The Late Development of Raising: What Children Seem to *Think* About *Seem*

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Why the Acquisition of Raising Seems to Matter

While it is clear that the study of language development contributes to linguistic theory, it is perhaps less widely recognized that by examining the time course of language development we can integrate the study of language into the broader study of biological development. The hope persists that this type of analysis will play a role in the genetic underpinnings of language, as it has already done in some areas of grammar. [1]

One area of grammar notorious for demonstrating late development involves various kinds of long-distance dependencies. In their comparative analysis of the development of different linguistic structures, Borer and Wexler (1987) argued that structures containing A-chains develop late.[2] We will base our study on more up-to-date and empirically correct versions of Borer and Wexler's A-Chain Deficit Hypothesis (ACDH), but the logic is the same: certain grammatical representations allowed by Universal Grammar (UG) are ungrammatical for young children because of constraints imposed by their particular biology as opposed to adult biology.

The basic argument for such maturation is Borer and Wexler's (1987) "Triggering Problem" (Babyonyshev, Ganger, Pesetsky and Wexler's (2001) "Argument from the Abundance of the Stimulus" (AOS)) that parallels Chomsky's argument from the Poverty of the Stimulus (POS; following Descartes). Since evidence for a particular structure is abundant in the input, why should it take so long for the structure to develop? Both the AOS and the POS provide evidence for biological (genetic) underpinnings of linguistic representations. In this paper, we present evidence for the late development of one structure in particular: subject-to-subject raising, thus providing evidence for the role of biology in the development of linguistic structure.

At the same time, developmental evidence can play a role in helping to determine the correct linguistic analysis of structures. Given good evidence for the developmental delay of a certain grammatical process G, then if a structure S is found not to be delayed, this provides evidence that S in fact does not make use of G. In this regard, subject-to-subject raising provides an important test case. According to the theory of development

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[1] In particular, the development of obligatory finiteness is genetically determined, as argued in Wexler (2002). The latest and most systematic behavioral genetic evidence strongly confirms that the development of finiteness is controlled by genetics and that the genetic source of finiteness is independent of the genetic source of phonological working memory (Bishop, Adams, & Norbury, 2006). There is also behavioral genetic evidence for the biological maturation of verbal passives (Ganger, Dunn, & Gordon, 2004).

[2] Borer & Wexler (1987) considered maturation to take place around age five. We have argued on the basis of much more detailed evidence that the age of development is closer to seven.

of long-distance structures that we take to be most empirically adequate, raising should show delayed development. Control structures, on the other hand, are not subject to the developmental constraint that we assume, thus they should not be delayed at anywhere near the level of raising structures.

Certain recent analyses, however, propose that control structures do not arise from a separate control module, but are actually a type of raising structure. Given the theory of development that we present, and depending on the precise syntactic analysis, these "control" structures perhaps should be delayed, possibly patterning with subject-to-subject raising structures. Closer inspection suggests that this is not so obvious, as we will see. Thus, evidence concerning how raising versus control structures develop can play a role in determining which analysis of this structure is correct, but much depends on the theory of development. As we might expect, the role of development is Janus-faced; it looks out on and contributes both to linguistic theory and biological theory.

Raising Issues for the Theory of Linguistic Development

Raising constructions involve movement or some other form of long-distance relation. The classic theory of the delay of long-distance relations in children is Borer and Wexler's (1987) A-Chain Deficit Hypothesis (ACDH).

(1) ACDH: A-chains are ungrammatical for children until a certain age. As children age, their brains mature such that A-chains become grammatical.

A great deal of evidence has accumulated that verbal passives and unaccusatives are very much delayed in young children.[3] On the other hand, ever since Borer and Wexler (1992) it has been known that the VP-internal subject hypothesis poses a problem for ACDH. If subjects are generated internal to the VP, then their movement to [Spec, IP] forms an A-chain. Yet empirical acquisition evidence shows that children are not delayed in placing the subject correctly outside the VP (Stromswold, 1996). The field for the most part concentrated on demonstrating late development for "object-to-subject" A-chains, leaving the problem of VP-internal subjects moving to [Spec, IP] to be solved. To address this problem, Wexler (2004) proposed the Universal Phase Requirement (UPR), in place of ACDH.

[3] Babyonyshev, Ganger, Pesetsky, and Wexler (2001) showed that native Russian-speaking children at age five could not systematically provide the correct analysis of unaccusatives, as tested by the Genitive of Negation in Russian. Miyamoto, Wexler, Aikawa, and Miyagawa (1999) demonstrated that children acquiring Japanese omitted nominative case for subjects of unaccusative verbs, but for no other verbs. They interpreted this to mean that the children had difficulty in producing the A-chain between the object of the unaccusative and [Spec, IP]. Without this chain, nominative case is not assignable, thus resulting in the lack of nominative case. Lee and Wexler (2001) for Korean provided further evidence for this position. Hirsch and Hartman (2006) demonstrated experimentally that children do not comprehend non-agentive object-experiencer verbs used in their "active" form (e.g. *The shadows scared Mary*), while also showing that children have no difficulty with their agentive counterparts (e.g. *The witch scared Mary*). Belletti and Rizzi (1988) argue that non-agentive object-experiencer verbs (their *preoccupare*-class) are unaccusative, involving derived subjects, while their agentive counterparts are not unaccusative.

(2) UPR: (holds of premature children, until around age seven) *v* defines a phase, whether or not *v* is defective.

The theory is couched in the Minimalist framework. Chomsky (1998, 2001) derives on minimalist considerations a very strong cyclic theory of syntax. Essentially merge proceeds from the bottom to the top of a derivational tree with most of the derivation closed off to further analysis or change as it proceeds. He proposed the Phase Impenetrability Condition (PIC) in (3):

(3) PIC: When working at a phase, the edge (the head and any specs) of the next lower phase is available for analysis, but nothing lower than the edge. In particular the complement is not available.

C (Complementizer) and *v* (the light-verb head of a phrase that takes VP as its complement and selects the external argument as its spec) are substantively defined as phasal heads (on an argument from completeness of semantic properties). Subjects of *v*P can move to [Spec, IP] because the subject, although inside a phase *v*P, can be probed at the next phase CP because the subject is at the edge (specifier position) of *v*. Passives and unaccusatives, however, create a special problem for the theory, as the object of V must move up to T (INFL) in the higher phase. Chomsky proposed that the *v* of passives and unaccusatives is "defective," that is, it does not assign an external argument and it does not operate as a phase. Thus the object of V is available at the higher C above it.

UPR states that children take the *v* of passives and unaccusatives to be phasal (although they know that this *v* does not assign an external argument). As such, verbal passive and unaccusative representations are ungrammatical for the premature child. This is the correct result empirically. On the other hand, the "VP-internal subject" of a transitive (i.e. one with an external argument) clause, generated in [Spec, *v*P] is at the edge of VP. At the next higher phase, C, the subject is available for analysis according to PIC. Thus T can "see" the subject, meaning that Agree and Move can take place; there is no need for non-phasal *v*. The child subject to UPR is also unhindered since there is no non-phasal *v* involved. UPR predicts that the child can raise the subject from the edge of *v*P with no problem. This solves the problem of VP-internal subjects that dogged ACDH.

The upshot of UPR is that there is no problem with any particular kind of chain, and no special assumptions about objects or subjects moving, or even Agreeing. The problematic constructions are (some of) those that demand a defective phase (e.g. non-phasal *v*). Consider the subject-to-subject raising structure in (4a).

(4) a. Bert seems to Ernie [*t* to be wearing a hat].
b. It seems to Ernie that Bert is wearing a hat.

