The Syntax of Quantification in SLA: An Emergentist Approach

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1. Introduction

Every discipline has a set of 'foundational ideas' that are stable over long periods of time and that provide a framework of assumptions within which every-day research is conducted. The field of second language research is guided by at least two ideas of this type, the first borrowed from theoretical linguistics and the second peculiar to the study of second language acquisition itself.

(1) The duality thesis
Humans have a dual-system language faculty consisting of both a grammar and a processor.

(2) The transfer thesis
Properties of the learner's first language are transferred to the second language.

I have no argument with the second thesis (in fact, a type of transfer is central to the proposal that I make below), but I reject duality. Instead, consistent with the emergentist thesis developed at length in O'Grady (2005), I hold that the basic properties of language follow from processing considerations and working memory, not from grammatical principles.[1]

On the view, I propose sentences are formed and interpreted by a computational system that does exactly what any processor does: it operates in a linear manner, it combines elements, and it checks to make sure that lexical requirements are being satisfied. But unlike conventional processors, it is not constrained by grammatical principles. Rather its properties follow from the fact that it seeks to reduce the burden on working memory by carrying out its operations at the first opportunity (the 'Efficiency Requirement').

As illustrated in O'Grady (2005), this approach offers promising accounts for many of the phenomena that lie at the heart of traditional syntactic analysis—the design of phrase structure, pronoun interpretation, agreement, control, raising, constraints on contraction and extraction, and so forth. Space does not permit a detailed discussion of these matters here (see O'Grady 2001 for a summary), but I will try to illustrate some features of this approach in the course of discussing the topic at hand, which has to do with the acquisition and use of quantifiers.

I will begin my discussion in the next section by introducing an emergentist theory of quantifier scope, drawing on ideas that are developed in much more detail in O'Grady (2006b). Section 3 considers cross-linguistic variation in scope—a prerequisite for the discussion of scope in second language acquisition that is presented in sections 4 and 5.

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*I am grateful for the helpful comments provided by Kevin Gregg, Bonnie Schwartz, Kamil Deen, Yuko Otsuka, participants in my recent course in Hawaii on quantification, and members of the GASLA audience.

[1] For general background on emergentism, see Ellis (1998), Elman (1999), MacWhinney (1999), Menn (2000), and O'Grady (2006a). The particular factors to which emergentists turn for their explanations vary considerably, ranging from features of physiology and perception, to pragmatics and social interaction, to properties of the input and of the learning mechanisms, to processing and working memory. As I explain here, my work draws most heavily on the latter two factors.

 Proceedings of the 8th Generative Approaches to Second Language Acquisition Conference (GASLA 2006), ed. Mary Grantham O'Brien, Christine Shea, and John Archibald, 98-113. Somerville, MA: Cascadilla Proceedings Project.

2. Quantifiers

The classic linguistic treatment of quantifiers holds that scope can be reduced to a structural relationship (usually defined in terms of c-command) between two operators. There are many different ways to implement this idea. In early work, scope was defined with reference to the position of the quantifiers in Logical Form, as determined by the operation of quantifier raising (e.g., May, 1977). For example:

(3) A boy climbed every tree.

a. [S *a boy*$_i$ [S *every tree*$_j$ [S t_i climbed t_j]]]
There is a particular boy who climbed every tree.

b. [S *every tree*$_j$ [S *a boy*$_i$ [S t_i climbed t_j]]]
For every tree, there was a (possibly different) boy who climbed it.

Subsequent work has added other ideas to the mix. For instance, Aoun and Li (1989, 1993) argue that the c-command relations relevant to scope involve the A-bar chains created by quantifier raising rather than just the particular operators themselves. In contrast, Hornstein (1995) suggests that the representations in which scope is encoded are created by the movement operations needed for Case checking, and that quantifier raising per se does not exist. Yet another idea is put forward by Beghelli and Stowell (1997), who posit special projections (Distributive Phrase, Share Phrase, etc.) to which quantifiers of the appropriate type covertly move (in an upward or downward direction) in order to check quantificational features.

2.1 The Roots of Scope

The particular idea that I will put forward reduces scope to the interaction of lexical semantics, pragmatics, and processing. I begin with the fundamental question of how to characterize the ambiguity of sentences such as (3), repeated here.

(4) A boy climbed every tree.

As I see it, the two readings of this sentence stem from a difference in the interpretation of the subject NP. On one interpretation it refers to a single boy, and on the other interpretation it has multiple referents. This is not quite the standard logicians' account that most linguistic analyses of scope have adopted,[2] but for reasons that will become clearer as we proceed I think that it offers a more promising way to deal with the scope contrasts found in natural language.

As I see it, the roots of scope can be discerned in a semantic effect that can be observed even in sentences that don't contain a quantifier.

(5) a. John and Mary sneezed.
b. Everyone sneezed.

The key observation is simply this: the meaning of these sentences entails multiple events—(at least) one for each person in the denotation of the subject NP. Intuitively, the reason is obvious: by virtue of its plural denotation, the subject is able to 'multiply' the denotation of the verb, giving the

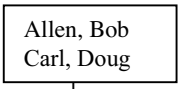
[2] On those accounts, the existential wide scope interpretation does in fact involve a single boy, but the universal wide scope interpretation need not involve multiple boys. Moreover, the truth of the existential wide scope interpretation is taken to entail the truth of the universal wide scope interpretation. There is no such relationship between the two interpretations that I propose.

interpretation in which there are multiple sneezing events. We can represent this as follows, with [M] standing for 'multiple' and the arrow indicating the effects of multiplication.[3]

(6) Everyone sneezed.
[M]---->[M]

The contribution of the computational system to all of this is quite minimal—it does no more than bring together a quantified NP and a verbal expression. This opens the door to multiplication, but that phenomenon is for the most part driven by pragmatics and lexical semantics. It takes place in (6) because of the way the world works—sneezing, jumping, and so forth are inherently individual events. By the same token, it can fail to take place in sentences such as the following.

