The Acquisition Path of Quantifiers: Two Kinds of Spreading

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March 9, 2004

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Acknowledgments: Thanks to Tim Bryant, Jill de Villiers, Lyn Frazier, Andrea Gualmini, Bart Hollebrandse, Angelika Kratzer, Bill Philip, Chris Potts, Uli Sauerland, and the participants at the UMass Workshop on the Acquisition of Quantification in Spring 2003. Errors of fact or interpretation are ours, not theirs. This work was supported in part by NIDCD Contract N01 DC8 2104 to Harry N. Seymour, P.I. We are indebted to The Psychological Corporation, San Antonio, TX, who undertook gathering the data and the initial analysis of it. The data are used by permission of The Psychological Corporation.

1.0 The Essential Distinction

The expression "quantifier spreading" refers to the phenomenon of children allowing a quantifier like *every* to refer to two nouns rather than one in a variety of experiments. For instance, in a scenario like Figure 1, children are asked the following question:

(Insert figure 1 – test item – around here.)

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(1) *Is every girl riding a bike? => no, not this bike (CS)*

Children – in half a dozen languages – respond "not this bike" pointing to the extra bike. The *every* modifying *girl* seems to have "spread" to modify the mentioned object *every bike*. The surprising notion is that a quantifier should apply to two separate NP's. We will argue that both theoretical and empirical progress has made the claim much less surprising.

New evidence reveals that there is a crucial contrast between this form, which we have come to call "Classic-spreading" (CS), and a second form where there is an extra pair of objects – neither mentioned – but involved in a common activity. For the scenario in Figure 2, children will say "no, not the dog" referring to the unmentioned eating activity in this scenario:

(Insert figure 2 – control-yes item – around here.)

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(2) *Is every rabbit eating a carrot => no, not the dog and/or bone (BS)*

This has come to be known informally as "Bunny-spreading" (BS) and it seems to involve an analysis of the set of events, not individuals. It is naturally captured by an adverbial paraphrase:

(3) It is always the case that a rabbit is eating a carrot.

Children who do CS generally do BS as well, but then they split. The presence of the combination characterizes younger children and many children who are analyzed with disorders up into the school years. At first it seems that both CS and BS should be captured with one analysis. Nevertheless, there are two crucial differences between these types. In one there is a mentioned extra object (bike), but no overt event, while in the other there is another event, but neither of the objects is mentioned (dog/bone). The distinction has been seen before, in the work of Bill Philip (1995), who differentiated a group of "perfectionist" (BS) children from a larger group of "spreaders" (CS).

1.1 **Our Goal: the acquisition path**

Our fundamental claim is that each kind of spreading calls for a distinct analysis and that there is a natural acquisition path from BS to CS to the adult grammar. The notion that each required a separate theoretical representation that reflects different moments of acquisition has only emerged clearly with the benefit of a large study of how 1450 children from 4-12 years comprehend quantification. It is noteworthy that recent work on L2 acquisition by DellaCarpini (2003) shows extensively that second-language learners also go through a stage of spreading. This suggests that it is not a factor of child cognition (Inhelder & Piaget, 1964), nor of language-independent child pragmatics (Crain et al, 1996), that lies at the root of the phenomenon, but rather the challenge of grammar construction which confronts L1 and L2 alike[1].

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[1] A great deal of attention has been devoted to the concept of Plausible Dissent (Crain et al, 1996. See in particular the experimental challenge to Plausible Dissent by Sugisaki and Isobe, 2001) Nonetheless, we think the approach to the semantics/pragmatic interface should be differently conceived. Grammatically secure representations are immune to odd pragmatics, which is why adults are not misled in the spreading environments. No child would have said "yes" to:

(i) *Is every carrot eating a bunny?*

When BS and CS appear together, they can both be captured by the notion of event quantification. When they split, we find one group which persists in Bunny-spreading while a large group does Classic-spreading-only until around the age of 9. So a new challenge arises: what difference in grammar would suddenly exclude BS and maintain CS? We argue that quite different grammatical analyses may lie at the root of each phenomenon. Our analysis falls within the general issue of how DP is acquired. We know that there are languages that have bare N, NP, and very intricate DP structures. Within the DP, some languages have complex agreement phenomena and some, like English, have determiner quantifiers. An important step is for the child to see that these quantifiers belong inside the DP. This study is about how the child takes that step[2].

1.2 Acquisition and Cross-linguistic Background

Initially, all quantifier phenomena were regarded as cognitive (Inhelder & Piaget, 1964), and children's apparent "errors" indicated some cognitive deficit. Roeper and Matthei (1974) argued that the errors arose because of the child's grammatical analysis. (See also Roeper and de Villiers, 1993, for extensions.) Roeper and Matthei observed that the quantifiers *all*, *some*, and *every* behaved like adverbs and proposed that children allowed quantifiers to "spread" to two adverb positions. In the early 1970s there was no natural mechanism for this proposal, but linguistic theory has moved steadily toward representations that show such an interpretation on the part of the child to be quite plausible within UG.

Hale (1985) and Bach et al. (1995) revealed that the adverbial quantifiers were universal while determiner quantification was rare. It became immediately natural to argue that the "spreading" phenomenon in acquisition had revealed a linguistic default, a core property of UG, not a kind of experimental artifact. Subsequent theoretical work, which we review below, has shown that an extra assumption about distributivity required by the child data is also necessary for adults. Thus the original acquisition proposal, which seemed to be a surprisingly strong extension of generative power, has been borne out by subsequent intuitional evidence and theoretical constructs.

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because their grammar delivers a clear, but nonsensical reading no matter what the situation. The grammar designates where pragmatic influence can occur. If a context elicits departures from adult interpretations, unless one can show that the child has not paid attention, then we should interpret the results as showing that children's grammars may allow a broader range of interpretations than adults'. If we eliminate this possibility from our agenda for exploration, we may miss much of what the acquisition process is. Therefore one should see the absence of Plausible Dissent as a potentially valuable experimental technique.