The traditional analysis of (4a) considers the surface subject of the sentence to start out in the subject position of the lower predicate, from where it is moved to [Spec, IP] of the matrix clause. Unraised versions of the raised sentence exist, with an expletive in subject position, as in (4b). The movement that derives (4a) creates an A-chain. The subject moves to an argument (A) position, [Spec, IP] of the matrix clause. As such, Borer and Wexler (1987) predicted that subject-to-subject raising structures would be delayed.

On UPR, even some structures with defective phases can be unproblematic for premature children. Consider an unraised structure like (4b). Presumably *seem* with an expletive subject is defective, since it does not assign an external argument. Thus a child will take this defective *v* to be phasal given UPR. There is no reason, however, that the child cannot make the derivation converge. No relation holds between matrix T and anything in the lower clause, so that even if the child takes *v* to be phasal, nothing in the computation is interrupted. UPR predicts that unraised *seem* in sentences like (4b) should converge for the immature child, even if the derivation they use (with phasal *v*) is slightly different than the adult representation. On the other hand, consider the analysis of (4a), the raised construction:

(5) Bert_i T v_{def} seems to Ernie [t_i T_{def} to be t_i *v** wearing a hat]

Wexler (2004) writes, "The embedded clause in raising constructions like [5] does not contain C, and it contains defective Tense, $T_{def.}$ The embedded verb has normal *v**, with its directly merged external argument *Bert*. See the arguments in Chomsky (1998). The external argument raises to [Spec, T_{def}], checking the EPP feature of T_{def}. Since T_{def} doesn't contain a full complement of phi-features, the phi-feature set of the subject *Bert* remains, and *Bert* is active. All this has taken place cyclically, in the phase determined by root C. *v* of the root verb *seems* does not define a phase, since it is defective, as we saw earlier. Since *Bert* is still active it can raise to the matrix T, deleting T's uninterpretable phi-features and EPP feature, resulting in convergence of [5]."

This is Chomsky's analysis of raising. It demands a non-phasal *v*. By UPR, the child takes *v* in (5) to be phasal. T then cannot probe *Ernie* (which is in the complement of *v*), and T will end up with uninterpretable features unchecked. This is Wexler's derivation from UPR of the prediction that raised sentences like (4a) will be ungrammatical for children subject to UPR.

It thus becomes crucial to test the early status of raised sentences like (4a) in children who are at the premature age. UPR makes the interesting prediction that, although raising involves movement of a lower subject, it patterns (is late in development) with the movement of objects (passives, unaccusatives) and not with the movement of another kind of subject (the VP-internal subject of a transitive clause). If the predictions are confirmed, it will be evidence that UPR, and not a constraint against some form of chain or movement is constraining children's early grammar.

An alternative proposal for accounting for delays in passives and unaccusatives, but allowing VP-internal subjects, was Babyonyshev, Ganger, Pesetsky and Wexler's (2001) External Argument Requirement Hypothesis (EARH), according to which children demand external arguments, which they formalize in Minimalist terms as in (6):

(6) EARH: Young children consider structures with defective *v* to be ungrammatical.

EARH predicts that verbal passives and unaccusatives will be ungrammatical for young children. Furthermore, it predicts that raised structures like (4a) will also be ungrammatical, as both of these structures lack external arguments. On the other hand, EARH predicts that VP-internal subjects can raise to [Spec, IP] with no problem, since these structures have an external argument.

As Babyonyshev et al. recognize, EARH also predicts that unraised structures like (4b) will be ungrammatical for young children, since such structures contain no external argument. The comparison between raised and unraised sentences (4a vs. 4b) carried out in this paper provides an empirical test to distinguish EARH from UPR.

Hyams, Ntelitheos, and Manorohanta (ms.) look for another explanation for why passives are delayed in acquisition. They write, "Descriptively speaking, children's difficulty seems to be restricted to those A-chains that derive a misalignment of thematic and grammatical hierarchies. The argument structure associated with transitive…and unergative… verbs…specifies an actor-like external argument, which is not represented in the passive, which involves a promotion of the theme to the external argument position. Unaccusative verbs have no external argument hence no violation of canonical alignment, and the alignment is also respected in subject raising." In essence, they take the problem with passives to be that a "canonical alignment" is not respected, which premature children find ungrammatical. As we have noted, children have problems with unaccusative structure, which would speak against this hypothesis. More to the point for the present study is that the hypothesis also predicts that there will be no problem with subject-to-subject raising.[4]

Acquisition of Raising: Previous Research

Few studies to date have investigated children's comprehension of raising structures. To our knowledge, the first detailed comprehension study of raising in English was carried out by Froud, Wexler and Tsakali (in preparation). They conducted a two-choice sentence-picture matching experiment testing both raised and unraised sentences, using thought-bubbles to represent the thinking aspect of *seem*.[5] 33 participants were run, in the four- to five-year age range. On unraised, expletive sentences with *seem* and an experiencer (e.g. *It seems to Homer that Lisa is eating a sandwich*), the mean correct response rate was around 80%. On raised sentences (e.g. *Lisa seems to Homer to be eating a sandwich*), the mean response rate was around 45%. That is, on raised sentences, children performed near chance level, whereas on unraised sentences the children performed significantly above chance.[6]

Recent experimental work by Becker (2005, 2006) purports to demonstrate that young children not only comprehend raising, but that they actually analyze control structures as raising structures. Becker offers a pair of experiments to support these two claims. In her first experiment, she finds that 64% of three-year-olds and 47% of four-year-olds accept as grammatical control-verb sentences with inanimate subjects and "compatible" complements (e.g. *The flower wants to be pink*). The same children also accept raising verbs with "compatible" predicates (e.g. *The flower seems to be pink*).

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[4] Hyams and Snyder (2005) suggest alternatively that premature children accept a very strong version of Wexler and Culicover's (1980) Freezing Principle, which prevents smuggling. Following Collins (2005), raising past experiencers requires smuggling, so young children are predicted not to comprehend such structures. The smuggling approach predicts that there is no problem with raising without an experiencer. As we argue later in the paper, raising even without experiencers is delayed for children.

[5] Since the basic methodology of our experiment follows theirs, the reader can get an idea of what they did in the section that describes our experiment.

[6] The presence of the experiencer is discussed in detail later in the paper.

There are many strategies that children could be employing to derive this result, but Becker first attempts to rule out the possibility that children simply ignore the matrix verb, producing some form of copula structure (e.g. *The flower is pink*), since then children's judgments might reflect nothing more than whether the subject can occur with the embedded predicate. She tested children on a second experiment, this one a truth-value judgment task in which a character either 'seemed' or 'wanted' to do something, but in fact, did not. For example, to test the raising structures, one scenario involved a white dog who stood under a black light, and thus appeared ("seemed to be") purple. The child was then asked to judge the truth of the sentence *The dog seemed to be purple*. Becker (2006) writes, "A child parsing only *the dog . . . be purple* should respond "false", since the dog was not in fact purple; but a child parsing *the dog seemed to be purple* should respond "true" since the dog did seem to be purple when standing under the lamp." Similar scenarios were constructed for the control conditions. For example, in one, a pig wants to eat a donut, but actually ends up eating a banana. The child is then asked to judge the sentence *The pig wanted to eat the donut*. Ignoring the matrix verb should lead the child to respond that the sentence is false, since the pig in fact did not eat the donut, whereas the child should respond correctly if he does parse the matrix control verb.

Given children's above chance performance on this test, Becker deduces that children must be paying attention to the raising and control verbs in the first experiment, and concludes (1) that young children *do* in fact understand raising constructions, and that (2) it is control verbs that they cannot handle, treating them instead as raising verbs.