(7)



a. Everyone gathered (under the tree).
b. Everyone congregated at the park.

Assuming that the domain of *everyone* consists here of just four individuals (Allen, Bob, Carl, and Doug), there will be just one gathering event, since gathering (and congregating) are inherently collective activities that require a certain minimum number of participants (say, three). Of course, if there were forty individuals in the domain of the quantifier, there could well be multiple gathering events, but this is not a computational matter—it has to do entirely with pragmatics and lexical semantics.

There are also intermediate cases, such as the following.

(8) Everyone paired off (once).

Again assuming four individuals in the domain of *every*, there are just two pairing-off events (i.e., just two pairs are formed)—not one, or four. Here again, this is a matter of pragmatics and lexical semantics; it has nothing to do with the computational system.

2.2 Forward Scope

Can a verb whose denotation has been multiplied have a similar effect on an NP with which it subsequently combines? The answer seems to be yes, as consideration of the following sentence reveals.

(9) Everyone climbed a tree.

On one interpretation, (9) describes a situation in which there are multiple climbing events, but only one tree—the single-referent reading. This can be represented as follows, with multiplication not extending beyond the verb.

(10) Everyone climbed a tree.
[M]------>[M]

On the second interpretation, (9) describes a situation in which there are not only multiple climbing events, but also multiple trees. This interpretation comes about because the denotation of the direct object NP is multiplied following contact with the verb, whose denotation in turn was multiplied

[3] A more conventional formalization might have *every* quantifying over an event variable in the sense of Davidson (1967, 1980); see also Higginbotham (1995). For a less conventional formalization, see Fodor (1982). Langacker (1991, p.129) uses the term 'replicate process' to refer to the effects of multiplication.

by previous contact with its quantified subject argument. (Fodor, 1982 makes a similar proposal, using a different notation.)

(11) a. First step: Combination of the verb with its first argument, the universally quantified NP *everyone*, followed by multiplication of the verb's denotation.

[Everyone climbed]
[M]------->[M]

b. Second step: Combination of the verb with its second argument, the existentially quantified NP *a tree*, followed by multiplication of that NP's denotation.

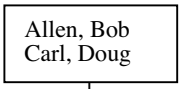
[Everyone [climbed a tree]]
[M]----->[M]

This yields the multiple-referent interpretation for the indefinite.[4]

On this view then, scope ambiguities are created by differences in the 'reach' of multiplication. Where it extends through the verb and into a direct object, as happens in (11), we get multiple reference for *a tree*. And where it does not extend to the direct object, as in (10), the indefinite NP has a single referent.

The key point here is that the multiple-referent interpretation of the direct object NP is possible only if the denotation of the verb has also been multiplied. One way to see this is to consider how scope works in sentences such as the following, in which the verb denotes an inherently collective event.

(12)



a. Everyone encircled a tree.
b. Everyone gathered at a restaurant.
c. Everyone surrounded a dog.

Let us assume that the domain of *everyone* in these sentences includes just four individuals (Allen, Bob, Carl, and Doug), but that it takes at least three people to encircle something, to gather somewhere, or to surround something. Then pragmatic considerations block multiplication of the denotation of the verb—there can be no more than one encircling event, for instance.

(13) Everyone encircled a tree.
[M]

Given the serial character of multiplication, this in turn predicts that the denotation of the direct object cannot be multiplied either.

(14) Everyone encircled a tree.
[M]---------X--------->

This seems to be exactly right—sentence (12a) describes a situation in which just one tree is encircled, just as (12b) requires an interpretation in which a single restaurant served as the gathering place, and (12c) denotes an event involving just one dog.

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[4] The question of precisely how many trees were climbed is left open. Each person may have climbed a different tree, or some people may have climbed the same tree and others a different one. Multiplication is neutral on this point; it requires only that there be more than one tree.

Contrary to what the standard account of quantification would have us believe then, scope is not a relationship between two quantifiers. Rather, it reflects the effects of a pragmatically driven operation (multiplication) that works its way through the sentence in an iterative, serial manner, creating a continuous chain of effects. Where the continuity is broken, as happens when the subject fails to induce multiplication of the verb's denotation, the multiple-referent interpretation for the direct object is impossible, as we have just seen.

In sum:

- Scope effects are the result of a pragmatically driven operation of multiplication.
- The operation applies in a serial iterative manner, with effects that must be continuous.

2.3 Inverse Scope

Thus far we have considered only patterns in which the effects of multiplication extend in a forward direction. It turns out that multiplication can sometimes occur in an inverse direction as well. In the sentence *John climbed every tree*, for instance, there are clearly multiple climbing events since one can't simultaneously climb more than one tree.

(15) John climbed every tree.
[M]<------[M]

What happens when the subject of a verb with a universally quantified direct object is not referentially rigid? The key sentence type, exemplified by (16), shows scope ambiguity.

(16) A boy climbed every tree.

On the single-referent interpretation of *a boy*, there are multiple climbing events with a single agent—exactly what we would expect if multiplication does not extend beyond the verb.

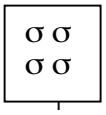
(17) A boy climbed every tree.
[M]<-------[M]

On the multiple-referent interpretation, in contrast, the denotation of the subject argument is multiplied.

