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# The role of animacy and language proficiency in the comprehension of English restrictive relative clauses by Iranian EFL learners: an emergentist approach

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## Abstract

Following an emergentist approach, the authors examined the comprehension of four different types of restrictive relative clauses (direct object/oblique vs. subject/indirect object) with animate/inanimate referents by Iranian EFL learners. To this end, an Oxford placement test and two sets of comprehension tests within a week's interval were administered. Of the two comprehension tests, one was used to examine the comprehension of direct object/oblique RC's with inanimate NP referents, and the other one investigated the understanding of subject/indirect object RC's with animate referents. The results of the first comprehension test showed that there was no significant difference in the comprehension of direct/oblique RC's with inanimate referents. But the result of the second comprehension test showed their better performance in the subject RC's than indirect object RC's with animate referents. The findings of the experiments showed that animacy influenced the processing difficulty of relative clauses which can be considered as a significant reasoning for these preferences or equalities. Current significant theories of relative clause processing can account for these results when additional assumptions are introduced showing that the possibility of semantically driven cues can be considered as a serious alternative.

**Keywords:** Subject RC, Object RC, Indirect object RC, Oblique RC, Emergentism

## Introduction

There have been a large number of studies on the acquisition of relative clauses over the last several decades. Relative clauses exert high demands on the syntactic resources of a language due to their diverse uses and functions (Cho and Lee 2016). As such, the study of the emergence of relative clauses in the acquisition of a foreign language provides us with insights into the nature of language learning and its development. In this regard, Keenan and Comrie (1977) provide us with the Accessibility Hierarchy. All languages have relative clauses in which the subject of the relative clause is related to a noun as in the main clause as in the English:

Newton was the man who discovered gravity.

A few languages do not permit relative clauses in which the object in the relative clause relates to the Noun. For example the English:

This is the book that Jack read.

would not be permitted in Malagasy. Still more languages do not allow the indirect object from the relative clause to relate to the Noun. The English sentence:

John was the boy they threw the ball to.

would be impossible in Welsh, for instance. Further languages cannot have relative clauses that relate to the noun via a preposition, as in:

They stopped the car from which the number plate was missing.

Or via a possessive; the English sentence:

He's the man whose car was stolen.

would not be possible in Basque. Unlike many languages, English even permits the relative clause to relate via the object of comparison as in:

The boy who Jack is taller than is my brother.

The Accessibility Hierarchy of Keenan and Comrie (1977) is represented concerning a series of positions for relativization:

**Subject > Object > Indirect Object > Object of Preposition > Genitive > Object of Comparison**

Subject relative clauses are available in all languages. But not all languages have relative clauses which come at the end of this hierarchy, for example, object of comparison relative clauses. Most languages must follow this order. If a language has object and genitive relative clauses, it must have the intervening indirect object and object of preposition relative clauses.

The majority of the studies have focused on the acquisition of subject and direct object relative clauses in first or second language acquisition. We further investigated indirect object and oblique relative clauses in learning a foreign language. Moreover, we studied the effect of the animacy of the referent on the acquisition of these types of restrictive relative clauses in English.

## **Background**

### **Emergentist approaches to language acquisition**

Emergentism as a recently general approach to language acquisition stresses the interaction between organism and environment and denies the existence of any pre-determined, domain-specific faculties or capacities. As such, it is an alternative to modular, 'special nativist' theories of the mind, such as theories of Universal Grammar (UG). According to emergentist approaches simple learning mechanisms, of the kind attested elsewhere in cognition, are enough to bring about the emergence of complex language representations.

Emergentist approaches to language learning can be divided into two types based on the dominant strategy that they adopt. On the one hand, there is an influential line of research that focuses on the importance of input (usage) for understanding how language acquisition works. Ellis (2002, 2006) provides an extensive discussion of this approach. On the other hand a smaller body of research explores the role of processor-working memory interface in language acquisition, addressing problems of learnability and development that have traditionally been the exclusive domain of UG-based work (O'Grady, et. al., 2007; O'Grady, 2008a, b).

### The traditional treatment of the acquisition of relative clauses

UG-based approaches have referred to factors like accessibility hierarchy, linear distance hypothesis, syntactic distance hypothesis, linear distance hypothesis, and syntactic effects in the acquisition of RC's.

The research on the acquisition of relative clauses showed that the comprehension and production of subject RC's such as 1(a) are easier than those of direct object RC's such as 1(b). (e.g. Diessel and Tomasello 2005; Friedmann et al. 2008; Keenan and Comrie's 1977; Kidd et al. 2007, O'Grady 1997, p. 174; Kim and O'Grady W. 2015; Sadighi, 1982).

(1) a. Subject relative clause

the lion [that \_ saw the zebra]

b. Direct object relative clause

the lion[that the zebra saw\_]

Previously, some researchers asserted that the internal structure of subject relative clauses makes them easier than direct object relative clauses to understand (e.g., O'Grady 1997, p. 174, and the references cited therein). Some researchers have asserted that it is easier for language learners of English, French, and Dutch to process subject relative clauses than object relative clauses. (e.g. Hakes et al. 1976; Wanner and Michael 1978; Frauenfelder et al. 1980; Holmes and O'regan 1981; Ford 1983; Frazier 1985; King and Marcel 1991; Cohen and Mehler 1996). Wanner and Maratsos (Wanner and Michael 1978) relate this finding to the filler-gap distance. Some researchers have noted that the observed developmental facts parallel the implicational relationships in Keenan and Comrie's (1977) relativization hierarchy (e.g. Eckman et al. 1988; Doughty 1991). This raises the question of why relativization of a subject should be less marked than relativization of a direct object and of why the acquisition process is affected by this difference. The UG-based literature on second language acquisition offers two proposals. Some researchers have attributed the contrasts in the difficulty of subject and direct object RC's to the differences in the depth of embedding of the clause-internal gap found in these patterns (O'Grady 1999; Wolfe-Quintero 1992). This suggestion relies on two phenomena(1) the gap in a relative clause must be related to its modified noun(Chomsky 1977; Gazdar et al. 1985; O'Grady 1997); and (2) the processing complexity of the structures depends on the number of syntactic nodes which are moved across. (O'Grady 1997:179; Collins 1994). This is referred to as the Structural Distance Hypothesis. On the other hand, Tarallo and Myhill (1983), Hawkins (1989) put forward a quite different idea by asserting that the processing difficulty of relative clauses depends on the linear distance between the gap and the head. This is referred to as Linear Distance Hypothesis. O'Grady et al. (2000) believed that Structural Distance and Linear Distance Hypothesis generate basically different claims about the factors related to developmental order in language acquisition. Determining which of these theories is right is hard in English where structural distance and linear distance overlap. Nevertheless, there is not such a difficulty in languages like Korean which has a different typological structure. It seems that UG-based views are somehow inefficient in their interpretations of the acquisition of relative clauses. We might need to look for a more accountable alternative. Such an alternative approach might be emergentism.

