

What the Study of Scope Can Tell us about Second Language Learning*

William O'Grady^a, Miseon Lee^b, & Hye-Young Kwak^a

^aUniversity of Hawaii, ^bHanyang University

This paper, designed specifically for language teachers, focuses on a phenomenon in second language learning that is largely independent of instructional effects, curricular materials, and classroom activities. Experimental work suggests that scope, the relationship between two or more logical operators (such as quantifiers or negatives), is highly sensitive to processing considerations, especially the burden on working memory. In a new experiment, we explore this matter further by examining transfer of scopal preferences in the case of Korean speakers who are learning English as a second language and English speakers who are learning Korean as a second language.

Key Words: scopal preference, quantifiers, negatives, second language acquisition

1 Introduction

Second language teaching has long been a major concern of educators around the world, and its importance has only increased in recent years in response to the demands of cultural and economic globalization. This notwithstanding, linguists have had relatively little concrete advice to offer to language teachers for a very good reason: most of the factors that determine success in a second language are not linguistic in nature. Rather, they involve considerations such as the teacher's skill, the student's motivation and aptitude, the quality of the textbook, the amount and frequency of exposure to the second language, the opportunities for practicing the language in a realistic setting, the age at which language study begins, and so on. The range of topics discussed at the 2008 PAAL conference allows us to extend the list of relevant non-linguistic factors to include anxiety management, cultural understanding, metalinguistic knowledge, metacognitive strategies, topic management in the classroom, interest level of the class material, teacher feedback, and social skills. No doubt there are still more.

From the point of view of language teaching, one does what one can to improve the factors over which one has control—the effort that goes into class preparation, the quality of the textbook and other instructional materials, the number of students in the class, the atmosphere in the classroom, the amount of exposure to the language, and so on. But, at the same time, it's important to recognize that there

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are some things over which teachers don’t have control. Interestingly, at least some of those things seem to lie at the very heart of the human language faculty. They therefore are highly relevant to all types of language learning, whether it’s by a child at home or by an adult in a classroom. The purpose of this paper is to focus on one such phenomenon and on how its study can shed light on the nature of second language acquisition.

2 The Phenomenon of Scope

Among the countless phenomena that make up language, none is more intriguing than scope—the interaction among logical operators, including quantifiers (*all*, *every*, *many*, *some*, etc.) and negation. As will see, scopal interactions have major consequences for how sentences are interpreted and are therefore a vital part of language. Let us consider in this regard the interpretation of sentences that contain a ‘universally quantified’ noun phrase such as *all the books*.

In a typical case, such as *All the books fell on the floor*, *all* has what we will call a ‘full set’ interpretation—it groups together each and every book in the relevant context so that some property can be attributed to them all. We will depict this as follows for expository purposes.

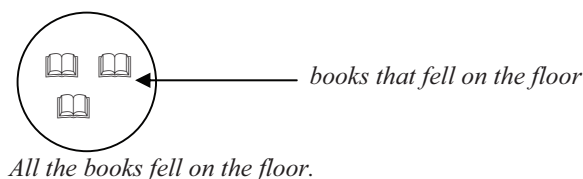


Figure 1: ‘Full set’ interpretation of *all the books*: the set includes each and every book in the relevant discourse context

As illustrated here, the property of having fallen on the floor applies to the entire group of books—anything in the relevant discourse domain that is a book must have fallen on the floor.

Matters become slightly more complicated when our example sentence is negated since the negative operator *not* can interact with *all* in a variety of intricate ways. Perhaps the simplest interaction occurs in sentences such as the following, in which *not* combines directly with the quantified noun phrase and unambiguously has scope over it. (That is, the interpretation of *all* is obligatorily modified under the influence of the negative.)

- (1) [Not all the books] fell on the floor.
 ↑ ↑
 negative quantified noun phrase

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Here the set denoted by the quantified phrase is partitioned, so that the property of having fallen on the floor applies to only some of the books. We will henceforth refer to this as the ‘partial set’ interpretation, which can be depicted as follows.

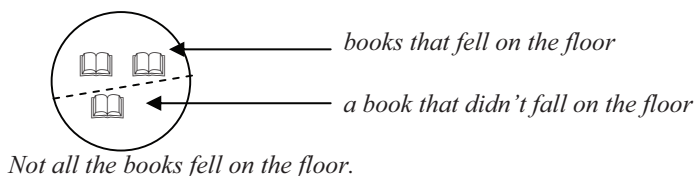


Figure 2: Interpretation of *all the books* when it is in the scope of negation: the set of books is partitioned, so that the property of having fallen on the floor applies to only some of the books.