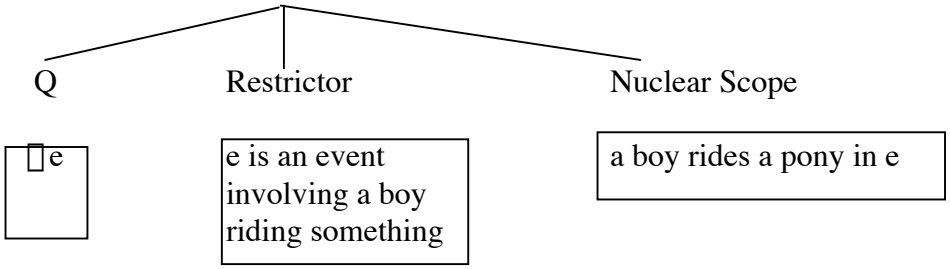
This view does not contradict the current interest in understanding more precisely just how discourse and context and illocutionary force interact for children.

[2] For studies of this topic in a variety of languages, see Chierchia (1998), Matthewson et al (2001), Eisenbeiss (2000), Clahsen et al (1994), Galasso (1999), Marinis (2000), Pérez-Leroux et al (to appear), Roeper (to appear) and others.

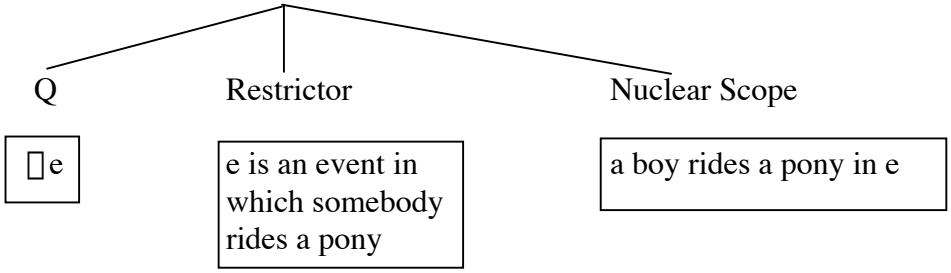
Philip (1995) in a pioneering empirical and theoretical study was the first to analyze classic quantifier spreading in terms of adverbial modification. It has been supported by work in six different languages (Roeper, 2003; Philip, 1996, 1998, 2002).

Unlike determiner quantifiers, which generally range over individuals and not events[3], adverbial quantifiers range over events and situations[4]. Like determiner quantifiers, structures involving adverbial quantifiers (in this case sentences) are tripartite: they can be divided into quantifier (Q), restrictor and nuclear scope. However, the tripartite structure in the case of adverbial quantifiers is less syntactically transparent and more flexible than in the case of determiner quantifiers, and is determined in large part by the focus structure of the sentence (Rooth, 1985; de Swart, 1993). For example, the sentence *a boy always rides a pony* can have either of the interpretations in (4), depending on which part of the sentence is focused:

(4) a. A boy always rides a pony



b. A boy always rides a pony



(4a) is the representation of the sentence in which *a pony* is focused, while (4b) is the representation of a sentence in which *a boy* is focused.

In Philip's analysis, *every* is interpreted as an adverbial quantifier, and the events forming the restrictor are the subevents of the contextually relevant event that meet a particular restriction. The restriction is that either the subject or the object is a participant in the subevent. The tripartite structure for Philip looks like the following:

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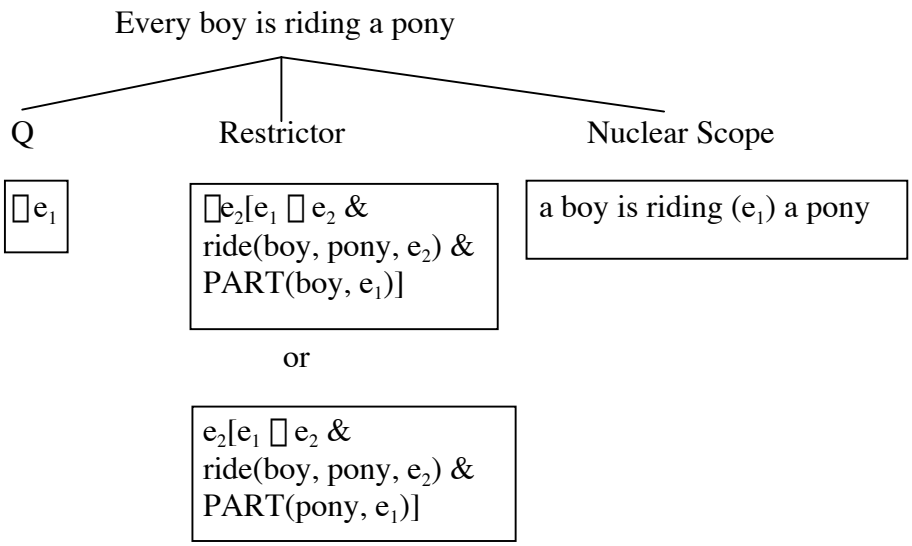
[3] The exceptions are event-denoting NPs, as in *the FBI's many investigations of professors*, where *many* ranges over events of investigation.

[4] They can also quantify atemporal cases, as in *an even number is always the sum of two primes*. See Lewis (1975).

(5)

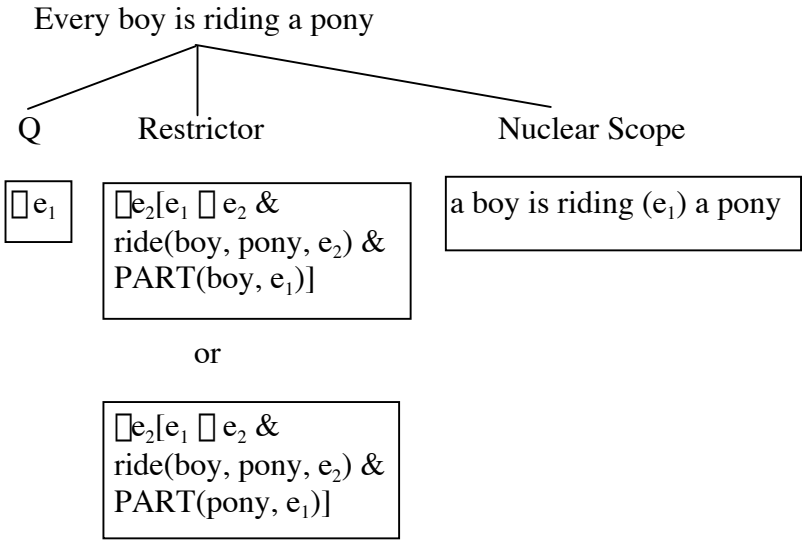


This should be interpreted in the following way: for every eventuality e_1, such that e_1 involves a boy or a pony as a participant, and furthermore e_1 stands in the part-whole relation to an eventuality e_2, in which a boy is riding a pony: e_1 is an eventuality of a boy riding a pony.