### The emergentist treatment of the acquisition of relative clauses

From an emergentist point of view factors like canonical word order, frequency, the length of the filler-gap dependency, the depth of the gap, and the place of the relativized element in a hierarchy of grammatical relations commonly employed in works on syntactic typology would affect the acquisition of RC's (Diessel and Tomasello 2000; Ozeki and Shirai 2007 p. 262; Goodall, 2002, p. 102; Grodner & Gibson, 2005, p. 262; Carnie 2013; Hawkins 2004, p.117).

Some researchers believe that the animacy of the head noun would affect the processing difficulty of relative clauses (Arnon 2005; Gennari and MacDonald 2008; Lau 2016; Mak et al. 2002; Roland et al. 2012, p. 480; Traxler et al. 2002). Kidd et al. (2007) assert that in the speech directed to children direct object RC's occur with an inanimate head, as in (2).

(2) the coke[(that) he drank].

Brandt et al. (2009) report that the comprehension of direct object RC's with inanimate heads is no more difficult than subject RC's. Thus, we are on the horn of a dilemma. If we compare subject RC's with direct object RC's that have an animate head, as in (1), we come up against the naturalness confound noted by Kidd et al. (2007). On the other hand, if we look at direct object RC's with an inanimate head, as in (2), we see that it is not different to process subject/object relative clauses. One way to solve this contrast is to compare relative clauses in which the referent is either animate or inanimate. We focus our attention in this paper on the two contrasts illustrated below.

(3) a. Subject RC

the girl[that \_ is passing a box to a woman]

b. Indirect object RC

the girl [that a woman is passing a box to\_]

(4) a. Direct object RC

the hat [that a girl tossed \_ onto the cushion]

b. Oblique RC

the hat [that a girl tossed the cushion onto\_]

The animacy of subjects and indirect objects is quite natural because they typically have an animate referent by being agents and recipients. Also, the contrast in (3) is entirely semantically reversible- it is just as likely for a 'girl to pass a box to a woman,' as it is for a 'woman to pass a box to a girl.' In the same manner, because direct objects and locative obliques normally have inanimate referents, they too are equally natural. Moreover, the patterns in (4) show the desired semantic reversibility- it is just as plausible 'to toss a hat onto the cushion' as it is 'to toss a cushion onto the hat.'

We study these contrasts using two comprehension tests that measure the participants' understanding of different types of restrictive relative clauses. We then report on these two comprehension experiments, the first involving the contrast between the direct object and oblique RC's and the second focusing on the subject and indirect object RC's.

This study is significant in that most of the previous studies have focused on the acquisition of subject and direct object relative clauses in first or second language acquisition. We further investigated indirect object and oblique relative clauses in learning a foreign language. Moreover, we adopted an emergentist approach by studying the effect of the animacy of the referent on the acquisition of these relative clauses. Knowing that

different types of relative clauses would create varying amounts of pressure on EFL learners' minds, the teachers would adapt their teaching strategies to such factors to come up with better results. Besides, if EFL teachers appreciate the effect of the animacy on the comprehension of relative clauses, they would be more effective in teaching relative clauses.

### 3 objectives of the study and research questions

This study investigated the role of animacy/inanimacy and proficiency in the comprehension of English restrictive relative clauses by Iranian EFL learners. Unlike most of the previous studies which followed a traditional view of grammar, this study was done from an emergentist point of view. The purpose of the study was to understand how animacy/inanimacy of the referent affects the comprehension of restrictive relative clauses at different proficiency levels. We also studied the effect of proficiency level on the acquisition of relative clauses. There were four types of relative clauses. Subject and indirect object relative clauses had animate referents. Direct object and oblique relative clauses had inanimate referents. The researchers of this study wanted to see if the Accessibility Hierarchy (Keenan and Comrie 1977) applied to Iranian language learners of English as a foreign language. They also investigated what psycholinguistic processes EFL learners followed while learning English.

Our research hypothesis was that Accessibility Hierarchy put forth by Keenan and Comrie (1977) would apply to Iranian EFL learners. Moreover, we believed that the animacy/inanimacy of the referent would affect the comprehension of English relative clauses by Iranian EFL learners. Finally, we hypothesized that proficiency level of the EFL learners would influence their language learning.

Our research questions were:

1. Is there any difference in the acquisition of different types of relative clauses looking for direct object/oblique RC's in the first set of tests and subject/indirect object RC's in the second test?
2. Does the animacy of the referent affect the acquisition of different types of relative clauses?
3. Does proficiency level affect the acquisition of different kinds of relative clauses?

## Method

### Participants

Ninety-two adult learners of English aged 18–25 participated in this experiment. They were students studying at Elementary, Intermediate, and Advanced levels at the Iran Language Institute (ILI), located in Shiraz, Iran. The students were all male. They had studied English at the ILI for six, twelve, and fifteen terms, respectively. Apart from their studies at the ILI and high school, they had no other experiences of formal learning of English.

### Instruments

Three tests were given to the participants: An Oxford Quick Placement test with multiple choice items was given to the participants to further verify their proficiency level.

They were divided into three groups of Elementary, Intermediate, and Advanced based on their scores (10–19), (30–39), and (50–60), respectively. The second test was a multiple choice comprehension test to measure their comprehension of the direct object versus oblique RC's. The test comprised of 10 items and was adapted from Houston (1978) and Kim and O'Grady W. (2015) (see the [Appendix](#)). It consisted of two blocks; each block had five randomly arranged comprehension questions. The questions in the first block were related to the extraction of direct objects, and those in the second one to the extraction of oblique objects. For example, question number one in (5) below was designed to measure the comprehension of direct object RC.

(5) The book that a boy is putting on a box is mine.

1. a. *The book is on a box.*
- b. *The box is mine.*
- c. *The boy is putting a box.*
- d. *The book is not mine.*

Students had ten minutes to answer the questions. The third test, a multiple choice comprehension test following the same application procedure and adapted from the same researchers, was used to measure the comprehension of subject/indirect object referents. This test, given a week after the second test, had ten items and consisted of two blocks. Each block had five randomly arranged comprehension questions. The first block dealt with the extraction of the subject and the second block with the extraction of the direct object. The participants had ten minutes to answer the questions. For example, question number one in (6) below was designed to measure the comprehension of subject RC.

(6) The boy who is giving a bag to Bob met Rodge.

