners at the university level. The major research tool employed in this work specifically distinguishes itself from previous studies in that the contents in the RC and matrix clauses were systematically manipulated to contain a similar degree of meaning in both RC branching directions. Carried out in this format, the study is able to highlight the roles of the embeddedness (the head noun in the matrix clause) and the focus (the pronoun in the RCs) in predicting any learning difficulties faced by adult EFL learners. It was found that the incorrect, incomplete, or deviant responses the participants under investigation adopted were predominately a result of interacting with the RCs nested into the left direction or occurring in the subject position of the main clause. To a large degree, after reading the left branching RCs, the

participants had extraordinary difficult retaining / memorizing / retrieving information found in the main clause.

With acceptance of this major research finding as a starting point, language teachers may consider introducing the right branching RCs prior to its left branching structure as they are easier to process. Elements of this strategy are present in Krashen's (1985) second language acquisition hypothesis, known as the Natural Order Hypothesis (cited in Gass, Behney, and Plonsky, 2013). This hypothesis states that a varying portion of any given language is acquired in a predictable order. Certain grammatical structures are acquired early, whereas others are acquired later in the process. According to this, language teachers should be aware that particular structures of a language are easier to acquire than others. Thus language structure should be taught in an order that is conductive to better learning. Teachers may begin by first encouraging language concepts that are relatively easy for learners (Os, Oo), and then move on to more difficult concepts (Ss, So). More specifically, the Os and Oo are easier than the Ss and So mainly because they are in accordance with the basic word order of English, the SVO, that most speakers are familiar with.

It is also important to incorporate into classroom lessons the more meaningful and communicative aspects of English RCs. This can be achieved by employing various methods which would include introducing the notion that subject relatives, such as the Os, are easier to comprehend because of their canonical word order. The order of subject and object, for example, or agent and patient is similar to simple transitive sentences. In particular, learners can arrive at the right interpretation of this type of RC when they assign the first NP the agent and the second NP the patient role, as in simple transitive sentences. In contrast, when working on the object relatives such as the Oo, students' awareness should be raised

regarding the fact that the agent-patient order found in canonical simple transitive is reversed; the patient expressed by the head NP precedes the agent expressed in the following RC. Finally, language teachers can make use of adult processing studies which suggest that the difficulties with object RCs, such as the So type (found as the most difficult type in this study), can be lessened when the clauses are attached to inanimate heads or when they contain pronominal subjects (e.g. "*the movie that you like"* is easier to comprehend than *"the girl who John likes"*). In other words, language teachers should be selective when introducing the examples of the So type. The RCs which are attached to the pronominal subjects should be preferred to those used to modify inanimate head nouns.

Looking at the general findings from a larger perspective, it is plausible to suggest that grammar instruction on English RCs should not only be based on the form (how it is used), but should incorporate the concept of use (when and why it is used) as well. This view of the study of grammar is emphasized by Larsen-Freeman (2001), who suggests that grammar is best presented in a manner that takes into account both the structure of the target language and its communicative use. "Grammatical structures not only have form (morpho-syntactic), they are also used to express meaning (semantics) in context-appropriate use (pragmatic)" (Larsen-Freeman, p. 252). Accordingly, language learners should not be exposed only to the context-reduced drill of sentence-combining. Rather, they should be provided with more opportunities to see how RCs can be used in different contexts to achieve various purposes such as identifying, characterizing, or naming referents. More meaningful lessons should be encouraged, including introducing discourse analysis or corpus-based study to help

students appreciate the specific use of various RC types such as subject relatives (Ss, Os) and objective relatives (So, Oo). For example, while subject embedded RCs (Os) are mainly used to provide *new* information about and characterize inanimate and animate heads nouns, the object embedded RCs (So) are most often used to ground an inanimate entity in discourse (Fox and Thomson, 1990).

Indeed, when we, as language teachers, understand our learner's challenges and undertake a critical assessment of our teaching materials, we will eventually be able to help them overcome the targeted difficulties and determine how to create the best possible materials and learning activities. As Krashen (1985) states acquisition of a second language calls upon meaningful interaction in the target language — natural communication — where speakers are aware not only of the form of their speech, but also their understanding of what they are saying and the messages they are conveying.

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Appendix I

The 4 Basic Relative Clause Construction Test

Left-branching	Question	Right-branching
Ss The girls who speak Japanese are my cousins.	**1. Who?** Who are the girls?	Os My cousins are the girls who speak Japanese.
So The man whom you met is my teacher.	Who is the man?	Oo My teacher is the man whom you met.
Ss The boy who is picking pears was born on August 15.	**2. When?** When was the boy born?	Os August 15 is the date on which the boy who is picking pears was born.
So The guy whom I kicked was shot last night.	When was the guy shot?	Oo Someone shot the guy whom I kicked last night.
Ss Kongjium district, which is located south of Ubon, is Surasak's hometown.	**3. Where?** Where is Surasak's home town?	Os Surasak's hometown is in Kongjium district, which is located south of Ubon.
So J-Town restaurant, which you recommend, is where Sam usually has lunch.	Where does Sam usually have lunch?	Oo Sam usually has lunch at J-Town restaurant, which you recommend.
Ss The red car, which is parked behind the building, is owned by Stephany.	**4. Which?** Which car does Stephany own?	Os Stephany owns the red car which is parked behind the building.
So The bank which I robbed two months ago was Siam Commercial Bank.	Which bank did you rob?	Oo Siam Commercial Bank was the bank which I robbed two months ago.

Left-branching	Question	Right-branching
Ss All passengers who were male were approached by the flight attendant.	**5. What happened?** What happened to the male passengers?	Os The flight attendant approached all passengers who were male.
So The woman whom I talked to at the concert was hit by a truck on the way back home.	What happened to the woman?	Oo A truck hit the woman whom I talked to at the concert on the way back home.
Ss Yesterday, the two boys who took an evening tutorial class at the school where I teach were kidnapped by a homeless guy.	**6. Double Rcs** What happened to the boys?	Os Yesterday, a homeless guy kidnapped the two boys who took an evening tutorial class at school where I teach.
So The twins whom you enjoy playing with in the park where I usually visit are adored by everyone.	What do people think of the twins?	Oo Everyone adores the twins whom you enjoy playing with in the park where I usually visit.