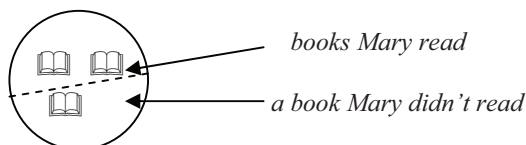
One of the intriguing things about scope is that it doesn’t work the same way in all languages. Take the following English sentence, for instance.

- (2) Mary didn’t read all the books.

The preferred interpretation among native English speakers for this sentence is the partial set reading—Mary read some of the books.

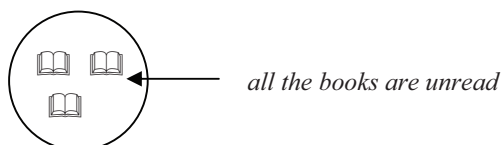
- (3) English—the partial set interpretation is preferred:

Mary didn’t read all the books.



In contrast, the preferred interpretation for the equivalent sentences in Korean and Japanese is the full set reading—all of the books were unread.

- (4) Korean and Japanese—the full set interpretation is favored:
 Mary-ka motun chayk-ul ilk-ci anh-ass-ta.
 Mary-wa subetano hon-o yom-anakat-ta.
 Mary-SUBJ all book-OBJ read-NEGATIVE
 ‘Mary didn’t read all the books.’



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3 Second Language Acquisition

So what happens when a speaker of Korean or Japanese tries to learn English as a second language? We have been working on this very question for several months and we have just finished a first round of experimental work.

The details of our experiment are outlined in O’Grady, Lee & Kwak (in press). Suffice it to say that we made use of a special type of comprehension task called a ‘truth value judgment task,’ in which subjects demonstrate their understanding of a sentence by indicating whether it is a true or false description of a particular situation. Here’s an example in which the context favors the partial set interpretation.

Tom is at his uncle’s repair shop.

Tom’s uncle is about to go out for lunch. He asks Tom to fix three radios and three computers before he returns. Tom promises to do so.

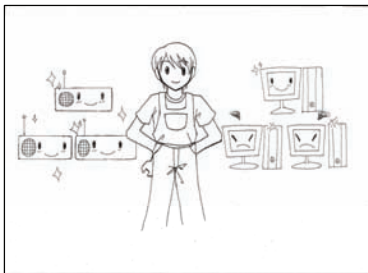
Tom fixes the three radios easily.

Then, Tom examines the first computer. But, he can’t fix it. He decides to wait until his uncle comes back.

Then, Tom looks at the second computer. There is something wrong with the sound, but he can’t fix it.

Finally, Tom comes to the third computer. There is something wrong with the screen. Screens are very hard to fix.

But, Tom manages to fix it.



Test sentence: *Tom didn’t fix all the computers.*

Full set interpretation: No (because only one computer was fixed; two are still broken).

Partial set interpretation: Yes.

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In our first experiment, we used this test with 42 native speakers of Korean, all of whom were students in a linguistics class at Hanyang University in Seoul, Korea. Based on their previous English-language courses, their proficiency in English was estimated to be at the intermediate or high intermediate level. They had received no formal training in semantics.

Table 1 summarizes our results when these subjects were tested on English.

Table 1. Percentage of 'True' Responses to English Sentences (Korean ESL Learners)

context favoring full set reading	context favoring partial reading
93% (157/168)	28% (47/168)

As can be seen here, the Korean speakers exhibit a strong preference for the full set interpretation in English. This preference is statistically significant ($t(41) = 9.06, p < .05$).

This is of course not the preferred interpretation in English, where the partial set interpretation is in fact favored. So why do Koreans prefer the full set interpretation? Could it be the influence of their first language?

A week after the ESL experiment, we had the same subjects take a Korean version of the test. Here's what we found:

Table 2. Percentage of 'True' Responses to Korean Sentences (Korean ESL Learners)

context favoring full set reading	context favoring partial set reading
97% (163/168)	21% (36/168)

As Table 2 shows, our subjects exhibited a very strong preference for the full set interpretation, accepting it as true in the matching contexts 97% of the time. In contrast, the partial set interpretation was judged to be true in contexts that favored it just 21% of the time. The preference for the full set interpretation is statistically significant ($t(41) = 12.49, p < .05$).

As can be seen here, our Korean subjects had essentially the same preference for the full set interpretation in Korean as they did in English. In fact, the scores on the Korean and English versions of the test were not significantly different. At first glance, it is tempting to say that this is simply an instance of the widely attested phenomenon of 'transfer'—a property of the first language is carried over to the second language.