While we acknowledge the ingenuity of Becker's experiments, there are a number of important problems for her two conclusions, which ultimately cast into serious doubt her claims about raising and control. Most doubtful is her claim concerning control verbs being non-thematic raising verbs for children. For one thing, there is no shortage of experimental evidence (which we review in detail later in the paper) and commonsense/anecdotal evidence that children *do* correctly understand control verbs, not least of which are strikingly contradictory data from Becker's own experiments.[7] To wit:

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[7] A cursory, search of the CHILDES corpus of children's utterances turns up thousands of *want* control constructions such as the following:

[I want to read this paper]
[I want to shave too]
[I want to have some espresso]
[um # I want to be a gypsy]
[I want to drive]
[I want to ride on a panda]
[I want to hold a lamb # I didn't hold it]

Needless to say, it is not very plausible that the three-year-old speaker of the third utterance means to convey that he actually *seems* to be having an espresso (the full transcript makes it clear that he does not). By the same token, the other utterances are odd indeed on the assumption that the children are using *want* to mean something like *seem* or any other raising verb.

Corpus-based evidence for children's correct interpretation of control verbs is not limited to production. Even when responding to a parent, young children show an unambiguous understanding of verbs like *want*, as in the following example and many hundreds of others:

MOT: do you want to do that again?

Becker reports that her subjects performed fine on the control verbs in her second experiment, but on her hypothesis children should be interpreting these verbs as raising verbs, which should have produced wrong answers. According to Becker's hypothesis, children interpret *want* as *seem* (or some other semantically-simple raising verb)[8], so if they are indeed parsing the main verb, they should interpret the sentence *The pig wanted to eat the donut* as roughly *The pig seemed to eat the donut*, which is false, and should prompt the children to respond as such. On the hypothesis that children interpret control verbs as raising verbs, the results of Becker's second experiment are unexplained. On the commonsensical hypothesis that children readily comprehend control verbs, these results are unproblematic.

Furthermore, Becker's hypothesis that children treat control verbs as raising verbs makes (at least) two syntactic predictions against which production data speak. First, if control verbs like *want* are actually raising verbs, then they should not allow bare DP complements. While such structures are allowed in the adult grammar (e.g. *The man wants an apple*), they should be ruled out for the child since bare DPs are not allowed with raising verbs (e.g. **The man seems an apple*). Yet a brief glance at data on the CHILDES corpus turns up thousands of examples of control verbs with bare DPs. Second, if control verbs are raising verbs, then a control verb like *want* might be expected to have an "unraised" counterpart (e.g. *It wants that the flower is pink*). Yet, there is no evidence from production data that children ever use control verbs in such a manner. Children's use of bare DPs with control verbs, children's lack of "unraised" forms with control verbs, and Becker's own second experiment, plus twenty years of research on the acquisition of control strongly speak against Becker's claim that children provide a raising analysis to sentences containing control verbs.

A plausible alternative explanation for the findings from Becker's first experiment is that children who accept sentences like *The flower wants to be pink* are simply those children operating under the assumption that the sort of cartoon inanimate objects used in the experiment can be agents/experiencers (either for the purposes of the experiment or more generally). This is particularly likely in a story-based, game-like experimental setting, where children are often willing (and even encouraged) to suspend normal judgments and anthropomorphize pictured objects.[9] In any case, if a slightly modified

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CHI: (o)k.
(bates/free20/hank20.cha:240)

It is unclear what to make of this exchange if we are operating under the assumption that children interpret control verbs as raising verbs.

[8] For Becker, if all control verbs, regardless of their particular adult meaning, map to the syntax of raising verbs, it would stand to reason that whatever raising verbs the control verbs map onto should themselves be relatively free of particular semantic meaning in order to accommodate such a large class of interpretations. Semantically vague raising verbs like "seem" and "appear" make more likely targets for such interpretation than raising verbs with more inherent meaning like "tend" and "happen (to)".

[9] That the results of the first experiment are due to younger children taking the inanimate subjects to be sentient in this experiment is strongly suggested by children's justifications for accepting the control sentences with inanimate subjects (Becker, 2004):

Test item: # The bucket wants to be in the sandbox
Child: I think the bucket should be in the sandbox.
Inv: But do you think the bucket could want to be in the sandbox?

version of Becker's first experiment (one that discourages children from imputing animacy to inanimate objects) significantly reduced the proportion of children who judge the relevant sentences to be acceptable, then Becker's conclusion would further be called into serious question.

While Becker's second experiment suggests that children comprehend raising structures, an alternative explanation, in the spirit of the very idea that Becker was attempting to control for, presents itself. Becker's reasoning for conducting the second experiment was to test whether children could simply be ignoring raising and control verbs (giving rise to the findings from her first experiment), presumably because children might ignore them if they could not understand them in the relevant structure, as predicted, for example, by UPR. If the children ignored the verb, Becker assumes that children's representation for *The dog seemed to be purple* would be *The dog . . . to be purple*. This is only true if children failed to notice the past tense morphology on the matrix verb. If children did recognize *seemed* as a past tense form, but did not know its meaning, then their likely parse would be *The dog was purple*. Such a parse, however, would lead children to correctly answer the raising sentences, since during the scenario, the dog *was* purple (when he stood under the black light). This analysis, where children can parse the past tense morphology of a verb they do not understand in the relevant linguistic frame, extends to two of the other raised sentences Becker tested: *the horse used to be small* (where he is now big) and *the rhino happened to be under the tree* (where he is now somewhere else). Substituting the past tense form of the copula for the raising verb produces correct responses, since during the scenarios the horse *was* small and the rhino *was* under the tree (they just no longer are). This account, however, fails on the final raised sentence Becker tested: *the horse tends to eat hay* (where he ate something else). In this case, the matrix verb *tends* is not a past tense form, and substituting the present tense copula form yields the ungrammatical string *the horse is eat the hay*. Interestingly, though, while children did quite well on the first three raised sentences, as predicted by substitution of the past tense form *was*, children had such great difficulty with this last *tends* sentence that Becker excluded it from all subsequent analyses. That only this sentence would be problematic is predicted if children parse nothing more than the past tense morphology of the raising verb. These two experiments, therefore, offer little concrete evidence that children can comprehend raising structures.

While a few studies have examined children's knowledge of raising, further experimentation is very much needed.

Adult and Child Productions Containing *Seem*

Previous acquisition studies of raising have failed to investigate the degree to which children hear raising structures and raising verbs, as well as the extent to which children produce such structures and verbs. Before asking whether children comprehend

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Child: I think so. (age 3;11)

Test item: # The flower wants to be pink
Child: And the bees want to eat them!
Inv: Do you think the flower could want to be pink?
Child: Yes, and green too! (age 3;1)

raising structures, it is desirable to know whether children are even exposed to such structures and whether they produce them. In order to determine the degree to which children hear and produce raising structures, we examined the child-directed and child-produced speech for all 1051 English-speaking children on the CHILDES corpus containing the raising verb *seem* (MacWhinney, 2000).[10] Detailed analyses were limited to utterances containing the verb *seem* after initial searches made clear that *seem* was by far the most frequent raising verb in the corpus, and would thus serve as the sole verb in the comprehension experiments to follow.[11]

From 552 child-directed utterances containing *seem*, 448 analyzable, non-repetitive utterances were extracted for further investigation. For the sample considered, this implies that a child hears a unique sentence containing *seem* every 1700 utterances. While this might seem rather scarce, an average American child hears about 7000 utterances per day (Cameron-Faulkner, Lieven & Tomasello, 2003); by a child's third birthday, he will have heard 4500 sentences containing *seem*. Further, the number of input examples containing *seem* exceeds the number of input utterances containing verbs most researchers (and parents!) would judge young children to know, including *crawl*, *feed*, *hug*, *lift, pass*, and *rub*. Thus, it is unlikely that any difficulties children might have comprehending raising structures involving *seem* could be directly attributed to the rarity of the verb in the input, as the verb simply is not that rare. Also, difficulties could not be attributed directly to children failing to hear the verb used in raised constructions. The vast majority of parental use (87%) is in the raised, non-expletive form. Furthermore, it is not the case that adults in some way modulate their use of unraised and raised structures, such that the raised sentences are only used with older children. The type of structure used (raised or unraised) is not a function of age; raised forms are used at all ages, even with children who have not yet reached their first birthday.