(18) A boy climbed every tree.
[M]<----[M]<------[M]

As in the case of forward scope, the viability of multiplication in potential inverse scope patterns is subject to pragmatic considerations. For example:

(19)



a. A boy gathered every apple.
b. A teacher collected every answer.
c. A child spilled all the nuts.
d. An assistant distributed every questionnaire.

Assuming that gathering involves an action on multiple things (say, three or more), then if there are just four apples (rather than fifty) on the ground, there will be no opportunity to multiply the

denotation of the verb. (That is, there will be just one gathering event.) This in turn correctly predicts that the subject NP will have only the single-referent interpretation in this case.

(20) A boy gathered every apple.
<------X---------[M]

Once again, we see that scope is not a relationship between quantifiers per se. It is part of a continuous chain of effects created by the serial application of the pragmatically driven operation of multiplication.

2.4 The Marked Nature of Inverse Scope

It is frequently observed that 'inverse scope' readings for sentences in which an existential quantifier precedes a wide-scope universal quantifier are relatively difficult to construct (e.g., Reinhart, 1997, p. 350 & 370). They are less common typologically than their forward counterparts (e.g., Keenan, 1974, p. 301–302, 1976, p. 319; Hawkins, 2004, p. 226), and are less accessible to native speakers of languages that allow them (e.g., Anderson, 2004, Marsden, 2004, p. 246). As Reinhart (ibid., p. 370) observes, '[inverse] scope is a marked option: It is often very hard to obtain and it requires a strong discourse motivation.'

But what makes inverse scope marked in the first place? Kurtzman and MacDonald (1993, p. 257) propose a processing explanation (see also Fodor, 1982, p. 143–145). An indefinite NP, they suggest, is initially interpreted as referring to a single entity ('the single reference principle').[5] This interpretation must then be revised upon exposure to the universally quantified NP in direct object position if the multiple-referent reading is to be derived.

(21) a. First step: Combination of the verb with its first argument, and assignment of a single-referent interpretation to that argument.

[a boy climbed]
[Sg]

b. Second step: Combination of the verb with its second argument, the universally quantified NP *every tree*, followed by multiplication of the verb's denotation.

[a boy [climbed every tree]]
[Sg] [M]<-------[M]

c. Third step: Multiplication of the denotation of the subject argument

[a boy [climbed every tree]]
[~~Sg~~]<------[M]
[M]

As illustrated here, the NP *a boy* is initially assigned a single referent. When the effects of multiplication are later felt, this interpretation must be 'undone' and recomputed.

This idea fits well with the view of quantifier interpretation and sentence formation being put forward here. Because sentences are built one word at a time from left to right by a linear, efficiency-driven processor, we expect an asymmetry in the accessibility of the two interpretations of *a-every* patterns. In particular, because 'inverse scope' (the multiple-referent reading) is incompatible with the preferred unidirectional operation of the processor, it is predicted to be computationally costly and therefore less accessible.

[5] The early referential interpretation of this NP may be further encouraged by the fact that, as subject, it is likely to be topical and therefore should be independently known to the hearer (Jackendoff, 2002, p.416).

2.5 Processing Evidence

There is increasing evidence that processing considerations are in fact responsible for the marked character of inverse scope patterns. Particularly relevant here is a series of self-paced reading experiments conducted by Anderson (2004). In one of her experiments, subjects (all adult native speakers) were presented with potentially ambiguous '*a-every*' sentences such as the following.

(22) *A-every* pattern
An experienced climber scaled every cliff.

Each test sentence was followed by a query such as *How many climbers scaled cliffs?*, with a choice of answers:

One Several

Reading times were then analyzed according to the subjects' answers to the comprehension question. The sentence was read significantly more slowly when subjects assigned it a multiple-referent interpretation than when they computed the single-referent reading (p. 105).

Other experiments in Anderson's study show that the multiple-referent interpretation is harder than the single-referent reading in the *a-every* pattern even when it is favored by the context and even when the modifier *different* is added as a lexical clue (e.g., *a different climber*). All of this is consistent with the idea that inverse scope is computationally costly, presumably because it requires the reanalysis of a previously interpreted element—the indefinite NP that had earlier been assumed to have single reference is reinterpreted with multiple reference. This disrupts the normal linear operation of the processor, which forms and interprets sentences in real time under conditions that value quickness (e.g., Frazier, 1987, p. 561: Hagoort, Brown & Osterhout, 1999, p. 275; Pickering, 1999, p. 124).[6]

In sum:

- Like forward scope, inverse scope is the result of a pragmatically driven operation of multiplication that applies in a serial iterative manner.
- The marked character of inverse scope reflects the extra processing cost associated with the recomputation of the reference of a previously interpreted NP.

3. A Cross-linguistic Difference in Scope

A striking contrast between English and Chinese arises in the patterns below. Whereas the English sentence in (23) manifests the familiar scope ambiguity, its Chinese counterpart is unambiguous, permitting only the forward scope interpretation (Huang, 1982, p112 & 129, Aoun & Li, 1993, p. 13).[7]

(23) A student read every book.
(multiple-referent reading and single-referent reading both possible)

(24) You yi-ge xuesheng du le meiyiben shu.
exist one-Cl student read Asp every book
'A student read every book.' (single-referent reading only)

[6] *Every-a* patterns such as *Every boy climbed a tree* appear not to manifest a systematic preference for either reading of the indefinite. This is presumably because the processor, aware of the potential for multiplication from the beginning of the sentence, keeps both options open.

[7] In fact, the sentence is not acceptable without the existential wide scope marker *you* 'exist.'