- 1 a. *Bob met Rodge.*
- b. *Rodge is giving a bag to Bob.*
- c. *The boy met Rodge.*
- d. *Bob is giving a bag to Rodge.*

## Results

### Experiment 1

#### *Statistical analysis (direct/oblique RC's)*

Repeated measures ANOVA was run to analyze any possible differences between the comprehension of extraction from different parts of the sentence, i. e., direct object versus oblique RC's. Also, the effect of proficiency level on the comprehension of different types of RC's was studied. Therefore, in this analysis, we investigated the effect of proficiency level and RC type as two independent variables on the comprehension of different types of RC's as the dependent variable. As both direct object and oblique RC's have inanimate referents, the animacy factor was controlled. The purpose of this analysis was to understand if there were any differences in the comprehension of RC's with different types of referents. We also studied the interaction of level and RC type. The referents of both direct objects and oblique objects were inanimate. This is in contrast to the conditions in the next experiment where the referents of both subject and indirect objects were animate. Therefore, by comparing the results of the studies from direct/oblique objects with results from subject/indirect objects, we can investigate the effect of animacy on the comprehension of different types of relative clauses.

**Results of the first comprehension test on direct object/oblique NPS (Table 1)**

Table 1 shows the number of participants, the means and the standard deviations of the scores for direct object RC's and oblique RC's in the three proficiency groups of Elementary, Intermediate, and Advanced levels.

Results of the effects of the level, RC type, and their interaction are shown in the following table.

As Table 2 shows, a repeated measures ANOVA was conducted to assess the impact of two different types of RC's, i.e., direct object relative clause and oblique on participants' scores on the relative clause test across three levels (Elementary, Intermediate, and Advanced). There was no significant interaction between RC type and level, Wilk's Lambda = .945  $F = 2.580, p = .081$ . There was no significant effect of RC type, Wilks' Lambda = 0.986,  $p = .268$ . The effect of level was significant,  $F = 3.897, p = .024$ .

To see if there were any significant differences between the levels, Scheffe test was run.

As Table 3 shows, there was a significant difference between the Elementary and Intermediate levels at .044 level of significance.

**Experiment 2**

**Statistical analysis (subject versus indirect object)**

Repeated Measures ANOVA was conducted to assess the impact of two different types of RC's, i. e. subject versus indirect object on participants' scores on the relative clause test, across three levels (Elementary, Intermediate, and Advanced). In this analysis, we had two independent variables of RC type and level and one dependent variable of participants' scores on the relative clause test. As both subject and indirect object RC's had animate referents, animacy was controlled. The results of the repeated Measures ANOVA are shown below.

**Result of the second comprehension test on subject/indirect object RC NPs**

Table 4 shows the descriptive statistics for the relative clause test scores for the subject and indirect object RC's across three levels.

Table 4 shows the number of the participants, the mean, and the standard deviation for subject RC and indirect object RC at three levels of Elementary, Intermediate, and Advanced. As it is shown the mean increases as the proficiency goes up.

Table 5 shows the effect of RC type, level, and their interaction.

As Table 5 shows, there was no significant effect of the level,  $F = 2.377, p = .099$ . There was no significant interaction between RC type and level, Wilks' Lambda = .993,

**Table 1** Descriptive Statistics of Relative Clause Test Scores for Direct Object and Oblique RC's Across Three Level

RC Type Level	Direct Object RC			Oblique RC		
	Number	Mean	Standard Deviation	Number	Mean	Standard Deviation
Elementary	30	4.16	.74	30	3.90	.84
Intermediate	30	3.66	1.02	30	3.26	1.36
Advanced	32	3.84	1.13	32	4.09	1.05

**Table 2** The Effect of RC Type and Level on the Participants' Scores

Source	Direct Object & Oblique	Type III Sum of Squares	df	Mean Square	Wilks' Lambda	F	Sig.
RC type	Linear	.887	1	.887	.986	1.242	.268
Level	Linear	11.631	2	5.815		3.897	.024
RC Type* Level	Linear	3.684	2	1.842	.945	2.58	0.081

$F = .321, p = .726$ . There was a substantial main effect for RC type, Wilks' Lambda = .759,  $F = 28.247, p = .000$ , with participants showing higher scores for subject RC's (see Table 4). Looking at the means shows that the participants had a better performance on subject RC's compared with indirect object RC's (3.94 versus 3.08 respectively). This finding was different from what we found about the participants' performance on direct versus oblique RC's. The result is in line with the findings of Diessel and Tomasello (2005), Friedman, Belletti, and Rizzi (2008), and Kim & O'Grady (2015).

**Discussion**

Regarding the research question one 'Is there any difference in the acquisition of different types of relative clauses looking for direct object/oblique RCs in the first set of tests and subject/indirect object RC's in the second test?' The findings of this study were in line with Keenan and Comrie's (1977) Accessibility Hierarchy in which it is asserted that the comprehension of subject RC's is easier than the comprehension of indirect object RC's. The results of this study showed that the participants had better scores in the comprehension of subject RC's than indirect object RC's. AS for direct object versus oblique RC's, the results of this study showed that there was no difference in the comprehension of these RC types. This finding is not in line with Keenan and Comrie's Accessibility hierarchy in which it is asserted that the comprehension of direct object RC's is more accessible than oblique RC's.

Regarding the second research question 'Does the animacy of the referent affect the acquisition of different types of relative clauses?' We found that the animacy/inanimacy of the referent affects the acquisition of relative clauses. There was no difference in the comprehension of the direct object versus oblique object relative clauses because the referents were inanimate. But, there was a significant difference in the comprehension of subject relative clauses compared with indirect object relative clauses, which was due to the animacy of the referents.

Regarding the third research question 'Does proficiency level affect the acquisition of different types of relative clauses?' We found that there was a significant effect of level

**Table 3** The Results of the Scheffe Test

(L) Level	(J) Level	Mean Difference (L-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Elementary	Intermediate	.5667*	.2230	.044	.0114	1.1219
	Advanced	.0646	.2195	.958	-.4819	.6111
Intermediate	Elementary	-.5667*	.2230	.044	-1.1219	-.0114
	Advanced	-.5021	.2195	.079	-1.0486	.0444
Advanced	Elementary	-.0646	.2195	.958	-.6111	.4819
	Intermediate	.5021	.2195	.079	-.0444	1.0486



**Table 4** Descriptive Statistics for the Relative Clause Test Scores for Subject and Indirect Object RC's Across Three Levels

RC Type Level	Subject RC			Indirect Object RC		
	Number	Mean	Standard Deviation	Number	Mean	Standard Deviation
Elementary	30	3.60	1.32	30	2.80	1.58
Intermediate	30	3.86	.73	30	3.13	1.71
Advanced	32	4.34	.70	32	3.31	1.74

for the comprehension of the direct object versus oblique relative clauses. Proficiency level did not have any significant effect on the comprehension of subject versus indirect object relative clauses.