Here we have a tripartite structure which seeks to interpret every part of a context as a part of an event to which the universal property of *every* applies. In effect, then, *every* is equal to *always*.

As it stands, Philip's analysis covers CS but not BS. To cover BS, he introduces an additional disjunct to the restrictor, the assertion that a perceived object participates in the subevent (shown below). The effect of this additional option is to make the restrictor vacuous: the truth condition now requires that every subevent of the event under consideration involve a participant.

(6)



or

PART(perceived object, e_1)

In other words, for the Bunny-spreading child, *every boy is riding a pony* is true *iff* every subevent in the picture that involves a participant is a subevent in which a boy rides a pony. This appears to be the correct truth condition. We adopt this part of Philip's semantic analysis, and below we make a syntactic suggestion about the position of the quantifier.

1.3 Bunny-Spreading as hidden *always*

Sauerland (2003) offers an interesting variant of Philip's account in which he argues that the child grammar has a silent *always* that appears in generic contexts in adult grammar as well. (7a,c) have the paraphrases in (7b,d).

(7) a. *When one sleeps, the other wakes up*
b. "it is always the case that when one sleeps, the other wakes up"
c. *a guide insures that every tour is a success*
d. "it is always the case that a guide insures that every tour is a success"
(It does not mean that there is a single guide for all tours.)

He argues that children eliminate *every* as not understood and therefore they obtain a reading in which there is always a horse that the child is riding. (8a) is interpreted as in (8b).

(8) a. *Every child is riding a horse*
b. "There is always a horse that a child is riding"

The test for this claim would be to see if in fact children would impose <u>always</u> when no quantifier is present. Given (9), will children say "not this bone", which would

(9) a. *a rabbit eats a carrot*
b. "a rabbit always eats a carrot"

be appropriate if there is a silent *always*? (e.g. *a rabbit always eats a carrot*). This remains to be explored.

Sauerland's suggestion fits a natural account of grammatical deficit: the children revert to a default implicit adverbial quantifier *always* and provide no analysis of *every*. It means that a child has not, in this respect, advanced beyond the initial state. If this remains true for older children, then it is a real disorder. The question then remains: why would *every* <u>resist</u> integration while other quantifiers like *all* are easily acquired? This is a deep question which throws us back again to the properties of *every*. If the child does not ignore the word completely, then she or he presumably acquires the part that is like *all* but nothing more.

We suspect that the lexical complexity of *every* is involved in invoking the invisible *always*. The fact that *every* vacillates between collective and distributive, and appears inside compounds that take on plural (*everybody helped themselves*), creates a challenge to a child seeking a unified analysis. Therefore the child holds onto a default adverbial analysis for a longer time until collectivity is recognized, as we discuss in section 3.4.1 below. The situational awareness that some universality is involved, via *every*, could promote the invisible adverb[5].

Notably, an indication that the child's analysis of *every* is incomplete is that outside of compounds like *everytime* or *everything* it is not reported in children's early production. It would be ideal to know if those children who gave spreading answers are precisely those who do not use *every* and a noun. A brief search of five CHILDES corpora (MacWhinney, 2000) involving six children (from Brown, Kuczaj, and MacWhinney) reveals that very few children use *every*, and virtually none before four or five. Some children use *every* only inside of compounds, and in general the children who use *every* + noun seem to use these constructions only adverbially. That is, they use expressions like *every time* and *every day* in non-argument positions, rather than *every woman* or *every toy* in argument position. Out of the six children surveyed, only two – Abe and Mark– have more than two clear instances of *every* + noun not used adverbially, and the total number of these cases in the five corpora does not exceed twenty-five. Moreover, about four of these uses (that is, about 17%) involve agreement errors: *every boys and girls*, *every cheese*, *every people*, and *every farm people*.

These naturalistic facts point in the direction of the adverbial and one initially of *every* as being like *all*, collective and plural. If *every dog is eating a bone* were understood as "every (time) dog is eating a bone", then we can see how close the child's analysis could be to adult input.

In sum, we believe that the presence of *every* is connected to the *always* analysis and we would predict that children would not produce a "spreading" analysis of *a rabbit eats a carrot*. However the idea that there can be a hidden *always*, even in the adult grammar, makes the proposition that a child could project such a quantifier without a lexical representation more plausible.

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[5] The concept of an invisible *always* is like the notion argued for by Nishigauchi (1999) and others that wh-expressions contain an invisible *every* in English. Strauss et al. (2003), using this database, show a correlation between children who fail the Control-No test and who fail to exhibit wh-exhaustivity. To fail the Control-No test is to answer "yes" to the sentence *Is every girl sailing a boat* when there is an extra girl, therefore clearly false. It is as if the child understands the question as *are girls sailing boats?*. The same children fail to answer exhaustively to *what were they wearing?*, as if the wh- represented *wh-something* instead of *wh-everything*. In other words when *every* is missing overtly, it is predictably missing covertly. Moreover, the fact that the experimental setups are radically different argues against any simple experimental or pragmatic variable as an explanation for this correlation.

Drozd (1999, 2001) and more recently Geurts (2001) have offered an analysis in terms of weak quantification under the plausible view that the quantifier *every* could be misanalyzed as a weak quantifier whose domain was elastic enough to include an extra element. In particular weak quantifiers entail an appraisal of the set marked by the object. While these approaches may also capture spreading and represent the child's semantic analysis, we argue that a syntactic approach captures the child's shift to a more restricted grammar. We will argue that the acquisition path involves a shift from an adverbial analysis to a Focus Phrase quantifier, then finally to a determiner quantification analysis.