There is an apparently straightforward way to characterize this difference—Chinese does not permit recomputation of the reference of a previously interpreted NP. Consider in the regard the manner in which the two languages deal with *a-every* patterns.

(25) English

	Single-referent reading	*Multiple-referent reading*
a.	[A student read]	[A student read]
	[Sg]	[Sg]
	(Combination of the verb with its indefinite subject argument; assignment of the default singular reference)	
b.	[A student [read every book]]	[A student [read every book]]
	[Sg] [M]<-----[M]	[Sg] [M]<-----[M]
	(Combination of the verb with its universally quantified object argument; multiplication of the verb's denotation)	
c.	- - -	[A student [read every book]]
		[~~Sg~~]<------[M]
		[M]
		(Multiplication forces reinterpretation of the reference of the subject NP)

(26) Chinese

Single-referent reading only

a. [You yi-ge xuesheng du le] 'A student read'
[Sg]

(Combination of the verb with its indefinite subject argument; assignment of the default singular reference)

b. [You yi-ge xuesheng [du le meiyiben shu]] 'A student read every book.'
[Sg] [M]<------[M]

(Combination of the verb with its universally quantified object argument; multiplication of the verb's denotation)

This difference is more principled than one might initially think—it is no accident that there are languages (such as English) that permit the two interpretations depicted in (25) and languages (such as Chinese) that permit just the single-referent interpretation depicted in (26), but none (to my knowledge) that allow only the multiple-referent interpretation. The key observation has to do with processing and the fact that the multiple-referent interpretation in *a/some-every* patterns requires the processor to depart from its normal linear course by recomputing the reference of the previously interpreted subject NP.

As Hawkins (2004) documents in great detail, when one of two otherwise comparable patterns makes heavier demands on the computational system, it is permitted less frequently across languages. Moreover, within languages where it is allowed, it is used less often and is more difficult to process.

The paradigm example of this involves relative clauses, for which Hawkins (1999, 2004) has demonstrated a suggestive correlation between typology and processing. In particular, we know on independent grounds that (at least in SVO languages) direct object relatives make greater demands on the processor than do subject relatives (Wanner & Maratsos, 1978: Gibson, 1998: Caplan & Waters, 2002). At the same time, we know that fewer languages permit direct object relatives than subject relatives, and that any language that allows direct object relatives must also have subject relatives. In

other words, if the 'harder' pattern is possible, then so is the comparable 'easier' one. Put yet another way (and paraphrasing Hawkins), the greater the demands that a particular pattern makes on the processor, the less likely that individual languages will permit it.

Scope appears to work the same way. As we have seen, the routine required for the multiple-referent reading of the *a/some-every* patterns makes greater demands on the processor than the routine required for the single-referent reading. And this has the expected typological consequences—the multiple-referent interpretation is allowed less commonly across languages (Keenan, 1974, p. 301–302, 1976, p. 319; Hawkins, 2004, p. 17).

The difference between English and Chinese in this regard is therefore a manifestation of a much more general pattern. English permits both the unmarked and the marked options, while Chinese permits only the unmarked one. And of course there should be no language that allows only the marked option, permitting the multiple-referent interpretation in *a/some-every* patterns but disallowing the computationally simpler single-referent interpretation.

In sum:

- Chinese differs from English in not permitting inverse scope.
- This reflects a processing-based markedness effect—Chinese lacks the routine that recomputes the reference of a previously interpreted NP.

4. Second Language Acquisition

Let us now turn our attention to second language acquisition, where an extraordinary piece of work by Marsden (2003; 2004a, b; 2005) has uncovered a very intriguing and challenging result.

Marsden's study focused on the acquisition of scope in Japanese, a language which (at least as a first approximation) permits only the single-referent interpretation of *some-every* patterns.[8] Here is a summary of her experiment.

4.1 Subjects (all adults)

21 native speakers of Japanese
38 Korean-speaking learners of Japanese (25 intermediate & 15 advanced)
17 Chinese-speaking learners of Japanese
29 English-speaking learners of Japanese (20 intermediate & 9 advanced)

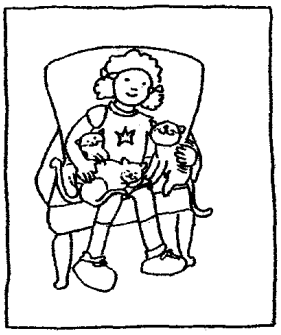
4.2 Method

Participants viewed a picture on a screen for ten seconds. A sentence was then presented aurally and visually (with the image lasting for fifteen seconds). Participants were asked to judge whether the sentence matched the picture, using a four-point scale that ranged from 'No, definitely not' to 'Yes, perfectly.'

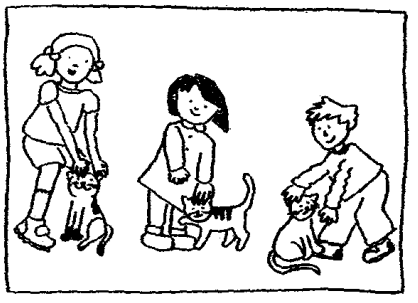
[8] As Kevin Gregg has observed (p.c.), there may be some controversy over the judgments reported by Marsden. In fact, her data indicates (2003, p.502, 2004b, p.236–240) that as many as 20% of the native speaker subjects may accept the multiple-referent interpretation of sentences such as (27).

4.3 Relevant Sentence Type[9]

(27) Dareka-ga dono neko-mo nadeta.
someone-Nom every cat stroked
'Someone stroked every cat.'



single-referent interpretation



multiple-referent interpretation

4.4 Findings

- The single-referent interpretation was highly acceptable to all three learner groups and to the native Japanese control group.
- The multiple-referent reading was rejected by the Korean- and Chinese-speaking learners, as well as by the native Japanese subjects.
- The intermediate English-speaking learners accepted the multiple-referent interpretation.[10]
- Six of the advanced English-speaking learners consistently rejected the multiple-referent interpretation while the remaining three consistently accepted it.