From an emergentist approach, a series of proposals have been put forward to interpret the contrasts in the processing difficulty of relative clauses. These proposals have mainly focused on five reasons: canonical word order, frequency, the length of the filler-gap dependency, the depth of the gap, and the place of the relativized element in a hierarchy of grammatical relations commonly employed in works on syntactic typology.

**Canonical word order effects**

Word order provides an insight into the subject RC advantage in English. Canonical word order facilitates the production and comprehension of relative clauses (Diessel and Tomasello 2000, 2005; Kidd et al. 2007; and MacDonald and Christiansen 2002, p. 40). As the example below illustrates, subject RC's differ from the direct object and indirect object RC's in maintaining the canonical subject-verb-complement order of English.

- (7) a. Subject RC.  
the man [that \_ is helping a boy].  
SUB VERB DO.
- b. Direct object RC.  
the man [that a boy is helping \_].  
DO SUB VERB.
- (8) a. Subject RC.  
the man [that \_ is throwing a ball to the boy].  
SUBJ VERB DO IO.
- b. Indirect object RC.  
the man [that a boy is throwing a ball to \_].  
IO SUBJ VERB DO.

**Table 5** The effect of RC Type and Level on the Participants' Scores

Source	Subject RC & Indir. Obj. RC	Type III Sum of Squares	df	Mean Square	Wilks' Lambda	F	Sig.
RC type	Linear.	33.58	1	.887	33.585	28.247	.000
Level	Linear	12.24	2	6.121		2.377	.099
RC Type* Level	Linear	.764	2	1.842	.382	.321	.726

Nevertheless, the Canonical Word Order Hypothesis cannot predict the similarity between the direct object and oblique RC's which have non-canonical word order.

(9) a. Direct object RC.

the bag [that a girl is placing \_ on a notebook].

DO SUBJ VERB OBL.

b. Oblique RC.

the bag [that a girl is placing a notebook on \_].

OBL SUBJ VERB DO.

The fact that there is no difference between the canonical word order in the direct object and oblique RC's in English explains why there is no difference between the comprehension of the direct object versus oblique RC's in English in our experiment.

### Frequency effects

As asserted by Ambridge and Kidd (2015), Hale (2001), and Levy (2008), there is a correlation between the frequency with which specific patterns occur in the input and the ease of production, comprehension, and acquisition of relative clauses. As for the relative clauses, we would hypothesize that the frequency of occurrence is relevant to the difficulty of relative clauses. According to Diesel (Diesel 2009, p.258) the frequency of subject and direct object RC's is far more than any other type of the relative clause in maternal speech. This is in line with our finding that subject RC's benefit from an advantage over their indirect object counterparts. But it does not justify the finding that oblique RC's are not more difficult than direct object RC's for EFL learners to comprehend. Kim, and O'Grady, W. (2015) assert that the Frequency Hypothesis may not offer a general explanation for the performance of children in the production of relative clauses. They note that a full account of RC's needs to explain not only why specific relative clauses are easier than others, but also why learners resort to the particular avoidance strategies while producing different types of relative clauses. One such approach involves passivization. In their study, for instance, English-speaking children passivized the verbs to create a subject RC.

(10) a. Targetted direct object RC.

the eraser [that the boy put\_ on the book].

b. Actual response after passivization.

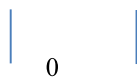
the eraser [that \_ was put on the book].

We should also pay attention to the frequency account for RC preferences in languages other than English. A case in point is the corpus studies done for Japanese. Ozeki and Shirai (2007, p. 262) report that the frequencies of subject, direct object, and oblique RC's are the same in the speech of a Japanese mother. So, if we find that subject RC's are easier to comprehend than direct object RC's in Japanese, we cannot relate it to the Frequency Hypothesis. Another factor which should be paid attention to is the type of verb used in the RC's. In our study, for instance, the verb takes three lexical arguments. It is therefore essential to see whether RC's of this sort occur in the input in quantities and proportions that might cause the preferences we have reported. It is important to note that it is hard to establish a causal relationship between input effects and language acquisition. In sum, input frequencies do not necessarily shape developmental asymmetries.

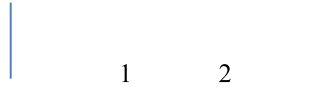
**Distance effects**

Many researchers like Goodall (2004, p. 102) and Hawkins (2004, p. 173) suggest that the processing difficulty of certain RC's depends on the distance between a gap and its filler. The more the number of elements that come between the filler and gap, the heavier the processing burden would be. (e. g. Gibson, 1998, 2000; Grodner & Gibson, 2005, p. 262; Lewis, Vasishth & Van Dyke, 2006; Warren & Gibson, 2002).

- (11) a. Subject relative clause.  
the man [ that \_ helped the boy ]

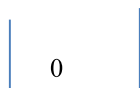


- b. Direct object relative clause.  
the man [ that the boy helped \_ ]



The filler-gap dependency in the subject RC can be resolved at minimal cost to working memory because there is just one intervening element (the complementizer that), which does not have a discourse referent. In the direct object relative clause, on the other hand, two items with discourse referents (the NP the boy and the verb help) intervene between the filler and the gap in the direct object relative clause, making it more difficult to process. In the same manner, subject RC's should also be easier than indirect object RC's, and direct object RC's should be easier than their oblique counterparts.

- (12) a. Subject RC.  
the boy [ that \_ is throwing a ball to Jack ]



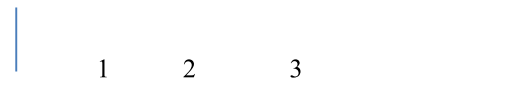
- b. Indirect object RC.  
the boy [ that Jack is throwing a ball to \_ ]



- (13) a. Direct object RC.  
the bag [ that a boy is placing \_ on a notebook ]



- b. Oblique RC.  
the bag [ that a boy is placing a notebook on \_ ]



Although the distance hypothesis correctly predicts that indirect object RC's are more difficult than subject RC's, it does not make a correct prediction about the equal ease of the comprehension of the direct object versus oblique RC's. Distance Hypothesis cannot make predictions about direct object versus oblique RC's.

**The depth hypothesis**

This hypothesis asserts that the depth of the filler-gap dependency is relevant to the difficulty of relative clauses (e. g. Hawkins 2004, p. 177; O’Grady 1997, p. 135). In English, subjects are higher than direct and indirect objects, while direct objects are higher than indirect objects and obliques, as depicted below in Fig. 1.

In a minimalistic view, this structure would be depicted in the form given below (Carnie 2013) in Fig. 2.