2.0 Evidence for the Acquisition Sequence

First let us present the new data that establish the proposed acquisition sequence. Empirical evidence for the move from BS → CS → target that takes place in middle childhood comes from data compiled by Seymour, Roeper, de Villiers, de Villiers, and Pearson as part of a large-scale project to discover linguistic milestones in the development of African American English (AAE) child speech and compare them to similar milestones in mainstream American English (MAE) child speech (Seymour et al., 2003). Data collection involved testing over 1450 children ages 4 to 12 on 350 items covering a range of language phenomena, including quantifier scope. (See Seymour & Pearson, 2004, for more details of the project.)

2.1 Participants

For the current analysis, there were 783 AAE-learners and 475 MAE-learners who participated. Of the total 1258, approximately two-thirds were considered to be typically developing (TD) and one-third were identified by previous testing in their schools and communities as language-impaired (LI), and were receiving language therapy. See Table 1.

Table 1. Subject Demographics

Age	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**All**
Language Status										
TD	169	192	216	31	53	47	58	37	58	861
LI	48	74	84	25	48	27	44	20	27	397
All	217	266	300	56	101	74	102	57	85	1258

Both dialect groups represent a nationwide U.S. sample with participants from the four major regions of the U.S.: the Northeast, the South, the Midwest, and the West. Most of the children (87%) were considered to be of "low socio-economic status,"

measured primarily by Parent Education Level. ("Low-SES" represented parents with high school diplomas or less.) There were 49% females and 51% males.

2.2 Procedure

Children were tested individually in their schools. Seven of the quantifier items tested knowledge of the meaning and scope of "every" with the now familiar scenarios. Children were shown a picture as in Figures 1 and 2 and asked "Is every X doing Y to Z?" (*Is every man holding a baby? Is every girl riding a bicycle?*)

There were two **Control-No** items. These had an extra "subject" individual, so the answer was "no," and the children were further asked, *why not?* to confirm their interpretation. Two were **Control-Yes** questions, like in Figure 2. Here the answers were "yes," but there was also an extra pair doing the same activity, but with different subject and different object. E.g. *"Is every rabbit eating a carrot?"* As before, children who answered "no" were asked *why not?* Finally, there were three **Test** questions, where the correct answer was again "yes," but there was an extra object in the picture (as in Figure 1). Children who answered "no" were asked *why not?* and their answers were coded as to whether they referred to the extra object.

Children's response patterns were coded as follows:

1. "Yes-men" (or perseverators) were those who said "yes" to all questions. They may have known some of the answers (whose answers were in fact "yes") but we determined that we had no way to distinguish true "yes" answers from those which were a set-response.
2. Children who got both Control-No questions were given credit for demonstrating mastery of those questions, while those with only one or zero were not. Mastery of Control-Yes also required correct answers to both questions. Mastery of the test questions was set at 2 of 3 correct answers.

Each child was characterized according to her or his scores on all three question types, so there were 8 possible combinations, plus "perseverators." Children who missed the Test questions and referred to the extra object to justify their responses were the Classic-spreaders (CS). Children who missed the Control-Yes questions and referred to the extra event were the Bunny-spreaders (BS). Those who did neither kind of spreading were called "non-spreaders."

The percentage of children at each age who exhibited the 9 possible response patterns was charted for the total group, for the typically developing children only, the language impaired only, and for each dialect subset, TD-AAE, TD-MAE, LI-AAE, LI-MAE.

2.3 Results

A developmental sequence was observed as predicted, from Control-No, to Control-Yes, to Test questions, so only a few children got test questions right and not

Control-No, or got Control-Yes, but not Control-No etc. and they were collapsed into one group of "other." For clarity, only the major response patterns which are also the profiles of interest--the BS, CS-only, and non-spreaders--are shown here. The one other response profile that accounted for a significant number of children were the perseverators. (In the graphs below, one sees less than 100% of each age group represented by the major response patterns, especially at the younger ages. The majority of those not represented were perseverators.)

Patterns for the dialect groups were similar, so their aggregated data are shown here (Figure 3). It is interesting to note that the distinctions were somewhat more pronounced among the MAE learners, indicating that both kinds of spreading were if anything more robust in the standard dialect. Patterns for the impaired children of both dialect groups are also graphed together (Figure 4).

Figure 3 shows the percentages of BS + CS, CS only, and children with the target grammar at each age. The sequence of rising slopes is very clear: Bunny-spreading increases between 4 and 5 years; Classic-spreading from 6 to 7, and the target response (non-spreading) after age 7.

(Insert Figure 3 – TD children – around here)

Even among typically developing children, perseveration and other irrelevant response patterns accounted for about 30% of the 4- and 5-year-olds' responses. Other authors have reported earlier acquisition, but in many cases they did not test children who failed the control questions, so their numbers are not generally included in their analyses (cf. Philip, 1995). Also, these data are from a lower socio-economic group than is typically sampled, and low SES is generally associated with slower language development (Hart & Riseley, 1995; Oller & Eilers, 2002). Still, there were about 15% of the youngest children who answered correctly, so it is not completely beyond their ability. Nonetheless, it would appear that target performance on these questions is not common until age 8 and it is not universal even at 12, the end point of our data collection.

(Insert Figure 4 – LI children – around here)

For Language Impaired children, the perseverators accounted for a much larger percentage: 50% at age 4 and 20% even at age 8. As shown in Figure 4, spreading of both types occurred at lower levels among the LI children than in the TD population, but the same sequence was observed: Bunny-spreading rose from 4 to 9, Classic-spreading did not appear to rise until 6 and it was still the major response type for these children at age 12. During this age range, the LI children never really achieved the target response, which never accounted for more than one-third of their answers.

3.0 Determiner-spreading and Floating Quantifiers captures CS

We now want to build a larger context for our discussion of quantifier spreading. Roeper and Matthei (1974) argued that *all* and *some*, when occurring linearly adjacent to the subject, appeared to apply to the object as well. Thus (10a) is interpreted as (10b). (See also discussion of these results in Frazier and Bader, this volume.)

(10) a. some of the circles are black
b. some of the circles have some black

Children also do the reverse: Takahashi (1991) showed that when confronted with a sentence with *every* in both subject and object position, children will interpret them as two instantiations of a single universal. For example, children aged 3-6 will answer "yes" to the sentence, *is every boy holding every balloon?*, when shown the following scenario:

(11)

balloon	balloon	balloon
|	|	|
boy	boy	boy

Q: Is every boy holding every balloon.
Child: Yes.