Marsden suggests that the learners' performance reflects two developmental steps that fit well with the Full Transfer/Full Access theory of second language acquisition. The key claim of this theory is that the parameter settings of the native language are initially carried over to the second language, but that continued access to UG eventually permits them to be reset in response to the appropriate triggers.

According to Marsden's FT/FA account, performance is target-like from the outset for the Korean- and Chinese-speaking learners, since their native languages resemble Japanese in barring the multiple-referent interpretation (finding two). In contrast, English-speaking learners initially transfer

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[9]Marsden's study also included sentences containing the group quantifier *subeto* 'all' as well as sentences containing a numeral quantifier instead of the existenial *dareka* 'someone.'

(i) Dareka-ga subeto-no neko-o nadeta.
someone-Nom all-Gen cat-Acc stroked
'Someone stroked every cat.'

(ii) Sannin-no onnanoko-ga dono neko-mo nadeta.
three-Gen girl-Nom every cat stroked
'Three girls stroked every cat.'

(iii) Sannin-no onnanoko-ga subeto-no neko-o nadeta.
three-Gen girl-Nom all-Gen cat-Acc stroked
'Three girls stroked all the cats.'

There were five tokens of each type; an interpretation was taken to be permitted when it received a mean rating of greater that 1.5 on a scale of 0 to 3.

[10]These subjects also accepted the multiple-referent interpretation of patterns (i) and (ii) in the preceding footnote.

the English parameter setting for scope to Japanese, thereby incorrectly accepting the multiple-referent interpretation (finding three).

A more controversial claim involves the performance of the advanced English-speaking subjects, six of whom correctly rejected the multiple-referent interpretation (finding four). According to Marsden, they have succeeded in resetting the parameter relevant to scope. But how precisely does this happen?

Working within the framework proposed by Beghelli and Stowell (1997), Marsden (2005) suggests that the key parametric difference between English on the one hand and Japanese, Korean, and Chinese on the other hand is that only English has true distributive quantifiers—the quantifier type required to give the multiple-referent reading in the patterns under consideration. She further proposes, following Chierchia (1998), that the defining property of a distributive quantifier is the presence of a [+Sg] feature (seen in English *every* and *each*, which combine with singular nouns). Crucially, it then follows that Japanese can't have true distributive quantifiers, since it lacks a count/mass distinction, as shown both by the lack of plural morphology (plural nouns are bare in Japanese) and by the requirement that numerals can modify nouns only with the help of a classifier.

(28) a. San-biki-no neko
three-Cl-Gen cat

b. *San neko
three cat

On Marsden's account, these features of Japanese trigger resetting of the scope parameter (2005:234–235). I think that there are at least two things wrong with this idea.

One problem, which Marsden herself is clearly worried about, is that her scenario makes things too EASY for second language learners—after all, how hard can it be to notice after a year or two that Japanese is not using a plural marker and that it is using classifiers? This in turn appears to predict earlier and more successful resetting of the scope parameter than is actually observed. Marsden tries to get around this problem by noting that the difference between English and Japanese with respect to number marking is somewhat obscured by two facts. First, Japanese has an optional plural marker for human nouns (*gakusei-tati* 'student-Pl'), which could mislead learners into thinking that it is like English in having genuine plural morphology. And second, English uses classifier-like elements with mass nouns (*two PIECES of paper*), which might lead learners to believe that it is not different from Japanese in this regard.

I think it's unlikely that UG could be fooled so easily. In fact, the theory of 'designated triggers' put forward by Fodor (1994) is specifically designed to avoid such difficulties. Noting that a great deal of the input to which learners have access is either misleading or ambiguous with respect to parameter setting, Fodor proposed that UG associates parametric values with very specific sentence types that alone can license them. For instance, in order to avoid mis-setting the *pro* drop parameter for English based on exposure to utterances such as *Looks good*, *Seems fine*, *Gotta go*, and so on, UG pays attention only to the behavior of subjects in embedded clauses—where learners of English will not encounter 'missing subjects.'

(29) *I think [looks good].

In the case of Marsden's scope parameter, it would therefore seem appropriate to have UG look for the absence of plural marking in *non-human* NPs and for the presence of classifiers with *entity-denoting* rather than substance-denoting NPs, since evidence from other types of NPs is evidently misleading, as Marsden notes. But then we come back to the first problem—why can't the parameter be set faster and more successfully than it is?

Another problem has to do with the typological viability of the proposed parameter. For instance, Korean behaves likes Japanese with respect to scope (at least for the patterns considered by Marsden), but it actually does have a genuine plural marker that is obligatory in certain contexts (including with non-human NPs). Moreover, Korean does not require classifiers with its numerals to the same extent that Japanese does.

(30) sey koyangi
three cats

It's therefore quite unclear whether the parameter required to get Marsden's FT/FA account to work is viable.

5. An Emergentist Proposal

How might an emergentist approach, which posits neither grammatical principles nor parameters, deal with Marsden's findings?

The first developmental step—in which English-speaking subjects incorrectly permit the multiple-referent interpretation in Japanese—is relatively easy to accommodate. We simply assume that English speakers transfer to Japanese *dareka-dono...mo* patterns the three-step routine that is permitted for English *some-every* patterns, including the step in which multiplication forces recomputation of the reference of a previously interpreted indefinite—thereby yielding the multiple-referent interpretation.