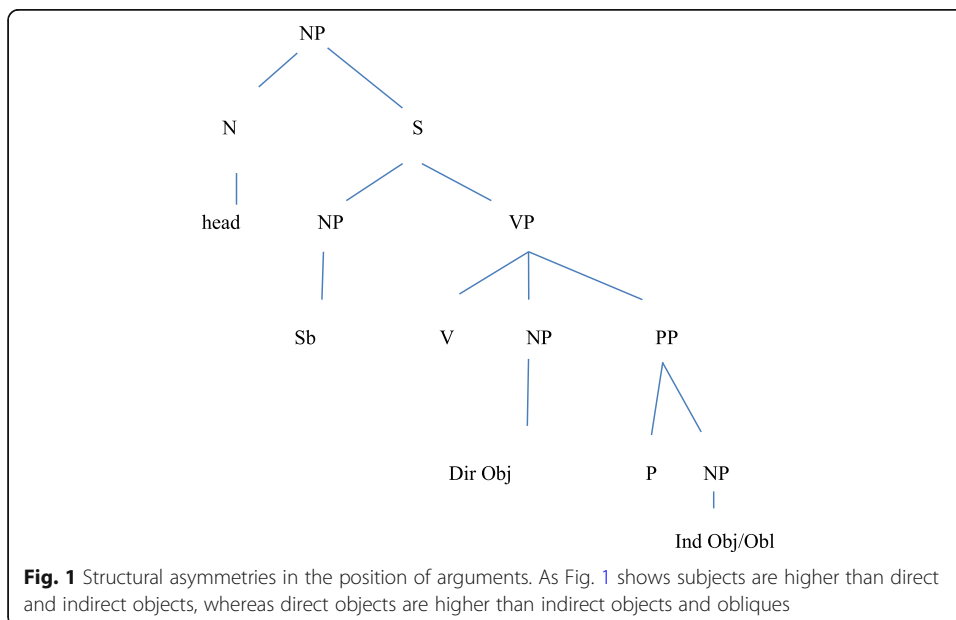
The depth hypothesis makes correct predictions about subject versus indirect object clauses in our study, but it cannot interpret the findings of our study about direct object versus oblique RC’s in the comprehension of which our participants did not show any significant difference. Elsewhere, Kim, and O’Grady, W. (2015) found that the depth account in SOV languages like Korean cannot make correct predictions about the comprehension of direct versus oblique RC’s. In their study, Korean children could perform better on test items that called for a direct object RC rather than oblique RC although direct object RC’s are at a lower position than oblique RC’s in the phrase structure of Korean language.

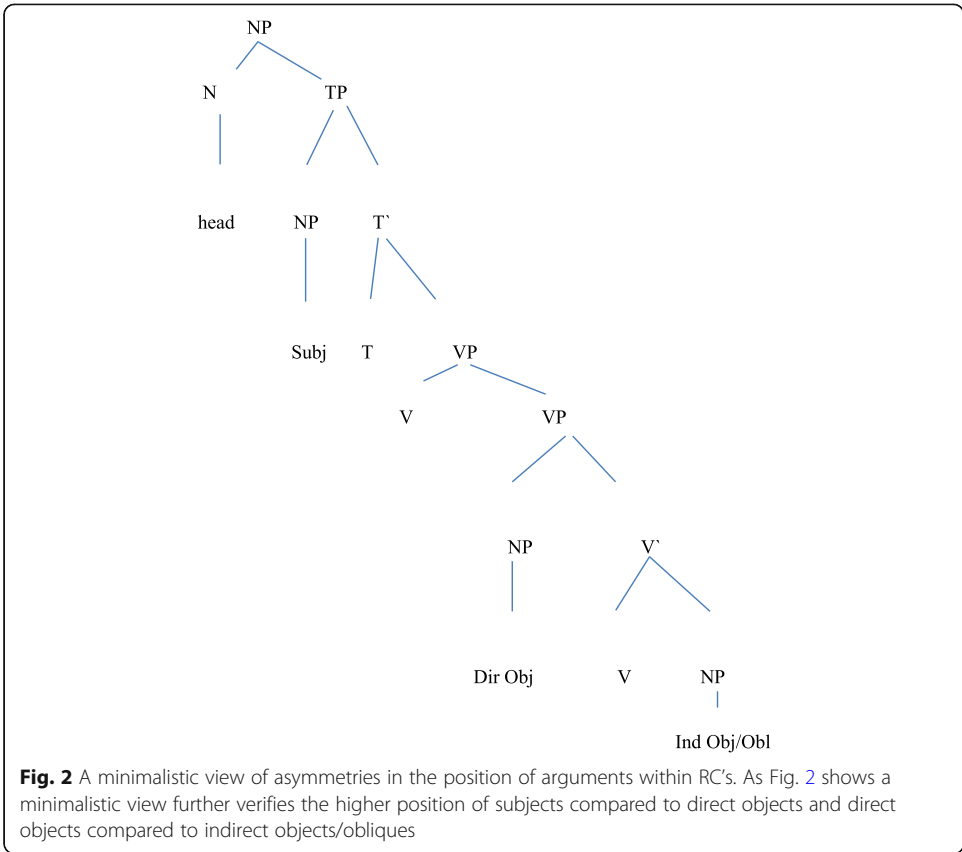
**Hierarchy effects**

Keenan and Comrie (1977) first proposed the accessibility hierarchy which is stated here in the revised format adopted by Hawkins (2004, p. 117).

(14) subject > direct object > indirect object/oblique.

In this study, we have studied two of the contrasts predicted by the hierarchy (subject > indirect object) and (direct object > oblique). This study proved the contrast (subject > indirect object), but the distinction (direct object > oblique) was not confirmed. It seems that we have to look at the effect of animacy on this hierarchy. In other words, we have to keep all the other conditions the same to see the hierarchy effect. The hierarchy might prove to be correct if we control the animacy of the referent. Kidd et al. (2007) propose that the





animacy of the head noun contributes to the difficulty of the direct object RC, although there are some other studies that have proven the generalization to be remarkably robust (Keenan and Hawkins 1987; and Hawkins 2007). But why should such asymmetries exist? Some proposals refer to processing considerations (e. g. Chater and Christiansen 2010; Filipović and Hawkins 2013; O’Grady 2011). It is harder for language learners to process indirect object RC’s than subject RC’s and they exist in fewer languages than subject RC’s do. In this regard, the next problem is to identify the factors that underlie the inferred processing difficulty. Factors like canonical word order, frequency, linear distance, depth of embedding, and hierarchy effects are, to some extent, among the reasons for such asymmetries.

The mapping of referents onto grammatical relations reflects something important about the organization and distribution of information. In a sentence like (15a), Tom is emphasized as the subject, while in (15 b) Tom as the indirect object is not highlighted.

- (15) a. Tom was handed a note by John.
- b. John handed a note to Tom.

In the same line, in a sentence like (16a) where the locative is the direct object the truck is highlighted in a way that is not possible in (16b), where it is an oblique.

- (16) a. We loaded the truck with timber.
- b. We loaded timber onto the truck.