For an adult speaker, the answer would have to be "no", since there is no distribution of balloons over children. These results suggest that children don't distinguish independent instances of quantification in the sentence, but rather treat them as components of a single instance of quantification. We will exploit this suggestion in our analysis of quantifier spreading.

The point of departure for our analysis is floating quantifier (FQ), where a quantifier is separated from the quantified material as in (12b):

(12) a. <u>all</u> the children have food
b. the children <u>all</u> have food.

Quantifier floating has been extensively explored since Sportiche (1988) argued that it reflected a VP-internal subject. He argued that the NP was moved away from the quantifier to a higher position, so that the quantifier did not float, but rather the noun itself moved:

(13) the boys$_i$ were [VP [all going$_j$ [DP t$_i$ [V-t$_j$ [PP to the movies]].

Since then both an adverbial and a predicative analysis of FQ have been proposed. It has been pointed out that quantifiers can move to all the adverb positions (Terada, 2003; Bobaljik, 1998) which does not follow from the VP-subject hypothesis:

(14) the children (all) have (all) been (all) going home.

It was pointed out, furthermore, that the quantifier could appear even when it could not be a part of the DP:

(15) a. Susan, Mary, and Sally were all here
b. *All Susan, Mary, and Sally were here

In addition, one could expand the quantifier to work like an anaphor:

(16) Susan, Mary, and Sally were all of them here.

And the meaning can sometimes be captured by an adverb which takes the subject set as its scope:

(17) a. Most of the media were here.
b. The media were mostly here

The meaning of (17b) is identical to (17a), rather than describing the manner in which the media were here (as in *the media were eagerly here*). (See Stickney, 2003, for evidence that spreading extends to *most*.) All of these arguments led to the view that floating quantifiers were in fact independently generated adverbs. It became easy to project them in the right position, but now difficult to state how they made a connection to the subject.

However, the acquisition data exhibited still a further important difference: the floated element applied to both the subject and object. Roeper and Matthei pointed out that expressions like (18) can, in adult grammar, mean either 90% of the committee is

(18) the committee is 90% behind the proposal

completely behind the proposal, or 100% of the committee is 90% behind the proposal. Beyond that ambiguity, it can feel "vague" as if a combination of both readings were possible. Nevertheless although many modern arguments allow meaning to change at S-structure, this proposal seemed rather strong since in effect two meanings were being carried along, unlike most adverbial movement operations.

3.1 Parsing Support

Frazier and Bader (this volume) have independently found parsing evidence that shows that initial (CP) quantificational adverbs are often interpreted as if displaced from their default position in a VP; thus two positions are psychologically engaged. Some adults will repeat the sentence with the quantifier in the lower position.[6] The position must be c-commanded; therefore it is important for the quantifier to occupy the c-

[6] In addition a natural experiment to do would be to ask children afterwards what question had been asked. Informal reports suggest that they often substitute adverbs or plurals or place the quantifier differently.

commanding CP position. The sentence in (19) is excluded because the putative origin of the quantifier cannot c-command the quantifier *all*.

(19) *the mother of t my friends are all pleasant.

Thus we have independent evidence from adults for both the chain connecting CP to a lower adverb position, but in addition for the precision of the c-command constraint, which plays a role in the analysis to follow (see also Goodluck (1978), Solan (1983) for the first strong arguments for c-command in acquisition and more recently Crain and Thornton (1998) and Lidz and Musolino (2002)).

The confluence of evidence from different psycholinguistic sources (acquisition, parsing, intuition) is very significant in its own right in the effort to establish biologically robust claims. It means that adults tapping unconscious judgments, children comprehending stories, and the timing of grammatical information in comprehension – very different modalities – all point toward the same mental entities being utilized in different ways.

3.2 Distributivity Feature

Modern syntactic analyses have moved precisely toward the view that the FQ has a connection to both the subject and the content of the predicate. A careful look shows that the FQ has a semantic relation to local elements in the moved position.

Bobaljik (1998) pointed out the subtle difference in interpretation between (20a) and (20b).

(20) a. <u>all</u> the contestants can win
b. the contestants can <u>all</u> win

In (20b) the implication is that they can win separately, distributively, but not that they might collectively win. Terada (2003) points out that the moved quantifier cannot appear by itself in English:

(21) a. *the boys came both
b. the boys came both alone.

He suggests that not only is a further predicated element present, but it must submit to a distributive reading. Consider cases like (22a,b)

(22) a. John left the two rooms both empty
b.*John left the two rooms both angry.
(putatively: he left the two rooms, feeling angry)

Consider also these facts which we have developed to underscore the point:

(22) c. *the boys arrived each together.
d. the boys arrived each together with his mother.

It is clear that the moved quantifier requires a distributable element to be in a predication relation with it. In effect, then, even the initial quantifier can take a distributive modifier. In the FQ case, it is obligatory. It is not clear how to express this obligatoriness, but one could pursue the idea that the quantifier can be in the Spec of the small clause only if it is a licenser with its second feature. In effect the FQ has an agreement feature that must be checked by another feature in a Spec-Head relationship. Now suppose we argue that for children the second NP is a kind of a predicate and therefore open to the kind of modification that predicates allow:

(22) e. Is each rabbit eating a carrot?
f. Are the rabbits eating each a carrot?
(for the spreading child: are the rabbits eating each carrot?)

Bobaljik has pointed out that there is no known reason why *every* should not float. If we argue that *every* floats like *each* for the child, then we would expect now that it will also project a semantic relation to the complement, just like the examples above.

(22) g. is every rabbit eating a carrot?
h. is a rabbit eating every carrot?

However we now argue that both the properties of distributivity and universality carried by *each* and *every* apply to the object for the child. Now we have reduced the difference between the child and adult grammar to this claim: for adults, universality applies to the subject and distributivity applies to the object, whereas for the spreading child both distributivity and universality apply to the object. (An interesting unexplored question is whether distributivity might apply to the subject for the child.)

Terada (2003) provides an analysis of adult FQ in terms of probe-goal feature-matching where FQs are adverbs projected in their base position with two features: one an anaphor, creating a chain with the subject position, and one a probe feature that seeks a [+distributive] feature with which it can agree. If the FQ is in a Spec position of a predicate phrase, like a small clause, then it can accomplish this relation. This is what requires that either the FQ position be occupied, as it is for adults, or c-commanded as we now argue that it is for children.