Note that this transfer can happen only with English speakers. Since Korean and Chinese resemble Japanese in not having the three-step routine, only the single-referent interpretation is possible for speakers of those languages and their performance in Japanese will therefore be target-like from the outset.

The much more difficult question has to do with how to account for the ability of at least some advanced English-speaking learners to retreat from their initial error and to realize that Japanese rejects the multiple-referent interpretation in *some-every* patterns. I think that we need to tell a weakening-and-atrophy story for this, essentially along connectionist lines. Paradis (2004, p. 28) outlines the basic idea: 'Every time an item [here, 'routine'] is activated, its threshold is lowered and fewer impulses are required to activate it. ... If the item is not stimulated, it becomes more and more difficult to activate over time. Attrition is the result of long-term lack of stimulation.'

There are various precedents for this even in the field of second language research. For instance, Carroll (2001, p. 151) proposes a theory in which rules 'compete to fire,' with the language faculty 'track[ing] how often a given rule has successfully applied.' More recently, Sharwood Smith and Truscott (2006) have made a similar proposal for the setting of parametric values (see also Truscott & Sharwood Smith, 2004).

The particular idea that I have in mind, consistent with the scenario sketched by Paradis, is essentially this: in the absence of any form-meaning mappings in the input that might activate the three-step routine that gives the multiple-referent interpretation, that routine weakens to the point where it can no longer be called up. At this point, the multiple-referent reading in *some-every* patterns becomes unavailable, and the learner's judgments converge with those of native speakers. Let me try to be more specific about precisely how this might happen.

First, totally independent of input, there is pressure from the processor to eliminate the three-step routine. As we have seen, the psycholinguistic evidence suggests that considerable computational cost is associated with the recomputation of the reference of a previously interpreted NP—consistent with the fact that the processor is forced to depart from its normal linear course. From this perspective then, 'use it or lose it' makes sense. Although the routine may initially be transferred, the processor has an incentive not to use or retain it.[11]

Second, as the routine that gives the multiple-referent interpretation is being weakened, the competing two-step routine that gives and maintains the single-referent interpretation is presumably being strengthened. In particular, it seems reasonable to suppose that lengthy exposure to Japanese will present the learner with at least a small number of *some-every* patterns that illustrate the single-referent interpretation for the indefinite.

[11] A side effect of suppressing the second routine is the elimination of potential ambiguity in *some-every* patterns. This in itself is a desirable result from a processing perspective.

(31) Dareka-ga dono hon-mo yonda. [single-referent reading only]
someone-Nom every book read
'Someone read every book.'

Even though such patterns are probably rare, two considerations mitigate the potential problem that this creates. First, as Gennari and MacDonald (to appear) note, the effect of experience may actually be stronger for rare interpretations than for common ones. Thus exposure to even a small number of sentences illustrating the single-referent interpretation may have a large impact on language learners.

Second, other constructions containing group-denoting quantifiers may help shape the learner's interpretive strategies. In the following sentences, for example, the denotation of the verb is multiplied by contact with a plural other than a universal quantifier, but there is no effect on the interpretation of the indefinite subject NP, which retains its single-referent reading.

(32) Dareka-ga hon-o ni-satu karita. [single-referent reading only]
someone-Nom book-Acc two-Cl borrowed
'Someone borrowed two books.'

(33) Dareka-ga nandomo/yoku watashi-o otozureta. [single-referent reading only]
someone-Nom many.times/often me-Acc visited
'Someone visited me many times/often.'

The interpretation of these sentences arguably helps confirm the interpretative stability of indefinites—once assigned, their reference cannot be recomputed.

In addition, it turns out that there IS a way to express a multiple-referent interpretation for an indefinite subject in Japanese, but that it involves use of the marked OSV word order.

(34) Dono hon-mo dareka-ga yonda.
every book someone-Nom read
'For every book, there was someone who read it.'

It is not implausible to suppose that occasional exposure to this word order, which itself is employed only under special circumstances, triggers the inference that it is used for the double-quantifier sentence precisely to license the multiple-referent interpretation that would otherwise be impossible. Indeed, it is worth noting that Marsden's experiment included OSV sentence types such as (34) and that all learner groups permitted both the single-referent and the multiple-referent interpretation in such patterns (Marsden, 2004b, p. 202).

The question of whether and how learners can retreat from an overgeneralization is an extremely difficult one, and it has long been a central issue in the study of language acquisition (first and second). Not surprisingly, UG-based analyses and the emergentist proposal differ sharply from each other in their approach to this problem.

The classic approach attributes the learners' success to the continued accessibility of UG, whose parameters can be reset in response to input involving seemingly unrelated phenomena. Thus, on Marsden's theory, exposure to information relating to the absence of plural morphology in Japanese permits learners to infer that inverse scope is prohibited—thanks to an innate UG-given link between the two.

The emergentist approach works very differently, attributing the success of learning under poverty-of-stimulus conditions to two processing-related factors—cost and strength.

- Cost: The three-step routine that gives the undesired multiple-referent interpretation in Japanese has a high computational cost—a fact determined by the processor, which must depart from its usual linear course to reassign reference to a previously interpreted NP.

- Strength: The routine in question is never called up in response to *some-every* patterns in the L2 input; instead, the competing two-step routine that gives the single-referent reading is invariably used. A processor interested in speed and efficiency (no other processor would be realistic) should strengthen the routines that are useful, and allow those that are not to steadily weaken and perhaps ultimately disappear.

Although this scenario provides a way for second language learners to retreat from overgeneralizations involving scope interpretation, two extraneous factors create room for variation among individual learners in terms of their ultimate attainment.