There have been different studies that describe the sort of contrasts that are highlighted here, including topicality, perspective, salience, given information, thematic prominence, profiling, centre of attention, and empathy. O’Grady (Kim, and O’Grady, W. 2015) presents two widely held assumptions:

1. *Relative clauses must be about the referent of their head noun* (e. g. Kuno, 1976; MacWhinney 2005)
2. *A clause's subject is the default topic* (Aissen, 1999; Lambrecht, 1994, p. 136), *while its direct object constitutes a less prominent topic* (e. g. Givon, 1984, pp. 138, 170–171).

Altogether, these assumptions suggest that construing a relative clause about its default topic (the subject) is more economical than interpreting it about some other elements (cf. Hsu et al. 2009, pp. 350–351; MacWhinney 2005; Mak et al. 2006, Mak et al. 2008; O'grady 2011, p. 20; Zukowski 2009, p.34). As a result, if we control the other factors, a subject RC should be most accessible of all.

## Conclusions

There have been a large number of studies about the production, comprehension, and acquisition of relative clauses over the past quarter century which have failed to provide a single explanation about the problem (Gennari and MacDonald 2008; Hawkins 2007; Kidd et al. 2007).

The results of our study show that the comprehension of subject RC's is easier than indirect object RC's for Iranian EFL language learners, while there is no difference in the comprehension of direct object RC's versus oblique RC's with inanimate referents. This would bring us to the following hierarchy:

(17) subject > indirect object.

direct object = oblique.

This finding raises a series of new questions. First, we should see if the asymmetries found in English are universal. In this regard, we have to pay attention to languages for which a non-subject advantage has been reported for acquisition – e.g., Basque (Gutierrez-Mangado 2011), Cantonese (Chan et al. 2011), and Japanese (Ozeki and Shirai 2007). Second, it is essential to investigate the source of the hierarchy effects (Hawkins 2004; & O'Grady 2011). Further explanation of these matters will highlight the factors that facilitate or hinder the acquisition of relative clauses.

Pedagogically, the findings of this study would be beneficial to EFL teachers and testers. If teachers know that certain kinds of relative clauses are harder to understand and learn for students, they will put more emphasis on teaching such relative clauses. Moreover, knowing that the animacy of the head noun would affect the acquisition of relative clauses, language teachers would implement this factor into their teaching techniques.

On the other hand, EFL testers would pay more attention to such hierarchies in the acquisition of relative clauses while preparing language tests. Knowing that certain kinds of relative clauses are harder to process for EFL learners, language testers would pay close attention to the item difficulty of the tests and the students' ability level in answering such questions.

## Appendix

### A Experiment 1

**The book that a boy is putting on a box is mine.**

1. a. *The book is on a box.*
- b. *The box is mine.*
- c. *The boy is putting a box.*
- d. *The book is not mine.*

**The hat that the boy tossed onto the cushion fell down.**

2. a. *The boy tossed the cushion.*
- b. *The boy tossed the hat.*
- c. *The cushion fell down.*
- d. *The boy fell down.*

**The sock that a boy is dropping into a basket is red.**

3. a. *The sock is red.*
- b. *The basket is red.*
- c. *The boy is dropping a basket.*
- d. *The basket is dropping into the sock.*

**The bag that a boy is placing on a notebook is bought by the girl.**

4. a. *The boy bought the book.*
- b. *The girl bought the book.*
- c. *The notebook is in the bag.*
- d. *The girl is placing a notebook.*

**The water that a boy is pouring into the girl's juice is fresh.**

5. a. *The water is fresh.*
- b. *The juice is fresh.*
- c. *The boy is pouring juice.*
- d. *The girl is pouring juice.*

**The notebook that a boy is placing a bag on is torn.**

6. a. *The boy is placing a bag on the notebook.*
- b. *The notebook is on the bag.*
- c. *A bag is torn.*
- d. *The notebook is not torn.*

**The box that the boy put the book on is brown.**

7. a. *The book is on the box.*
- b. *The book is brown.*
- c. *The boy put the box.*
- d. *The box is not brown.*

**The blanket that the boy laid the sweater on was similar to Jone's.**

8. a. *The sweater is on the blanket.*
- b. *The sweater was similar to Jone's.*
- c. *The blanket is Jone's.*
- d. *The boy laid the blanket.*

**The table that the boy pushed the couch toward is broken.**

9. a. *The boy pushed the table.*
- b. *The boy pushed the couch.*
- c. *The couch is broken.*
- d. *The table is not broken.*

**The letter that a boy is hiding a photo under is torn.**

10. a. *The boy is hiding a photo.*
- b. *A photo is torn.*
- c. *The letter is under a photo.*
- d. *The letter is not torn.*

*B Experiment 2.*

**The man that knows Bob killed his brother.**

1. a. *The man killed his brother.*
- b. *Bob killed his brother.*
- c. *The brother killed Bob.*
- d. *The man killed Bob.*

**The boy who is giving a bag to Bob met Rodge.**

2. a. *Bob met Rodge.*
- b. *Rodge is giving a bag to Bob.*
- c. *The boy met Rodge.*
- d. *Bob is giving a bag to Rodge.*

**The boy who is showing a hat to John visited my father.**

3. a. *John is showing a hat to the boy.*
- b. *John visited my father.*
- c. *The boy is showing a hat to John.*
- d. *John is showing a hat to my father.*

**The boy who is throwing a ball to Jack talked to Robert.**

4. a. *Jack talked to Robert.*
- b. *The boy talked to Robert.*
- c. *Jack is throwing a ball.*
- d. *Robert is throwing a ball.*

**The boy who is passing a box to a man saw the shopkeeper.**

5. a. *The boy saw the shopkeeper.*
- b. *The boy is passing a box to the shopkeeper.*
- c. *The boy saw a man.*
- d. *The boy is the shopkeeper.*

**The boy who Bob is handing a cup to broke the glass.**

6. a. *Bob broke the glass.*
- b. *Bob is not handing a cup.*
- c. *The boy is handing a cup to Bob.*
- d. *The boy broke the glass.*

**The boy who Jack is bringing a chair to visited George.**

7. a. *George is bringing a chair.*
- b. *Jack visited George.*
- c. *The boy visited George.*
- d. *Jack is not bringing a chair.*

**The boy who Johnathan is reading a book to ran into James.**

8. a. *The boy ran into James.*
- b. *James is reading a book.*
- c. *The boy is reading a book.*
- d. *Johnathan ran into James.*

**The boy who Alex is pushing a bicycle to resembled John's father.**

9. a. *John resembled his father.*
- b. *Alex resembled John's father.*
- c. *The boy is pushing a bicycle.*
- d. *Alex is pushing a bicycle to the boy.*

**The boy who Martin is lending an umbrella to explained the lesson to Patrick.**



10. a. *Martin explained the lesson.*
- b. *The boy is lending an umbrella to Patrick.*
- c. *The boy is lending an umbrella to Martin.*
- d. *Martin is lending an umbrella.*

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#### Availability of data and materials

The data is a set of scores that the participants obtained on a multiple-choice comprehension test of relative clauses in English. As the study was done in an EFL context the results cannot be extrapolated to other ESL contexts or to the context of English as a native language. Hence the researcher does not want to share the data. Moreover, the participants of the study did not allow the researcher to share the data.