However, there is a problem for transfer explanations in general, which is that they are helpful and insightful only to the extent that they can explain why

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transfer occurs in some cases but not others. And indeed, as we will see next, the preferred interpretation in the first language is transferred to the second language only some of the time.

As part of our research, we have also been investigating the acquisition of Korean by native speakers of English. So far, we’ve collected data from just five relatively advanced learners of Korean, so our results here are obviously preliminary. But they are nonetheless very suggestive.

Table 3. Percentage of ‘True’ Responses to Korean Sentences (English-Speaking KSL Learners)

context favoring full set reading	context favoring partial set reading
100%	50%

As can be seen here, the English-speaking learners of Korean did *not* carry the preference from their native language over to the second language: they favored the full set interpretation in Korean, not the partial set interpretation that is preferred in English. This raises the obvious question of why there apparently was transfer in case of the ESL learners, but not in the case of the KSL learners.

Table 4. When Transfer Happens and When It Doesn’t

Native lg.	Preference in that language	Carried over to L2?
Korean	Full set interpretation	Yes
English	Partial set interpretation	No

Why should this be? Methodologically, it’s always a good idea to consider the possible effects of instruction and the input before proceeding to less obvious possibilities. Let us consider each in turn.

We currently have no information about whether English-speaking learners of Korean as a second language receive instruction on scope preferences in Korean, so we will set this particular matter to the side for now. However, when it comes to the acquisition of English as a second language, matters are somewhat clearer as we have received reports that teachers and textbooks do provide at least some Korean-speaking learners with the information that the partial set interpretation is preferred in English. Crucially, however, this information seems to have had no impact: our Korean-speaking learners of English showed the same strong preference for the full set interpretation in English that they do in Korean—the precise opposite of what one would expect if instruction could explain what is going on.

How then can we explain the interpretive preferences of second language learners? The answer, we believe, lies in the way in which sentences are processed—that is, the way in which they are understood as they are encountered one word at a time in the course of actual speech.

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So how does processing work? Following O'Grady (2005), our key assumption about the mechanism responsible for processing (the 'processor') is simply this:

- (5) The processor seeks to minimize the burden on working memory.

In the case of the processing of scope relations, two additional assumptions are relevant.

- i. As the processor works its way through a sentence, it immediately assigns each word and phrase an interpretation, based on available clues such as its dictionary meaning, its position, the context, and so forth.
- ii. The revision of a previously assigned interpretation is costly since it disrupts the normal linear operation of the processor, forcing it to go back and redo its work.

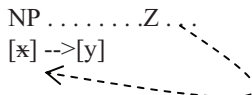
If these assumptions are right, then the following situation should be especially difficult for the processor to deal with.

- (6)a. A phrase is encountered and assigned an interpretation 'x', based on its position and other local properties:

NP
[x]

- b. Based on the properties of a subsequently encountered element, the phrase is reinterpreted:

NP Z . . .
[x] -->[y]
←



The latter procedure adds to the burden on working memory resources by requiring both the recovery of the earlier phrase and its reinterpretation. As we will show next, the processor's aversion to such increases in working memory load underlies the facts that we have observed in second language acquisition.

Korean-speaking learners of English

Let's begin by considering how the processor goes about interpreting scope in Korean sentences that contain a negated verb and a quantified direct object. We'll start with the full set interpretation of the Korean equivalent of *Mary didn't read all the books*. As illustrated below, this interpretation should be completely

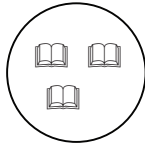
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straightforward for the processor since it requires no revision to the first interpretation assigned to the phrase *all the books*—it retains its full set reading.

(7) The full set interpretation:

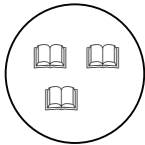
First: Formation of the NP *motun chayk* ‘all the books’ and assignment of the full set interpretation:

Mary-ka motun chayk-ul
Mary-NOM all book-ACC



Later: Formation and interpretation of the rest of the sentence, with no change to the interpretation of the quantified NP.

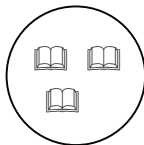
Mary-ka motun chayk-ul ilk-ci anh-ass-ta.
Mary-NOM all book-ACC read-NEGATIVE



As can be seen here, the formation of this interpretation is straightforward, with no need to revise the full set interpretation that has already been assigned to the quantified phrase. Matters are very different in the case of the partial set interpretation.