While these input analyses make clear that children do indeed hear raising structures with the verb *seem*, analysis of children's use of such structures shows children rarely produce them. In all, only 67 child-produced utterances containing *seem* appear in the corpus, of which only 33 constitute non-repetitive, analyzable examples. There is thus an almost 14:1 ratio of adult-use to child-use of sentences containing *seem*, while the overall ratio of adult-produced to child-produced unique utterances in the corpus is less than 2:1. This input-output discrepancy is even more striking given that for verbs with similar input frequencies to *seem*, such severe discrepancies do not exist (e.g. 1.9:1 for *carry*, 2.1:1 for *climb*, 3.4:1 for *crawl*, 2.3:1 for *dance*, 0.8:1 for *feed*, 0.7:1 for *hug*, 4.0:1 for *lift*, 2.1:1 for *pass*, and 4.1:1 for *rub*). Of the analyzable child-produced examples, only 11 appear in children younger than five. Furthermore, the percentage of raised uses is less in the children than the adults (64% vs. 87%). The few children who do, however, produce raised structures with *seem*, are for the most part five years of age or older.

A closer examination of children's raised sentences reveals a striking asymmetry between the type produced by children younger than six years of age and those six and older. All the examples produced by the younger children involve small-clause adjectival complements (e.g. *that seems fun*), while eight of the nine older children's utterances

[10] At the time the searches were conducted (5/2004), this constituted every English-speaking child available in the CHILDES database.

[11] While these analyses focus exclusively on *seem*, it should be noted that other raising verbs do appear in the input to these children, including dozens of examples of *appear*, *tend* (to), *used* (to), and *happen* (to).

have verbal complements (e.g. *they seem to be following the same direction*). It is thus possible that younger children's grammar allows raising with adjectival complements, but not with verbal complements, which might be due to *seem* having different syntactic entailments depending with which type of complement it appears.[12]

Given that natural production data demonstrate that children hear many sentences involving the raising verb *seem*, but rarely produce raising structures, we now turn to experimental work investigating children's comprehension of such structures. Later in the paper, we return briefly to further analyses of children's productions of raising structures.

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[12] Why should there be a difference in the age at which *seem* with VP complements (verbal-*seem*) develops versus *seem* with small-clause (adjectival) complements (adjectival-*seem*)? Note that there are many considerations suggesting that adjectival-*seem* does not involve raising of the subject. Adjectival-*seem* tends not to allow an experiencer *to*-phrase between itself and its complement:

(i) *John seems to Bill sad.
(ii) John seems to Bill to be sad.

The experiencer, though, is allowed with adjectival-*seem* if it is fronted, but a fronted experiencer is also allowed in copular constructions:

(iii) To Bill, John seems sad.
(iv) To Bill, John is sad.

When taking a verbal complement with a stage-level predicate like *available*, verbal-*seem* allows both existential and generic readings:

(v) Firemen seem to be available.
  a. There exist some firemen x such that x seem to be available (existential reading)
  b. For all firemen x, x seem to be available (generic reading)

With adjectival-*seem*, however, only the generic reading is present:

(vi) Firemen seem available.
  a. *There exist some firemen x such that x seem available (existential reading)
  b. For all firemen x, x seem available (generic reading)

In Diesing's (1992) framework, the existential reading is derived via lowering the subject from [Spec, IP] back into [Spec, VP]. This, of course, is only possible when the subject initially raised from [Spec, VP] to [Spec, IP]. For the generic reading, on the other hand, the subject is directly generated in [Spec, IP], forming a subject-predicate relationship, with a control analysis. The lexical NP in [Spec, IP] controls a PRO subject in [Spec, VP], which is assigned a theta-role by the verb. This suggests an analysis like (vii):

(vii) John seems sad
  $[_{IP}$DP John $[_{I'}$ INFL seems $[_{VP}$ PRO sad]]]

Consequently, the subject cannot lower and only the generic interpretation is licensed. Thus, adjectival-*seem* is syntactically very similar to the copula. Crucially, there is no defective *v* involved, in fact no raising of the argument at all, thus no violation on UPR. As such, young children's early productions with adjectival-*seem* are no challenge to UPR, which actually predicts their early use, alongside the much later development of verbal-*seem*.

Comprehension of Raising: An Experimental Investigation

To investigate the acquisition of raising, four sentence structures were tested: transitive-active sentences (7), sentences with the verb *think* and finite embedded clauses (8), unraised, expletive-*it* sentences with *seem* (9), and raised sentences with *seem* (10).

(7) Homer is eating a sandwich.
(8) Lisa thinks that Bart is playing an instrument.
(9) It seems to Homer that Marge is pushing a cart.
(10) Homer seems to Maggie to be bowling a ball.

To assess children's comprehension of these sentence types, we conducted a two-choice sentence-picture matching task in which children were shown two pictures side-by-side on a laptop computer screen, and were asked to choose the picture best matching the sentence they were read. Answers were logged on the computer before proceeding to the next item. All sentences were read aloud twice before children were allowed to respond. Item presentation was randomized on an individual subject basis. In order to minimize task demands, only four characters (from *The Simpsons* television cartoon), with whom the children were familiarized during the introduction, were used throughout the experiment. Thought-bubbles were used to convey the notion of "thinking" for the *think* condition and both *seem* conditions. The notion of thought-bubbles was familiarized in the introduction. Previous research has shown that children comprehend such pictorial depictions of thinking (Wellman, Hollander, & Schult, 1996).

The active-transitive condition involved pictures in which one character interacts with an object. The foil picture for this condition had a different, non-mentioned character interacting with the same object. For the *think* condition and *seem* conditions, the correct pictures involved one character thinking about another character performing some action. Thus the picture below (Figure 1) would constitute the correct picture for the following three sentences: *Lisa thinks that Bart is playing an instrument* (think-condition), *It seems to Lisa that Bart is playing an instrument* (unraised-condition), and *Bart seems to Lisa to be playing an instrument* (raised-condition). For these three conditions, three different foil types were constructed. *Matrix-reversal* (MR) foils involved switching the character who does the thinking. Thus the MR foil for the picture below would involve Bart playing the saxophone, thinking about Lisa. *Embedded-reversal* (ER) foils involved switching the character who performs the action denoted by the embedded predicate. With respect to the picture, this would involve Lisa playing the saxophone, thinking about Bart. Finally, *double-reversal* (DR) foils involved switching both who is doing the thinking and who is performing the relevant action. The DR foil to the picture would therefore have Bart thinking about Lisa playing the saxophone. The use of these three foil types allows for the pinpointing of any difficulties in comprehension, whether it be with determining who is doing the thinking (MR foils), with who is performing the action mentioned in the embedded clause (ER foils), or both (DR foils). On any given trial, the child was always presented with the correct picture and one of the three foil types. Each of these foil types was tested six times per condition. Each child thus saw 18 items for the think-condition, unraised-condition, and raised-condition (only

12 items were used for the active-control condition). Location of the correct picture (left side or right side of the screen) was balanced across conditions and the entire experiment.