Terada's formulation is:

(23) An FQ bears a Number feature which is uninterpretable and a collective or distributive feature [+Col/Dist] which is interpretable.

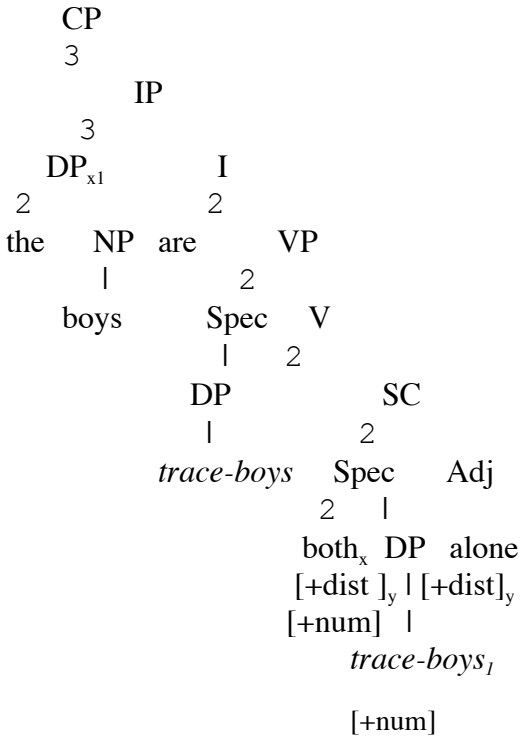
In our account below, we consider FQ to be just [+dist]. A small clause structure has a [+num] feature to achieve agreement with *boys* and a [+dist] feature for *alone*. Consider how *both* works:

(24) [both [boys] [alone]]

numx numx
+dist-y +dist-y

Thus in a structure of this sort, we have these connections:

(25)



Both is in the Spec of the small clause (and a *trace* is in both possible origins under raising from a small clause or from the VP subject position). The distributive feature functions as a probe seeking an element to which distributivity can apply. Again, it can be linked to the subject (boys) by an anaphoric index, not a Spec-Complement agreement relation. The anaphoric index allows satisfaction of the [num] agreement and links a [+universal] interpretation to the subject. In effect we have long-distance AGREE.

Now we find that *a bike* (from Figure 1) can receive this distributive interpretation from the child's floated quantifier, but when distributivity is impossible because of the semantics of the word, as with "*cold*", in (26b) we predictably get an instant decline in grammaticality. In example (26b), *cold* does not distribute, though in

(26c) distributivity is not required since *each* is not in the Spec of a small clause where it would impose an agreement relation.

(26) a) the dogs are eating each alone
b) ?*the dogs are eating each cold
c) each of the dogs is eating cold

Once again, if child floats *every* in the same manner, then the child's response should predictably be: "not this bike".

It is no doubt the case that we need a more complete semantic characterization of this syntactic account to state clearly what conceptual demands are made by the FQ analysis. We argue that there is a first stage semantic representation with a minimal syntactic representation, simply giving an adverb-like interpretation to the universal force of *every* with the whole clause in its scope. Thus the child can interpret such sentences with a minimum amount of language-particular information. FQ children may be aware that their analysis is incomplete as witnessed by their resistance to using *every* (outside of compounds like *everybody*), but questions with *every* may force them to impose some analysis.

In this stage the child does not project a DP above the NP, and interprets subject quantifiers as being adverbial elements in a Focus Phrase (FocP), a projection dominating CP, which has been argued for Hungarian quantification by (Brody, 1990) and extended to acquisition by Kang (1999)[7]. From this position, the quantifier takes scope over the entire sentence, quantifying over events in a manner similar to Philip's analysis: the sentence is judged true if and only if each subevent in the scenario involves both the subject and the object. This is the perfectionist, or Bunny-spreading BS stage, entailing reference to the unmentioned dog+bone.

In the second stage, there is a more refined syntactic representation, with a kind of FQ analysis that applies to *every* as well as *each* and allows only CS because the initial quantifier is now interpreted, not as an adverb applying to events, but as an NP quantifier raised to the FocP position. We provide the details of this analysis shortly[8].

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[7] For instance, the quantifier in "Every boy is riding a pony" can be assumed by the child to reside in FocP without any extra assumptions about movement. Object quantifiers like in "every boy is holding every balloon" are not interpreted with independent quantificational force, as we have seen, but rather as dependent on some other universal quantifier in the sentence. We will assume that the quantificational element in FocP forms a chain with the overt quantifier in object position, allowing the universal interpretation to reside outside the object.

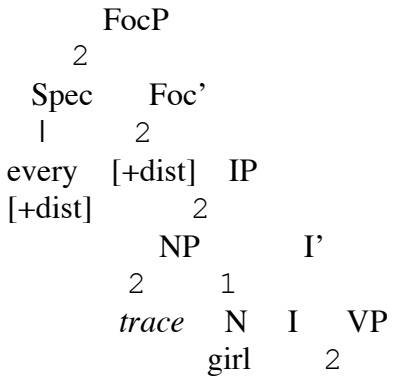
[8] Gualmini, Meroni, and Crain (2003) hint at intriguing evidence that looks consistent with our account. They report that for a sentence like:

(i) Every ghostbuster has a pig or a cat

3.3 FQ connects to *Every* in FocusP

Kang (1999) develops this analysis and suggests, following Brody's analysis of Hungarian, that quantifiers are inherently focused and that grammars generate an optional FocP above CP which would allow c-commanding of a lower FQ position.[9] We wish to maintain the part of the analysis that allows movement of the quantifier to Spec-FocP, but we argue that this is not the movement of a focused constituent, but rather movement driven by the quantifier's need to check its [+dist(ributive)] feature, which can be checked by the Focus head. This results in a distinction in the adult grammar between the quantifier *each*, which we will argue in section 3.4 is necessarily associated with the [+dist] feature, and the quantifier *every*, which is not associated with this feature. How does *every* come to be distributive in some cases? We claim that distributivity is not a lexical feature in this case, and that *every* is interpreted as distributive just in cases where the predicate selects for a distributive argument in the position that is filled by the *every*-NP[10]. This captures Stage II after the pure adverbial stage:

(27)



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children consistently add an "extra" restriction, much as they say the Drozd (2000) and Philip (1995) accounts do, where either every ghostbuster has the same (collective) or every one has a different (distributive) choice.