(8) First: Formation of the phrase *motun chayk* ‘all the books’ and assignment of the default full set interpretation:

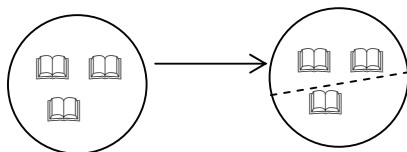
Mary-ka motun chayk-ul
Mary-NOM all book-ACC



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Late: The negative operator is encountered and assigned wide scope, forcing reinterpretation of the quantified phrase by partitioning the earlier formed set.

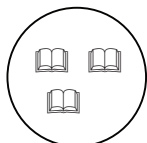
Mary-ka motun chayk-ul ilk-ci anh-ass-ta..
Mary-NOM all book- ACC read-NEGATIVE



As can be seen here, in order to derive the partial set reading, the processor has to reinterpret the quantified phrase, converting its initial full set interpretation to the partial set interpretation. This is of course the precise sort of situation that the processor tries to avoid since it increases the burden on working memory. That is presumably why this interpretation is not only less common than the full set interpretation in Korean, it is not even accepted by some speakers.

Now consider the acquisition of English as a second language by Koreans. If Korean speakers simply transfer to English their preference for the full set interpretation, their processor will encounter no special processing cost—the quantified phrase simply receives and retains the full set interpretation.

(9) Mary didn't read all the books.



Hence, Korean learners of English end up with a preference for the full set interpretation in English, regardless of instruction.

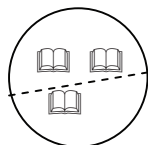
English-speaking learners of Korean

Next, consider the acquisition of Korean by English-speaking learners. As mentioned at the outset, the preferred reading of sentences with a negated verb and a universally quantified direct object in English involves the partial set interpretation. In contrast to the situation in Korean, this interpretation does not cause any special difficulty for the processor in English. This is because the negative occurs to the left of the quantified direct object in English. This allows the

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processor to partition the set immediately, just as it does in phrases such as *not all the books*, instead of first building a full set interpretation and then revising it.¹

- (10) Mary didn’t read all the books.



We now come to the key question, which is this: Why don’t English speakers transfer their preferred interpretation in their native language to their second language. The answer, we propose, is that transfer is blocked by processing considerations: as already noted, the partial set interpretation is costly in Korean (see (8) above)—in contrast to the situation in English. The relevant principle can be stated as follows:

- (11) A processing constraint on transfer:

The preferred interpretation in the L1 will also be favored in the L2 if and only if it doesn’t have a greater processing cost in the L2.

Our processing-based principle seems to make just the right predictions. On the one hand, it predicts that English speakers should not transfer the partial set interpretation that is preferred in English to Korean. That is because that interpretation is more costly in Korean than it is in English, for the reasons that we have already seen.

Table 5. English Speakers Learning Korean

Preferred interpretation in English	Processing difficulty in Korean
partial set (low cost)	high—DO NOT TRANSFER!

On the other hand, our principle predicts that Korean speakers should transfer the full set interpretation that is preferred in Korean to English. That’s

¹ Of course, this does not explain why the partitioned set interpretation is not only possible, but also preferred in English. Following Musolino & Lidz (2006) and others, we assume that this preference is best understood in terms of a pragmatic implicature: the full set reading is typically suppressed because English offers a more commonly used and unambiguous way to express this interpretation, namely the *not ... any* pattern (e.g., *Mary didn’t read any books*).

It is also important to note that the full set interpretation is nonetheless preferred in certain cases, as in *Max didn’t consider all the people who would be inconvenienced by his decision*, brought to our attention by Kevin R. Gregg.

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because that interpretation is no more costly in English than it is in Korean, and can therefore be carried over with ease to the second language.

Table 6. Korean Speakers Learning English

Preferred interpretation in Korean full set (low cost)	Processing difficulty in English low—TRANSFER!
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4 Conclusion

No matter how good the teacher is, how carefully he or she prepares for class, how clear his or her explanation is, how good the textbook is, how interested the students are, how closely they pay attention, how much exposure they have to the second language, some properties of language are simply harder than others. The study of processing allows us to understand why this is so: certain of the operations that allow us to form and interpret sentences create a greater burden on working memory than do others.

As we have tried to show here, considerations of this sort are vital to an understanding of transfer—one of the most widespread (and mysterious) phenomena in second language learning. As our example involving scope illustrates, there is reason to think that preferred interpretations are transferred only when they do not create more processing ‘cost’ in the second language than they do in the first.

There’s nothing that anyone can do to make a particular interpretation easier or harder—that’s determined automatically by factors that are beyond individual control. Nonetheless, an awareness of these factors and of their importance in shaping the language acquisition process is vital if we are to understand why language learning follows the course that it does and how we can create optimal programs for teaching language.

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