#### Authors' contributions

All authors of the research had more or less equal contributions in the process of conception and design, acquisition of data, and analysis and interpretation of data. They have all been involved in revising the manuscript critically to the same extent. They all take public responsibility for the whole content. All are equally accountable for all aspects of the work. All authors read and approved the final manuscript.

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#### References

- Aissen, J. (1999). Markedness and subject choice in Optimality Theory. *Natural Language and Linguistic Theory*, 17, 672–711.
- Ambridge, B., & Kidd, E. (2015). The ubiquity of frequency effects. *Journal of Child Language*, 42, 239–273.
- Arnon, I. (2005). Relative clause acquisition in Hebrew: towards a processing-oriented account. Paper presented at the Boston University conference on language development, Boston.
- Brandt, S., Kidd, E., Lieven, E., & Tomasello, M. (2009). The discourse bases of relativization: An investigation of young German- and English-speaking children's comprehension of relative clauses. *Cognitive Linguistics*, 20, 539–570.
- Carnie, A. (2013). *Syntax: a generative introduction* (3rd ed.). Boston: Wiley-Blackwell.
- Chan, A., Matthews, S., & Yip, V. (2011). The acquisition of relative clauses in Cantonese and mandarin. In E. Kidd (Ed.), *The acquisition of relative clauses: Functional and typological perspective* (pp. 197–225). Amsterdam: John Benjamins.
- Chater, N., & Christiansen, M. H. (2010). Language acquisition meets language evolution. *Cognitive Science*, 34, 1131–1157.
- Cho, D. W., & Lee, K. (2016). English relative clauses in science and engineering journal papers: A comparative corpus-based study for pedagogical purposes. *Lingua*, 3, 61–70.
- Chomsky, N. 1977. On W h-Movement. In P.W. Culicover, T. Wasow, & A. Akmajian (Eds.), *Formal Syntax* (pp. 71–132). New York: Academic Press.
- Cohen, L., & Mehler, J. (1996). Click monitoring revisited: An on-line study of sentence comprehension. *Memory and Cognition*, 24, 94–102.
- Collins, C. (1994). Economy of derivation and the generalized proper binding condition. *Linguistic Inquiry*, 25, 45–61.
- Diessel, H. (2009). On the role of frequency and similarity in the acquisition of subject and non-subject relative clauses. In T. Givón & M. Shibatani (Eds.), *Syntactic complexity* (pp. 251–276). Amsterdam: John Benjamins.
- Diessel, H., & Tomasello, M. (2000). The development of relative clauses in spontaneous child speech. *Cognitive Linguistics*, 11, 131–152.
- Diessel, H., & Tomasello, M. (2005). A new look at the acquisition of relative clauses. *Language*, 81, 1–25.
- Doughty, C. (1991). Second language instruction does make a difference. *Studies in Second Language Acquisition*, 13, 431–469.
- Eckman, F., Bell, L., & Nelson, D. (1988). On the generalization of relative clause instruction in the acquisition of English as a second language. *Applied Linguistics*, 9, 1–13.
- Ellis, N. (2002). Frequency effects in language processing. *Studies in Second Language Acquisition*, 24, 143–188.
- Ellis, N. (2006). Language acquisition as rational contingency learning. *Applied Linguistics*, 27, 1–24.
- Filipović, L., & Hawkins, J. A. (2013). Multiple factors in second language acquisition: The CASP model. *Linguistics*, 51, 145–176.
- Ford, M. (1983). A method of obtaining measures of local parsing complexity throughout sentences. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 9, 203–218.
- Frauenfelder, U., Segui, J., & Mehler, J. (1980). Monitoring around the relative clause. *Journal of Verbal Learning and Verbal Behavior*, 19, 328–337.
- Frazier, L. (1985). Syntactic complexity. In D. Dowty, L. Karttunen, & A. Zwicky (Eds.), *Natural language processing: Psychological, computational and theoretical perspectives* (pp. 129–189). Cambridge: Cambridge University Press.