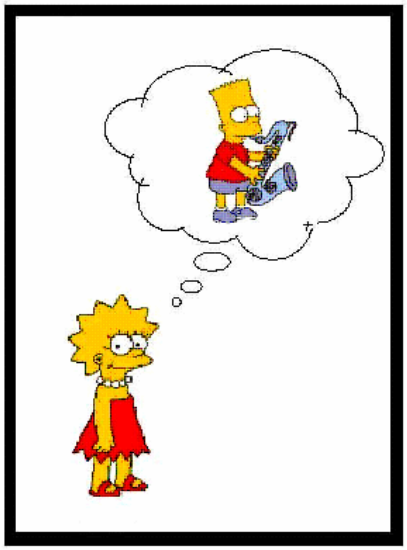

Figure 1

At this point, we should address the decision to use an experiencer *to*-phrase with the *seem* sentences. According to UPR, in no way is the presence of the *to*-phrase required to elicit poor performance from the children. This theory straightforwardly predicts that children are incapable of grammatically representing sentences involving subject-to-subject raising, whether or not this raising takes place over an experiencer. The decision to include the *to*-phrase was based exclusively on experimental considerations. It was felt that even if children cannot grammatically represent raising structures, they would still be able to roughly infer the meaning of a sentence of the form *A seems to be Z* by directly associating *A* and *Z*. How to design a plausible foil for such a sentence using a sentence-picture matching task is not at all clear. The problem is not even specific to this particular methodology, as the same concern was raised earlier for the items used in Becker's work (2005, 2006), where alternative explanations exist for her findings with experiencer-less raising structures. By including the experiencer, we are able to easily construct an experiment that is simple for children and affords the possibility of detecting difficulties with raising.

There are many reasons, however, why one would prefer an experimental design that did not involve the experiencer phrase. Many languages that have raising structures, nonetheless do not allow raising over (non-clitic) experiencers (e.g. Icelandic, Italian, and for many speakers, French). There is thus the possibility that any problems children might have with the raising sentences tested in this experiment could simply be due to children having a problem with raising over experiencers, whether it be for grammatical reasons or processing reasons, and not a general problem with raising. We return to this possibility in detail later in the paper. Regardless, given that English does allow raising over experiencers, this experiment examines, at a very minimum, whether children have acquired this property of their language.

The transitive-active sentences were meant to serve as control items to ensure that children were paying attention to the experimental stimuli, given that the correct item could be determined simply by attending to the subject of the sentence. There is voluminous evidence that even very young children have no difficulty with such sentences. Any difficulties with this condition would be a reflection of attentional problems and not core grammar. Thus, those children who did experience difficulties would be subject to elimination from the experiment. The *think* sentences were meant to serve as cognitive controls for the sentences involving *seem*. If children are able to comprehend the *think* sentences, then there is no reason why any difficulties with *seem* are due to either problems comprehending thought-bubbles or a general deficit in theory of mind.

Data were gathered from 70 children (34 girls, 36 boys), with 10 children in every one-year interval from three to nine years of age, with participant details in Table 1.

Table 1

Group	Number	Age Range	Mean Age
3 year-olds	10	3.04-3.87	3.51
4 year-olds	10	4.18-4.95	4.52
5 year-olds	10	5.13-5.83	5.49
6 year-olds	10	6.03-6.98	6.45
7 year-olds	10	7.05-7.79	7.52
8 year-olds	10	8.10-8.77	8.45
9 year-olds	10	9.05-9.96	9.49
Total	70	3.04-9.96	6.49

The experimental results, collapsing momentarily across foil type, are summarized in Table 2.

Table 2

Group	Actives	Think	Unraised	Raised
3 year-olds	100.0%	88.3%	85.6%	43.9%
4 year-olds	99.2%	92.8%	88.9%	45.6%
5 year-olds	99.2%	95.6%	92.8%	44.4%
6 year-olds	99.2%	95.6%	91.7%	51.7%
7 year-olds	100.0%	96.1%	96.7%	71.1%
8 year-olds	99.2%	98.3%	98.9%	75.6%
9 year-olds	100.0%	100.0%	98.9%	92.2%
Total	99.5%	95.2%	93.3%	60.6%

Overall, children performed extremely well on the transitive-active controls. All age groups were 99% accurate for these control trials. No child made more than a single mistake on this condition, and only 4 of 70 children made even one mistake. Thus, no children were omitted from subsequent analyses due to inattention. Children likewise performed quite well on the *think* trials, with all age groups scoring above 88% correct. This indicates that children generally had no difficulties comprehending thought-bubbles. Similarly, children performed quite well on the unraised condition, with no groups

scoring below 85% accuracy. Children generally had no difficulty comprehending the verb *seem*, at least in its unraised form.

As predicted by UPR, however, children had great difficulty with the raised sentences. Across the 40 youngest children, accuracy did not differ from chance level ($t(39) = -0.978$, $p = 0.334$). No group scores noticeably better than chance level until the seven-year-olds. Across the first four groups (three-year-olds to six-year-olds), development is flat, with only a 6.7% increase in performance over these three years. In the following year alone, however, performance rockets up an impressive 22.8%. This type of rapid growth following years of level stagnation is exactly what is expected on a maturation account, where prior to some genetic event, children lack the necessary grammatical representation to derive the correct sentence meaning, but after maturation, such analyses are possible. This sudden increase in raising performance is further noted in individual subject analyses, counting the number of children in each age group who score above chance (minimum 14 of 18 items correct). As seen in Table 3, before the age of seven, only eight children scored at above chance level on the raised condition. In the subsequent seven year-old group, there are already six children scoring above chance. Of the 41 children who fail to score above chance on raising, 78% of them are less than seven years of age. Meanwhile, 70% of the children seven years-old and up score above chance on this condition.

Table 3

Group	# Children Scoring Above Chance on Raising
3 year-olds	2
4 year-olds	1
5 year-olds	2
6 year-olds	3
7 year-olds	6
8 year-olds	6
9 year-olds	9

A preliminary examination of the data thus supports the class of grammatical acquisition theories (including UPR) predicting that structures involving subject-to-subject raising are delayed. Children comprehend unraised structures involving *seem*, but cannot comprehend their semantically-equivalent raised counterparts until around the age of seven. Before this age, very few children (only 20%) comprehend raising structures, whereas most children older than this do comprehend raising. While the above data certainly demonstrate a delay for raised sentences with *seem*, certain children did have difficulties with *think* and unraised *seem* trials, as made clear by an examination of performance as a function of foil type.

Children do rather well (>75% correct) on all foil types with *think* at all age ranges. Yet for these *think* sentences, it is also clear that children have the greatest difficulties with the MR foils. Children are overall 5% worse with MR foils compared to the average of the other two foil types. The fact that the younger children score significantly better on *think* trials with ER and DR foils compared to trials with MR foils suggests that ER and DR trials are somehow easier for children. This might be because when given a sentence of the form *X thinks that Y is doing Z*, even children who did not

know the meaning of *think*, but who nonetheless correctly parsed the embedded clause, would still be able to correctly reject the ER and DR foils, since both (incorrectly) involve pictures in which the subject of the embedded clause is not performing the action denoted by the embedded predicate. When presented with the MR foil, however, children cannot simply look to the embedded clause to determine which picture to choose, since both the correct picture and the MR foil have the subject of the embedded clause performing the action denoted by the embedded predicate. In order to consistently choose the correct picture over the MR foil, children must understand that the matrix subject in the *think* sentences denotes the experiencer.

Thus a test of children's knowledge of *think* is whether or not they score well on those *think* trials involving MR foils. We take "above chance" performance on *think* sentences with MR foils to be 83% accuracy and greater.[13] As indicated in Table 4, 14% of all the children fail to meet this level of proficiency. Five of 10 children failing on the MR *think* trials are three-year-old, and nine of 10 are younger than six. These children either do not comprehend the verb *think*, do not comprehend the pictures used to depict characters thinking (i.e. thought-bubbles), or fail at theory of mind, such that they cannot represent one character thinking about another. Numerous studies suggest that theory of mind develops around the age of four (for a review see Wellman, Cross & Watson, 2001), and this could account for the difficulties that some children had on the *think* trials. Children who do not comprehend these *think* items fail to offer interesting data as pertains to knowledge of raising, and are excluded from many of the subsequent analyses.