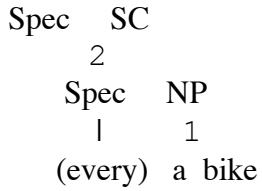
To really establish the distributive property we expect one might try:

(ii) every ghostbuster has a pig or a cat or a dog.

We think it would be interesting to see if those who impose distributivity here would also tend to allow spreading with a single object.

[9] Hollebrandse (to appear) argues that backwards spreading is weaker because the child projects a Topic node that is occupied and therefore provides no landing site for a focal quantifier. This approach would seem to be compatible with ours.

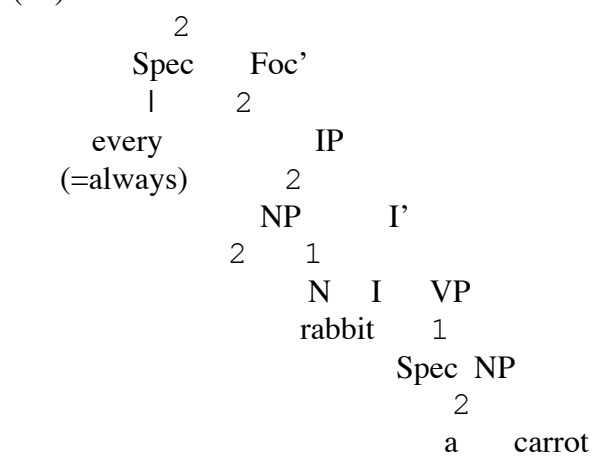
[10] This distinction is in the spirit of the analysis of Beghelli and Stowell (1997), who distinguish Strong Distributivity, associated with the quantifier *each*, from Weak Distributivity, associated with *every*. The featural distinction between *each* and *every* is also due to Beghelli and Stowell, but their movement analysis is implemented in a different way.



The raised *every* now c-commands the VP as well as the subject NP, therefore it can c-command an empty FQ (*every*) position as well if we assume that it is an adverb position, a default interpretation in that position. Later on, it is learned that *every* is not distributive and hence doesn't raise to Spec-FocP. Therefore we do not find the FP-FQ chain with *every* among adults and we do not find spreading interpretation. This is precisely the connection between adverb positions which Frazier and Bader (this volume) have advocated as well on parsing grounds.

The focus structure proposed by Kang could provide a starting point for both the event theory and the path to the FQ stage and finally the adult stage. So it gives us Stage I:

(28)



This representation achieves Bunny-spreading. Now one goal of a good acquisition theory is that it make minimal syntactic changes, but that the syntactic changes have the effect of narrowing the range of semantic interpretations. There is no reason in principle why a shift in semantic representation couldn't propel the grammar forward. However, the efficiency of syntax may be very important here. So a possible hypothesis may be precisely that syntactic shifts restrict semantic interpretations. It is still true that semantic factors may trigger the syntactic shift. This would provide a version of the syntax behind the acquisition sequence. In sum, we argue for the following sequence:

1. in the BS phase, the FocP position hosts an adverbial quantifier over events. *Every* is interpreted as though it was *always*.

2. In the 2nd (CS) stage, *every* raises to Spec-FocP to check its [+dist] feature and transfers its [+dist/+universal] features to the FQ position via co-indexing. Now *every* quantifies over individuals, not events,

In the next stage *every* will be reanalyzed as rooted in the DP and will lose its connection to the FQ.

3.4 The Move to the Adult State

How do we account for the final move to the adult state?

We will now integrate an approach by Beghelli and Stowell (1997) with the Kang/Brody analysis. We have assumed movement to a Spec-FocP position dominating CP (following Kang/Brody) but unlike K & B, we assume that the movement is not driven by a general operation on quantifiers, but rather by the feature [+dist] that is found on certain quantifiers but not others.

In the second stage, the child has learned that English has determiner quantifiers, and that movement to Spec-FocP must be motivated by a feature's need to be checked. This is the stage where children begin to make finer-grained distinctions between quantifiers of different types, but not yet fine-grained enough to distinguish *each* from *every*. In view of the frequency with which *every* behaves distributively, we assume that when the child begins to classify quantifiers into distributive and collective, she or he classifies *every* as distributive[11], assigning it the feature [+dist] that drives movement to Spec-FocP. This conflation of *each* and *every* is not surprising in light of the mixed properties of *every*, which is highly marked crosslinguistically (Angelika Kratzer, p.c.). In this stage, children will do Classic-spreading but not Bunny-spreading.

In the final, adult state, children learn that *every* is in fact a mixed quantifier that is sometimes interpreted as distributive and sometimes as collective. Using this information, they reanalyze *every* as a quantifier lacking the feature [+dist], and as a consequence remaining in situ, while its distributive counterpart *each* raises to Spec-FocP. When it remains in situ, the NP containing *every* will sometimes receive a collective interpretation and other times a distributive interpretation, depending on the properties of the predicate that selects it.

3.4.1 Triggering Collectivity

What kind of evidence drives the move to the adult state? All that is needed is for the child to conclude that *every* is sometimes collective. We can imagine a few different sources of evidence. One is the ability of *every* to occur under the scope of negation, in which case it necessarily receives the collective interpretation, as in the following sentences from Beghelli and Stowell:

(29) a. John didn't read every book

[11] See Beghelli and Stowell (1997) for many examples of both the distributive and the collective uses of *every*.

b. ??John didn't read each book

Another case would involve the use of *every* in an argument position that must have a collective interpretation, as in the following:

(30) The teacher gathered every student
(compare: *the teacher gathered each student)

In other situations, the argument position is in principle available to both collective and distributive NPs, but the context makes it clear that a collective interpretation is appropriate ((31a) is from Tunstall 1998).

(31) a. The waiter lifted every glass
(where the glasses are all on the same tray and are lifted with one action)

b. The boy ate every raisin
(where he gulped them all down in one motion)

Acquiring the details of *every* in this way illustrates how the child's grasping of semantics can lead to the acquisition of syntax.

Various other facts about *every* need to be explained, and might submit to an explanation in the current framework: for example, the inability of *every* to take a partitive complement (*every of the boys) and the ability to occur inside possessive constructions (the FBI watched his every move).