First, the development of computational routines is 'usage-dependent'—routines are strengthened (or weakened) in response to opportunities to interpret quantifiers in the second language. Experience is therefore crucial, and variation in its quantity and composition can be expected to affect learners' prospects for success, as in all theories of learning.

Second, the formation and strengthening of routines takes place in procedural memory, the cognitive system responsible for the learning and automatization of computational operations in general. It is frequently suggested that the ability of procedural memory to support new learning diminishes with age (e.g., Paradis, 2004; Ullman, 2005). If this is correct, variation in the degree of impairment could well have consequences for individual attainment in second language acquisition—not a desirable prospect, but one that all theories have to countenance in one form or another.

6. Conclusion

In sum, I have presented an analysis of quantifier scope that involves no special grammatical operations (such as quantifier raising), no special levels of grammatical representation (such as logical form), and no grammatical principles. Instead, scope is reduced to the effects of a pragmatically driven multiplication operation that works its way through the sentence in a serial iterative manner, creating a continuous chain of effects.

This operation interacts with the processor that supports it in at least one crucial way—consistent with standard assumptions about the linear character of processing, recomputation of a previously interpreted NP is costly. This in turn is reflected in the relative inaccessibility of the multiple-referent reading in *some-every* patterns, in its typological markedness, and in its relative rarity in the input in languages that do permit it.

As typically happens when a familiar phenomenon is given a new analysis, opportunities arise not only to rethink the character of the phenomenon itself, but also to re-examine claims and assumptions about how it is acquired. This certainly seems to be the case with scope, a phenomenon that manifests the very properties that make the study of SLA so intellectually interesting—the presence of seemingly abstract constraints, a significant difference across languages in the operation of those constraints, and the paucity of relevant data in the input (the poverty of stimulus problem). Is there a general emergentist 'lesson' that can be drawn from this case study?

As I see it, the idea behind Full Transfer/Full Access theories is basically right, but only if we rethink what is transferred and what is accessed. In particular, what is transferred is not a set of parametric values, and what is accessed is not Universal Grammar. Rather, as the acquisition of scope in Japanese illustrates, transfer applies to the native language processing routines, and the cognitive system that is accessed is simply the processor, which determines the cost and calculates the strength of those routines.

This suggestion extends various precedents. For example, Whong-Barr (2006) suggests that processing routines may be transferred *in addition to* parameter settings. And, more to the point, Carroll (2001) argues that in fact transfer should "be conceptualised in terms of the transfer of parsing and production procedures" (p. 82). Moreover, she goes on to suggest (p. 190) that the same parser is used for both the first language and the second language (the Uniform Parsers Hypothesis; Dekydspotter, Schwartz & Sprouse, 2006 adopt a similar position). Crucially, however, Carroll adopts

the duality thesis, observing that the operations of the parser are tied to structural properties of the grammar (p. 190) and accepting a role (albeit indirect) for Universal Grammar.[12]

In contrast, of course, I reject the duality thesis—there is no grammar, universal or language-particular. Instead, the descriptive and explanatory burden of linguistic analysis falls entirely on the processor and the routines that it creates. If the phenomenon considered here is at all typical, then there is reason to think not only that the processor is capable of bearing this burden but that further inquiry along these lines will deepen our understanding of the mechanisms and circumstances that contribute to second language acquisition.

References

Anderson, C. (2004). The structure and real-time comprehension of quantifier scope ambiguity. Ph.D. dissertation, Northwestern University.

Aoun, J. & Yen-hui, A. L. (1989). Constituency and scope. *Linguistic Inquiry 20*, 141–72.

Aoun, J. & Yen-hui A. L. (1993). *Syntax of scope*. Cambridge, MA: MIT Press.

Beghelli, F. & Stowell, T. (1997). Distributivity and negation: The syntax of *each* and *every*. In A. Szabolsci (ed.), *Ways of scope taking* (pp. 71–107). Dordrecht: Kluwer.

Caplan, David & Gloria Waters. (2002). Working memory and connectionist models of parsing: A reply to MacDonald and Christiansen (2002). *Psychological Review 109*.1, 66–74.

Carroll, S. (2001). *Input and evidence: The raw material of second language acquisition*. Philadelphia: John Benjamins.

Chierchia, G. (1998). Reference to kinds across language. *Natural Language Semantics 6*, 339–405.

Davidson, D. (1967). The logical form of action sentences. In N. Rescher (ed.), *The logic of decision and action*, (pp. 81–95). Pittsburgh: University of Pittsburgh Press.

Davidson, D. (1980). *Essays on actions and events*. Oxford: Clarendon Press.

Dekydspotter, L., Schwartz, B. & Sprouse, R. (2006). The comparative fallacy in L2 processing research. Paper presented at the Generative Approaches to Second Language Acquisition (GASLA) Conference. Banff, Alberta.

Ellis, N. (1998). Emergentism, connectionism and language learning. *Language Learning 48*, 631–64.

Elman, J. (1999). The emergence of language: A conspiracy theory. In B. MacWhinney (ed.), *The emergence of language*, pp. 1–27. Mahwah, NJ: Erlbaum.

Fodor, J. D. (1982). The mental representation of quantifiers. In S. Peters & E. Saarinen (eds.), *Processes, beliefs, and questions: Essays on formal semantics of natural language and natural language processing* (pp. 129-64). Boston: Reidel.

Fodor, J.D. (1994). How to obey the Subset Principle: Binding and locality. In B. Lust, G. Hermon, & J. Kornfilt (eds.), *Syntactic theory and first language acquisition: Cross-linguistic perspectives. Vol. 2: Binding, dependencies, and learnability* (pp. 429–51). Mahwah, NJ: Erlbaum.