Table 4

Group	# Children Think-MR < 83%	% Children Think-MR < 83%
3 year-olds	5	50%
4 year-olds	2	20%
5 year-olds	2	20%
6 year-olds	0	0%
7 year-olds	1	10%
8 year-olds	0	0%
9 year-olds	0	0%
Total	10	14%

Turning to children's comprehension of the unraised sentences as a function of foil type, by four years of age all foil conditions are answered above 75% correct. Again, however, children have the greatest difficulty with MR foils, scoring 10% worse on the MR foils with unraised *seem* compared to the average of the DR and ER foils. Just as children can answer the *think* sentences with ER or DR foils by merely parsing the embedded clause, so, too, can children comprehend the unraised sentences with ER and DR foils by doing nothing more than correctly parsing the embedded clause. In a sentence of the form *It seems to X that Y is doing Z*, children cannot just look to the embedded clause with MR foils, since both the correct picture and MR foil have the subject of the embedded clause performing the action denoted by the embedded

[13] Strictly speaking, statistically significant above chance performance for six items, before even compensating for multiple comparisons, requires getting all six items correct. To compensate for children's distractibility, a slightly more liberal cut-off has been used (5 of 6 correct).

predicate. In order to correctly reject the MR foil with unraised *seem*, children must also comprehend who is doing the thinking (i.e. correctly understand the relationship between *seem* and the *to*-phrase experiencer). In order to understand this relationship, children must comprehend *seem*. Thus, accurate performance on unraised sentences with MR foils serves as a test of whether or not the children comprehend the verb *seem*. Again, taking "above chance" performance to be 83% accuracy (minimum 5 of 6 items correct), 19% of children have difficulty with unraised *seem*. As shown in Table 5, all of the children who have trouble with unraised sentences are younger than seven years of age. Fully 70% of the three year-olds fail on unraised *seem*, constituting half of all those who fail.

Table 5

Group	# Children Unraised-MR < 83%	% Children Unraised-MR < 83%
3 year-olds	6	60%
4 year-olds	3	30%
5 year-olds	2	20%
6 year-olds	2	20%
7 year-olds	0	0%
8 year-olds	0	0%
9 year-olds	0	0%
Total	13	19%

These data make it clear that while the good majority of children four years of age and older comprehend the verb *seem* (at least in its unraised form), most three-year-olds do not. This suggests that raising cannot be studied in children younger than four, as they do not even know the meaning of the raising verbs used in the unraised form, which brings up many challenging questions for Becker's research. She tested three-year-olds' knowledge of raising constructions, but had no independent assessment of whether the children actually knew the raising verbs used in the experiment (e.g. she never tested the verbs in their unraised form). Once again, the results of those children who do not comprehend *seem* in its unraised form cannot speak to the question of children's comprehension of raising, and will be omitted from many subsequent analyses.

Children's comprehension of the raising sentences appears quite different than their comprehension of the other sentence forms. All foil types are answered at or below chance level until seven years of age, as seen in Figure 2 (below chance level is indicated by the line at 38%).[14] While MR and ER foils are answered at chance level before age seven, DR foils are consistently answered at below chance level. That is, children actually prefer the DR foil to the correct picture, and are not randomly guessing when a DR foil is paired with a raised sentence, though they do appear to be guessing when given MR and ER foils. Systematic preference for DR foils and chance performance with MR and ER foils is further reflected in individual subject analyses, where of the 31 children younger than seven who score at chance level on the average of ER and MR trials (33%-66% accuracy), 84% score below chance on DR trials (<17% accuracy). Children are not selecting the DR pictures, though, simply because such pictures are

[14] Below chance performance was calculated for six items per (foil) condition across an age group of 10 children, not correcting for multiple comparisons, which yields a mildly liberal cut-off.

inherently more attractive. As noted earlier, children actually prefer the MR pictures with *think* sentences and unraised *seem* sentences.[15]

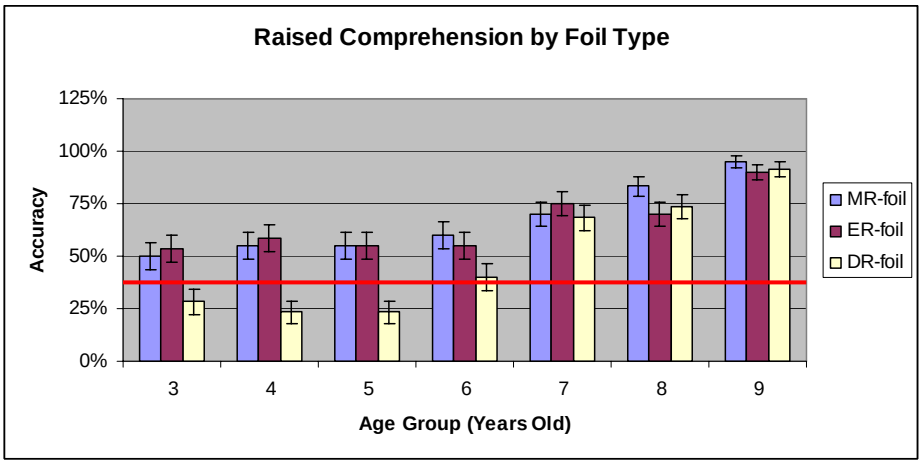

Figure 2

According to UPR, children lack the syntactic means necessary to compute raising. This inability to mediate the dependency between the matrix subject position and embedded subject position appears quite compatible with children's poor performance on raising trials. What then to make of the much worse and below chance performance for the DR foils compared to the other foils? The effect of foil type suggests that children are applying different strategies when interpreting raised sentences depending on which type of foil is presented along with the correct picture. The data rule out several strategies.

First, children are not blindly guessing when presented with a raised sentence. Guessing would result in chance performance across all foil types, but children *consistently* choose the incorrect picture when presented with DR foils. Second, children are not simply analyzing the nearest noun to the embedded predicate as the subject of the embedded clause. This would predict below chance performance for both ER and DR foils, but children only demonstrate below chance performance for the DR foils. Third, they are not simply ignoring the matrix subject plus *seem* and just parsing the embedded clause, as this would predict below-chance performance for ER and DR foils.

Instead, children appear to be providing a "think analysis" to the interpretation of raising sentences. The sentence *Bart seems to Lisa to be playing an instrument* leads children to interpret it as meaning *Bart thinks Lisa is playing an instrument*. This interpretation maps directly to the DR foil and straightforwardly accounts for why children choose the DR foil over the correct picture. Since for ER and MR foils neither the correct picture nor the foil matches such an interpretation, children simply guess, which accounts for chance performance with ER and MR foil types.

This *think* analysis might work syntactically in one of many ways. First, children might replace *seem* with *think* and ignore the fact that the embedded clause is non-finite, resulting in the forced parse *X thinks to Y to be Z*. Such an analysis requires children to ignore the preposition *to* and to ignore the fact that *think* elsewhere in the grammar

[15] Note that this also indicates that children's preference for MR foils with *think* and unraised *seem* is not due to any inherent preference for the MR pictures, since with raised *seem* children prefer DR foils.

requires a finite embedded clause. An alternative analysis would be that children actually take *think* to be a possible object-control verb. While this is not licit for adult speakers in English, such an analysis is fine for certain semantically related verbs (11).

(11) John believes/imagines/understands Mary to wear a hat (every Sunday).

As for the preposition *to*, children might ignore it, or even take it as a marker for *think* that takes a non-finite complement. Regardless of the exact representational details, it is clear from the acquisition data that some structure with these semantic entailments holds for children's analysis of raising structures containing *seem* and an experiencer.