- Friedmann, N., Belletti, A., & Rizzi, L. (2008). Relativized relatives: types of intervention in the acquisition of A-bar dependencies. *Lingua*, 119, 68–78.
- Gazdar, G., Klein, E., Pullum, G., & Sag, I. (1985). *Generalized phrase structure grammar*. Cambridge: Harvard University Press.
- Gennari, S., & MacDonald, M. (2008). Semantic indeterminacy in object relative clauses. *Journal of Memory and Language*, 58, 161–187.
- Gibson, E. (1998). Linguistic Complexity: Locality of Syntactic Dependencies. *Cognition*, 69, 1–76.
- Gibson, E. (2000). The Dependency Locality Theory: a Distance-based Theory of Linguistic Complexity. In Y. Miyashita, A. Marantz, & W. O. Neil (Eds.), *Image, Language, Brain* (pp. 95–126). Cambridge MA: MIT press.
- Givon, T. (1984). *Syntax: a Functional-Typological Introduction* (Vol. I). Philadelphia: John Benjamins.
- Goodall, G. (2002). OKn the Syntax and Processing of Wh Questions in Spanish. In A. K. Chand, A. Radrigues, & B. Schmeiser (Eds.), *proceedings of the West Coast Conference on Formal Linguistics* (pp. 101–114). Somerville, MA: Cascadilla press.
- Goodall, G. (2004). On the syntax and processing of wh-questions in Spanish. In V. Chand, A. Kelleher, A. Rodríguez, & B. Schmeiser (Eds.), *Proceedings of the west coast conference on formal linguistics* (pp. 101–114). Somerville: Cascadilla Press.
- Grodner, D., & Gibson, E. (2005). Consequences of the Serial Nature of Linguistic Input for Sentential Complexity. *Cognitive Science*, 29, 261–290.
- Gutierrez-Mangado, M. (2011). Children's comprehension of relative clauses in an ergative language: The case of Basque. *Language Acquisition*, 18, 176–201.
- Hakes, D. T., Judith, S. E., & Linda, L. B. (1976). Understanding sentences with relative clauses. *Memory and Cognition*, 4, 283–290.
- Hale, J. (2001). A probabilistic early parser as psycholinguistics model. In *Proceedings of the second meeting of the North American chapter of the Association for Computational Linguistics* (pp. 1–8). Pittsburgh: Carnegie Mellon University.
- Hawkins, J. (2004). *Efficiency and complexity in grammars*. Oxford: Oxford University Press.
- Hawkins, J. (2007). Acquisition of relative clauses in relation to language universals. *Studies in Second Language Acquisition*, 29, 337–344.
- Hawkins, R. (1989). Do second language learners acquire restrictive relative clauses on the basis of relational or configurational information? The acquisition of French subject, direct object and genitive restrictive clauses by second language learners. *Second Language Research*, 5, 156–188.
- Holmes, V. M., & O'regan, J. K. (1981). Eye fixation patterns during the reading of relative-clause sentences. *Journal of Verbal Learning and Verbal Behavior*, 20, 417–430.
- Houston, J. R. (1978). *The Acquisition of English Restrictive relative clauses by Native Speakers of Arabic* (PhD dissertation). Urbana-Champaign: University of Illinois.
- Hsu, C.-C., Hermon, G., & Zukowski, A. (2009). Young children's production of head-final relative clauses: Elicited production data from Chinese children. *Journal of East Asian Linguistics*, 18, 323–360.
- Keenan, E. L., & Comrie, B. (1977). Noun phrase accessibility and universal grammar. *Linguistic Inquiry*, 8, 63–99.
- Keenan, E. L., & Hawkins, S. (1987). The psychological validity of the accessibility hierarchy. In E. L. Keenan (Ed.), *Universal Grammar: 15 essays* (pp. 60–85). London: Croom Helm.
- Kidd, E., Brandt, S., Lieven, W., & Tomasello, M. (2007). Object relatives made easy: a cross-linguistic comparison of the constraints influencing children's processing of relative clauses. *Language & Cognitive Processes*, 22, 860–897.
- Kim, C. E. & O'Grady, W. (2015). Asymmetries in children's production of relative clauses: data from English and Korean. *Journal of Child Language*. Available on CJO 2015. <https://doi.org/10.1017/s0305000915000422>.
- King, J., & Marcel, A. J. (1991). Individual differences in syntactic processing: The role of working memory. *Journal of Memory and Language*, 30, 580–602.
- Kuno, S. (1976). Subject, theme, and the speaker's empathy - a reexamination of relativization phenomena. In C Li (ed.), *Subject and Topic*, (pp. 417–44). San Diego: Academic Press.
- Lambrecht, K. (1994). *Information structure and syntactic form: opic, focus and the representation of discourse referents*. Cambridge: Cambridge University Press.
- Lau, E. (2016). *Acquisition of relative clauses in Cantonese: A multi-factorial analysis*. (PhD dissertation). Manoa: University of Hawai'i at Manoa.
- Levy, R. (2008). Expectation-based syntactic comprehension. *Cognition*, 106, 1126–1177.
- Lewis, R., Vasishth, S., & Van Dike, J. (2006). Computational principles of working memory in sentence comprehension. *Trends in cognitive science*, 10, 447–54.
- MacDonald, M., & Christiansen, M. (2002). Reassessing working memory: a comment on Just & Carpenter (1992) and Waters & Caplan (1996). *Psychological Review*, 109, 35–54.
- MacWhinney, B. (2005). The emergence of grammar from perspective taking. In D. Pecher & R. Zwann (Eds.), *Grounding cognition* (pp. 198–223). Cambridge: Cambridge University Press.
- Mak, M. V., Vonk, W., & Schriefers, H. (2002). The influence of animacy on relative clause processing. *Journal of Memory and Language*, 47, 50–68.
- Mak, W., Vonk, W., & Schriefers, H. (2006). Animacy in processing relative clauses: The hikers that rocks crush. *Journal of Memory and Language*, 54, 466–490.
- Mak, W., Vonk, W., & Schriefers, H. (2008). Discourse structure and relative clause processing. *Memory & Cognition*, 36, 170–181.
- O'Grady, W. (1997). *Syntactic development*. Chicago: University of Chicago Press.
- O'Grady, W. (1999). Toward a new nativism. *Studies in Second Language Acquisition*, 21, 621–633.
- O'Grady, W. (2008a). Does emergentism have a chance? In H. Chan, H. Jacob, & E. Kipia (Eds.), *Proceedings of 32nd annual Boston University conference on language development* (pp. 16–35). Somerville: Cascadilla Press.
- O'Grady, W. (2008b). Innateness, universal grammar, and emergentism. *Lingua*, 118, 620–631.
- O'Grady, W. (2011). Relative clauses: Processing and acquisition. In E. Kidd (Ed.), *The acquisition of relative clauses: Processing, typology, and function* (pp. 13–38). Amsterdam: John Benjamins.
- O'Grady, W., Lee, M., & Choo, M. (2000). The acquisition of relative clauses in Korean as a second language. *The Korean Language in America*, 5, 345–356.
- O'Grady, W., Nakamura, M., & Ito, Y. (2007). Want-to contraction in second language acquisition: An emergentist approach. *Lingua*, 118, 478–498.

- Ozeki, H., & Shirai, Y. (2007). The consequences of variation in the acquisition of relative clauses: An analysis of longitudinal production data from five Japanese children. In Y. Matsumoto, D. Y. Oshima, O. W. Robinson, & P. Sells (Eds.), *Diversity in language: perspectives and implications* (pp. 243–270). Stanford: CSLI Publications.
- Roland, D., Mauner, G., O'Meara, C., & Yun, H. (2012). Discourse expectations and relative clause processing. *Journal of Memory and Language*, *66*, 479–508.
- Sadighi, F. (1982). *The Acquisition of English Restrictive Relative Clauses by Native Speakers of Persian* (PhD Dissertation). Urbana: Champaign: Illinois University.
- Tarallo, F., & Myhill, J. (1983). Interference and natural language processing in second language acquisition. *Language Learning*, *33*, 55–76.
- Traxler, M., Morris, R., & Seely, R. (2002). Processing subject and object relative clauses: evidence from eye movements. *Journal of Memory and Language*, *47*, 69–90.
- Wanner, E., & Michael, M. (1978). An ATN approach to comprehension. In M. Halle, J. Bresnan, & G. Miller (Eds.), *Linguistic theory and psychological reality* (pp. 119–161). Cambridge: Cambridge University Press.
- Warren, T., & Gibson, E. (2002). The Influence of Referential Processing on Sentence Complexity. *Cognition*, *85*, 79–112.
- Wolfe-Quintero, K. (1992). Learnability and the acquisition of extraction in relative clauses and wh questions. *Studies in Second Language Acquisition*, *14*, 39–70.
- Zukowski, A. (2009). Elicited production of relative clauses in children with Williams syndrome. *Language and Cognition Processes*, *24*, 1–42.

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