In general the move to the adult grammar involves fixing the many properties of DP and the position of quantifiers inside them. Each quantifier has distinctive properties of syntactic distribution.

3.5 Disorders

What happens to the children who continue to carry out BS? They have not advanced beyond the early grammar, largely a reflection of the Initial State, where the child is using the quantifier to analyze events rather than the properties of individuals. In fact, with age, many of the LI children do advance from BS to CS, but not to the final step of the adult grammar. Such children will have the same experiences as others but their grammar will not allow reanalysis. If the crucial experiences are really quite precise, and hence not as frequent as the frequency of the quantifiers themselves, then a program for exposure in therapy sessions might make a difference.

4.0 Conclusion

We have argued that a large study provides a close look at the acquisition path where we see two quite different forms of quantifier spreading. One is close to a default adverbial projection, while the other engages sophisticated aspects of syntax and continues often until children are 9 years old.

Our analysis involved developing a confluence of argumentation about how focus, floating quantifiers, and distributivity interact under c-command and the theory of feature-checking. The theory supports both modern theories of syntax and event semantics.

From that representation we were able to project three stages of the acquisition path in which the child shifts syntactic structures and thereby restricts semantic interpretations. These shifts in turn depend upon quite refined "triggering experiences" (Chomsky, 1975) where distinctive situations that combine pragmatics with the syntax/semantics interface force a grammatical revision. While purely semantic shifts are possible, this model of acquisition growth may reflect a general property of the syntax/semantics interface and explain why the two systems must interact in subtle ways.

Our conclusions remain tentative because, despite the many studies that reproduce spreading effects, we have mentioned half a dozen experimental variations that have not been explored. And we do not know enough about how other quantifiers behave when there are subtle variations in context. For instance, Sauerland and Yatsushiro (2003) have found that children do not perfectly control *both* and have an interesting challenge in allowing a sentence like *every boy has noses* (which excludes a boy with only one nose) where the plural is in the scope of *every* while also allowing a distributive reading for *every boy has friends* (which can include a boy with only one friend). These should be coupled with how children learn the syntactic peculiarities of each quantifier, such as the fact that *every* does not allow the partitive reading (*<u>*every of the boys*</u>). We need a real map of how all of these variations in quantification are acquired before the true acquisition path will be evident.

Our focus has been on the DP dimension of grammatical growth. Not only must the child decide whether his grammar has bare N, NP or DP, many decisions about the position of quantifiers (and adjectives, possessives, and agreement) within DP must be made, all of which require time and refined experience.

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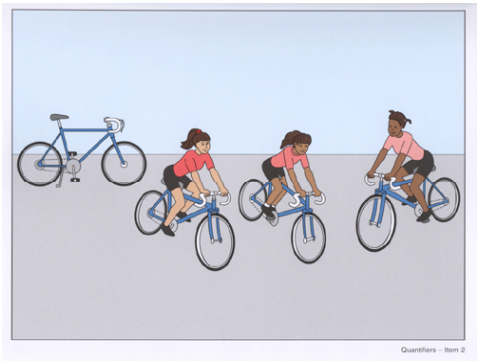


Figure 1. *Is every girl riding a bike?*

Figure 2. *Is every bunny eating a carrot?*

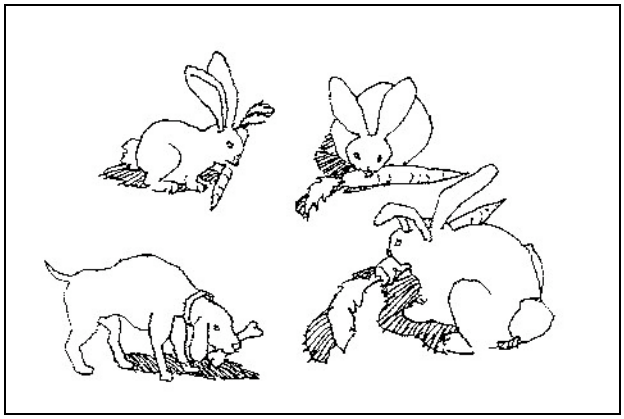


Figure 3 (TD)

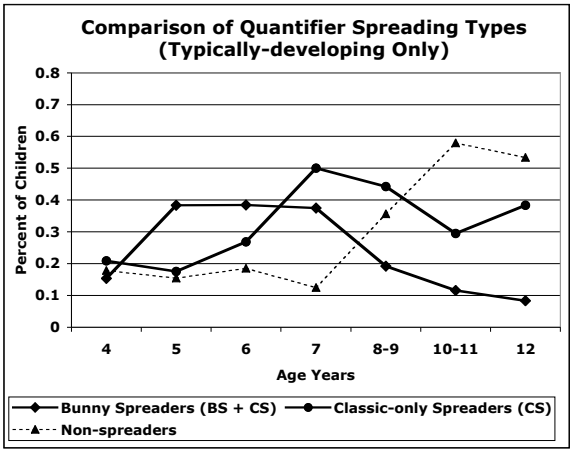
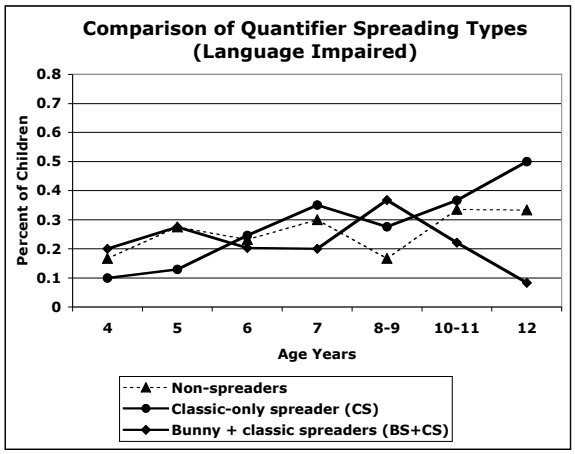


Figure 4. (LI)


Comparison of Quantifier Spreading Types
(Language Impaired)
Percent of Children
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
4
5
6
7
8-9
10-11
12
Age Years
Non-spreaders
Classic-only spreader (CS)
Bunny + classic spreaders (BS+CS)