Many things can be said about why children invoke such an analysis. First, and most importantly, children are unable to provide the (correct) adult representation for these raising sentences. Nonetheless, children have heard *seem* used many times, most often in contexts where it is clear to them that something like "thinking" is being referenced. At a level of general semantic conception, *think* and *seem* share many properties. As the experimental evidence also makes clear, children comprehend quite well sentences with *think*, probably as soon as they develop a theory of mind. While children do not comprehend raising sentences, they nonetheless attempt to find some reasonable interpretation for such sentences, most likely unconsciously. Returning to the earlier CHILDES data, it is worthy of note that the utterances children hear containing *seem* might lead them toward a think analysis for raised *seem*. The majority of raised sentences that children hear contain animate subjects, where animacy is a prerequisite for sentience, and only sentient entities may be subjects of *think*.

It must be asked whether this strategy is particular to the context of the experiment, or whether it reflects core knowledge on the part of the child. That is, do children merely substitute *think* for *seem* given the demands of the experimental task, or do they actually come to the task with a lexical entry for *seem* along the lines of an object-control version of *think*? Also, should we expect this analysis to hold for all raising verbs? While such an analysis can easily be extended to *appear*, it is unclear how it could apply to certain other raising verbs (e.g. *used* (to)). Also, it is important to note that children cannot be extending this analysis to sentences with unraised *seem*, since this would most likely lead to comprehension difficulties, while children performed quite well on unraised structures. That there are so few examples of *seem* in children's productions suggests that children do not actively maintain such an analysis of *seem*, since if they did have such a representation we might expect them to produce more utterances with raised *seem*. Recent experimental work by Hirsch, Orfitelli, & Wexler (in progress), discussed below, does suggest, however, that the *think* analysis for raised *seem* is rather pervasive.

We conclude that premature children have no problem with unraised structures but demonstrate a very significant delay on subject-to-subject raising structures. In natural production, young children do not produce raised structures, although they produce unraised adjectival complement structures with the same verb *seem*. Even more strongly, in our experimental comprehension study, children younger than seven years of age performed extremely poorly on raised structures although they performed very well on unraised structures. Good performance on *think* trials and unraised *seem* rules out "cognitive complexity" explanations for difficulties with raising.

These are exactly the predictions that the Universal Phase Requirement makes. Since raising structures demand a defective *v*, and UPR says that children will replace this by a fully phasal *v*, raising structures will be ungrammatical for them. As such, they will either guess at the answer or use an interpretive strategy, assimilating the structure to another structure that is grammatical for them. Evidence was reviewed that many children treat the raised structures as if they are a non-raised structure with a verb meaning roughly *think*. In many ways, this is the use of a syntactic-homophone (Babyonyshev et al's term), along the lines of Borer and Wexler's (1987) analysis in which children use the adjectival passive structure (grammatical for them) as a substitute, when it works, for the verbal passive (ungrammatical for them).

EARH, on the other hand, does not fare well. EARH, which says that all structures must have an external argument, correctly predicts that raised structures will be delayed for premature children, since they lack an external argument. On the other hand, unraised structures using expletives and *seem* are also predicted to be problematic by EARH, since they too lack an external argument. Yet children do quite fine on these structures, thus EARH cannot be maintained. Hyams, Ntelitheos, and Manorohanta's hypothesis about canonical structure also fails to predict the data, since it expects children to have no problem with raised structures. Hyams and Snyder's maturation theory of strong freezing does predict that these structures will be delayed, although it also predicts that raising without the experiencer should be understood, which we argue against later in the paper.

Thus our data select between a constraint against non-phasal *v* and a constraint against non-theta-role assigning *v* (no external arguments). The former turns out to be empirically correct. It looks as if children are not biologically prepared to handle categories that should be phasal (on the simplest minimalist terms, as Wexler (2004) argues) but are not. On the other hand, children have no trouble with structures in which *v* does not assign an external argument, so long as *v* does not have to be non-phasal. As for ACDH, it fares fine on the raising data, but it already has trouble with VP-internal subjects. In the following sections, we consider further evidence in support of UPR.

Children's Comprehension of Raising and Passives: An Experimental Investigation

Maturation theories such as UPR and ACDH predict that the acquisition of raising should match that of passives, both across age groups, and more importantly, within individual children. In order to examine whether raising and passive acquisition do indeed mirror one another, a few words on the acquisition of passives are required. With respect to English, the acquisition literature is quite clear that passives are delayed (Slobin, 1966; Turner & Rommetveit, 1967; Bever, 1970; Maratsos & Ambramovitch, 1975; Maratsos, Fox, Becker, & Chalkley, 1985; Gordon & Chafetz, 1990; Fox & Grodzinsky, 1998; Hirsch & Wexler, 2004a).

Not only do English-speaking children show a delay for passives, they have significantly more difficulty with passives with "psychological" verbs (e.g. *see, love*, *hear*; subject-experiencer verbs) compared to passives with actional verbs (e.g. *push, kick*, *wash*), but importantly not actives. This interaction is confirmed by every study that has crossed voice and verb type (Maratsos, Kuczaj, Fox & Chalkley, 1979; Maratsos, Fox, Becker & Chalkley, 1985; Sudhalter & Braine, 1985; Gordon & Chafetz, 1990; Fox

& Grodzinsky, 1998; Hirsch & Wexler, 2004a; Hirsch & Wexler, 2006; Hirsch & Hartman, 2006). Coupled with Horgan's (1978) findings that children's early passives describe states and not events, Borer and Wexler (1987) hypothesized that children lack the syntactic means to represent verbal passives (their ACDH), while better performance on actional passives was due to an adjectival strategy. Since verbal passives and adjectival passives are homophonous in English, and given that children otherwise lack a syntactic parse of verbal passives, children treat actional verbal passives as adjectival passives, for which their grammar does provide an analysis. As (subject-experiencer) psychological verbs universally tend not to form adjectival passives, children are unable to comprehend psychological passives, resulting in guessing and chance performance.

There is much evidence supporting the hypothesis that young children's (actional) passives are adjectival. Babyonyshev and Brun (2003) present relevant evidence from Russian, a language with different verb forms for imperfective and perfective aspect. They studied the passives children hear and produce with respect to the aspectual form used. In terms of what children hear, for active voice sentences there was no significant difference between the use of perfective and imperfective aspect. In the passive voice there was also little difference, with a slight minority of perfective forms used by parents. Yet, 91% of the passives produced by the children were perfective. Babyonyshev and Brun suggest that this striking asymmetry is understandable in terms of an adjectival strategy, since perfective passives, but not imperfective passives, are homophonous in Russian with the adjectival passive form. Terzi and Wexler (2002) asked how children would comprehend actional passives in a language in which verbal passives and adjectival passives are not homophonous (Greek). They found that unlike English-speaking children, who master actional passives quite early, Greek children had great difficulty with actional passives, even at later ages. In a recent study, Hirsch and Hartman (2006) present experimental evidence that the earliest passives children comprehend are not the paradigmatic actional passives used in previous experiments (e.g. with *hit*), but those with object-experiencer verbs (e.g. with *scare*). In part, their explanation centers on the fact that achievement verbs make even better adjectival passives than activity verbs.