Frazier, L. (1987). Sentence processing: A tutorial review. In M. Coltheart (ed.), *Attention and performance XII: The psychology of reading* (pp. 559–86). Hillsdale, NJ: Erlbaum.

Gennari, S. & MacDonald, M. to appear. Acquisition of negation and quantification: Insights from adult production and comprehension. *Language Acquistion*.

Gibson, E. (1998). Linguistic complexity: Locality of syntactic dependencies. *Cognition 68*, 1–76.

Hagoort, P., Brown, C.& Osterhout, L. (1999). The neurocognition of syntactic processing. In C. Brown & P. Hagoort (eds.), *The neurocognition of language* (pp. 273–307). New York: Oxford University Press.

Hawkins, J. (1999). Processing complexity and filler-gap dependencies across grammars. *Language 75*, 244-85.

Hawkins, J. (2004). *Efficiency and complexity in grammars*. Oxford.

Higginbotham, J. (1995). *Sense and syntax*. Oxford: Clarendon Press.

Hornstein, N. (1995). *Logical form: From GB to minimalism.* Oxford, UK: Blackwell.

Huang, J. (1982). Logical relations in Chinese and the theory of grammar. Ph.D dissertation, MIT.

Jackendoff, R. (2002). *Foundations of language*. Oxford, UK: Oxford University Press.

Keenan, E. (1974). The functional principle: Generalizing the notion of 'subject of.' *Proceedings of the 10th Regional Meeting of the Chicago Linguistic Society*, pp. 298–309.

Keenan, Edward. 1976. Towards a universal definition of 'subject.' In C. Li (ed.), *Subject and topic* (pp. 303–333). New York: Academic Press.

[12] In Carroll's theory, UG provides 'a range of representational features from which categories at various levels of analysis can be constructed' (p. 84; see also p. 210).

Kurtzman, H. & MacDonald, M. (1993). Resolution of quantifier scope ambiguities. *Cognition 48,* 243–79.

Langacker, R. (1991). *Foundations of cognitive grammar. Vol. 2: Descriptive applications*. Stanford, CA: Stanford University Press.

MacWhinney, B. (1999). Preface. In B. MacWhinney (ed.), *The emergence of language* (pp. ix–xvii). Mahwah, NJ: Erlbaum.

Marsden, H. (2003). Inverse scope in L2 Japanese. *Proceedings of the Twenty-Seventh Boston University Conference on Child Language Development*, 496–507.

Marsden, H. (2004a). L2 knowledge of quantifier scope in Korean and English learners of Japanese. *Durham Working Papers in Linguistics 10*, 137–50.

Marsden, H. (2004b). Quantifier scope in non-native Japanese: A comparative interlanguage study of Chinese, English, and Korean-speaking learners. Ph.D. dissertation, University of Durham.

Marsden, H. (2005). L2 poverty of the stimulus at the syntax-semantics interface: Quantifier scope in non-native Japanese. In Y. Otsu (ed.), *Proceedings of the Sixth Tokyo Conference on Psycholinguistics* (pp. 217–41). Tokyo: Hituzi Syobo.

May, R. (1977). The grammar of quantification. Ph.D. dissertation, MIT.

Menn, L. (2000). Babies, buzzsaws and blueprints: Commentary on review article by Sabbagh & Gelman. *Journal of Child Language 27*, 753–55.

O'Grady, W. (2001). An emergentist approach to syntax. Available at http://www.ling.hawaii.edu/faculty/ogrady/.

O'Grady, W. (2005). *Syntactic carpentry: An emergentist approach to syntax*. Mahwah, NJ: Erlbaum.

O'Grady, W. (2006a). The emergentist program. Available at http://www.ling.hawaii.edu/faculty/ogrady/.

O'Grady, W. (2006b). Quantifiers and their interpretation. Manuscript. Department of Linguistics, University of Hawai'i.

Paradis, M. (2004). *A neurolinguistic theory of bilingualism.* Amsterdam: John Benjamins.

Pickering, M. (1999). Sentence comprehension. In S. Garrod & M. Pickering (eds.), *Language processing* (pp. 123–53). East Sussex, UK: Psychology Press.

Reinhart, T. (1997). Quantifier scope: How labor is divided between QR and choice functions. *Linguistics and Philosophy 20*, 335–97.

Sharwood Smith, M. & Truscott, J. (2006). Full transfer full access: A processing-oriented interpretation. In S. Unsworth, T. Parodi, A. Sorace, & M. Young-Scholten (eds.), *Paths of development in L1 and L2 acquisition* (pp. 201–16). Philadelphia: John Benjamins.

Truscott, J. & Sharwood Smith, M. (2004). Acquisition by processing: A modular perspective on language development. *Bilingualism: Language and Cognition* 7, 1–20.

Ullman, M. (2005). A cognitive neuroscience perspective on second language acquisition. In C. Sanz (ed.), *Mind and context in second language acquisition: Methods, theory, and practice* (pp. 141–78). Washington, D.C.: Georgetown University Press.

Wanner, E. & Maratsos. M. (1978). An ATN approach to comprehension. In M. Halle, J. Bresnan, & G. Miller (eds.), *Linguistic theory and psychological reality* (pp. 119–61). Cambridge, MA: MIT Press.

Whong-Barr, M. (2006). What transfers? In S. Unsworth, T. Parodi, A. Sorace, & M. Young-Scholten (eds.), *Paths of development in L1 and L2 acquisition* (pp. 187–99). Amsterdam: Benjamins.

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