In order to investigate the relationship between the acquisition of raising and passives, the same 70 children who participated in the previous raising study were administered a passive test within two weeks of having taken the raising test. This experiment tested four conditions, crossing voice (active vs. passive) and verb type (actional vs. psychological).[16] Eight verbs were used, consisting of four actional verbs (*push, kiss, kick, hold*) and four psychological verbs (*remember, love, hate, see*). Eight

[16] The passives conditions were further subdivided according to whether or not they contained a *by*-phrase, half of the passives being full passives (with a *by*-phrase) and half being truncated passives (without a *by*-phrase). It has been claimed by Fox and Grodzinsky (1998) that children comprehend truncated psychological passives, which they take as evidence that children do not have a general deficit in passive comprehension. Their claim that truncated psychological passives are not delayed, based on only eight children, has since been shown to be false. Not only has their finding not been replicated, but numerous studies using both more children and more items demonstrate that truncated psychological passives are just as delayed as their full counterparts (Gordon & Chafetz, 1990; Hirsch & Wexler, 2004a; Hirsch & Wexler, 2005; Hirsch & Wexler, 2006). Of the 140 subjects examined by Hirsch & Wexler (2006), only two children have scores matching the Fox and Grodzinsky pattern of good performance on truncated psychological passives and poor performance on full psychological passives. Fox and Grodzinsky's result appears to be due to methodological problems, including too few subjects, too few experimental items, a failure to randomize conditions, and delays between when conditions were tested.

items were constructed for each active condition, and 16 items for each passive condition. All sentences were semantically reversible. In order to minimize task demands, once again only four *Simpsons* cartoon characters were used throughout the experiment. To assess children's comprehension of these four sentence types, we employed a two-choice sentence-picture matching task wherein children were shown on a laptop screen two pictures side by side depicting opposite events. Children were told to choose the picture best matching the sentence they were read, after which their answers were logged on the computer before continuing to the next item. All sentences were read twice to the child before he was allowed to respond. The location of the correct picture (left or right side of the screen) was balanced across the individual verbs, conditions, and the entire experiment. Items were presented in a randomized order to each child.

The results of this experiment appear below in Table 6. Children performed extremely well on both active conditions. Excellent performance on the psychological actives, which were comprehended slightly better than their actional counterparts, indicates that children have no general problem comprehending psychological verbs, nor any difficulty with the experimental methods for assessing such knowledge. We replicate all past experiments crossing voice and verb type, and find much worse performance for psychological passives as compared to actional passives. Furthermore, the study replicates previous findings that psychological passives are not comprehended until around seven years of age (Maratsos et al., 1987; Hirsch & Wexler, 2006).

Table 6

Group	Actional Actives	Psych Actives	Actional Passives	Psych Passives
3 year-olds	96.3%	98.8%	65.6%	38.1%
4 year-olds	95.0%	98.8%	86.3%	50.0%
5 year-olds	97.5%	98.8%	92.5%	58.8%
6 year-olds	97.5%	98.8%	89.4%	45.6%
7 year-olds	97.5%	97.5%	95.6%	75.6%
8 year-olds	100.0%	98.8%	92.5%	82.5%
9 year-olds	100.0%	100.0%	95.0%	90.6%
Total	97.7%	98.8%	88.1%	63.0%

For the purpose of examining in detail the relationship between the acquisition of raising and that of passives, it is vital to minimize the influence of any compensatory strategies that children might be employing in an attempt to comprehend structures for which their grammar is unable to provide a representation. Since these strategies are hypothesized to be dependent on environmental factors and mechanisms of general cognition, and not on pure syntactic competence, they must be isolated for the purpose of exploring deeper syntactic knowledge.[17] For raising, this means examining only the data

[17] That children's analysis of actional passives is at least in part determined by environmental factors is demonstrated in recent work by Hirsch, Modyanova, & Wexler (2006). They administered a survey to the parents of the 140 children tested in the Hirsch & Wexler (2006) study, querying parents about numerous biographical details. It was found that many environmental factors (e.g. parents' education, child's age at enrollment in daycare, number of hours child is read to, etc) predict acquisition of actional passives. None of the more than twenty factors surveyed, however, predicted the acquisition of psychological passives. The child's age (younger or older than seven) was the only predictor of psychological passive acquisition.

from MR and ER trials since children employ a consistent strategy when given DR foils (i.e. the *think* analysis). As for passives, only psychological passives should be included, as actional passives are "understood" using an adjectival strategy. Thus, in all subsequent analyses, performance on raising will be examined only with respect to comprehension of raising sentences paired with MR and ER foils. Similarly, for passives, only scores on psychological passives will be examined further.

Plotting children's scores on raising and passives by age group reveals very similar development curves (Figure 3). Before seven years of age, children show generally no improvement in comprehending either raising or passives, with sudden and dramatic improvement at age seven across both structures. It is only with the seven year-old group that there is a noticeable deviation from chance level for both structures[18].

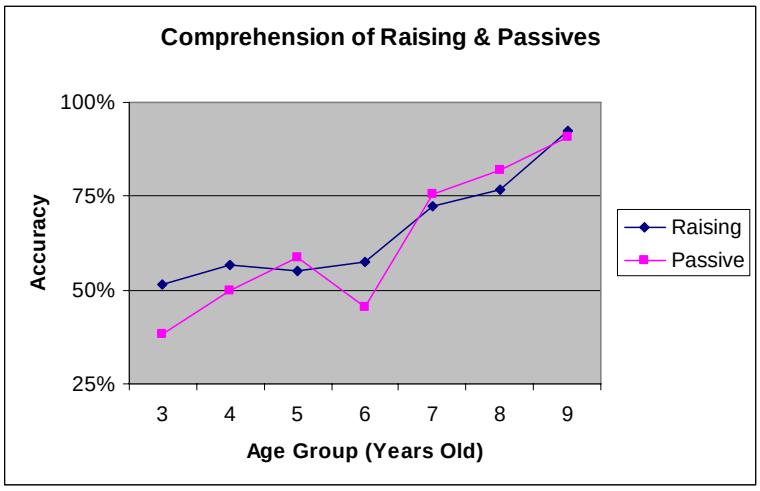

Figure 3

The similarity in the patterns of acquisition is further demonstrated by considering the number of subjects in each age group who score above chance on each structure.[19] As reflected in Figure 4, before the age of seven, no more than three of ten children score above chance in any age group. The seven year-old group, however, has six children who score above chance on raising and passives. This sudden increase in above-chance comprehension accounts for the sudden increase in group accuracy, as opposed to all children doing just slightly better.

[18] An anonymous reviewer asks about the slight drop in passive comprehension in the six year-olds in Figures 3 and 4. This appears to be just coincidental, as the six year-old comprehension level is not significantly different than that of the five year-olds in either analysis, nor does the accuracy of the six year-olds differ from chance level.

[19] Note that above chance performance here is different than in Table 3, as responses to DR items are not being considered. Here, above chance performance for raising is at least 75% correct (9 of 12 items correct). For passives, above chance performance is defined as at least 75% correct on both truncated and full psychological passives (6 of 8 items correct on both subconditions), which is relatively conservative.

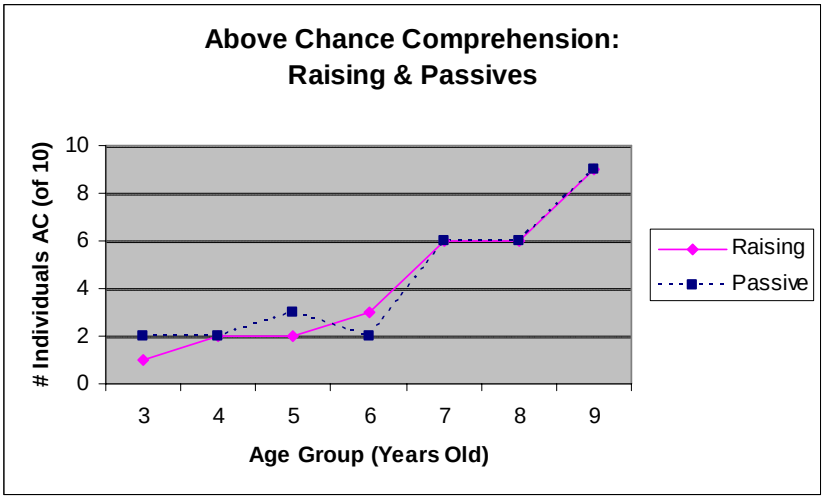

Figure 4

While such data strongly suggest that the acquisition of raising and passives are fundamentally linked, providing exciting evidence in support of certain maturation theories, what such theories predict is not simply that the average age of acquisition for both structures should match (in this case somewhere between age six and seven), but rather, that acquisition of both structures should correlate within individual children.

It is important to note, however, that the maturation theories do not predict that a strictly linear correlation should hold between children's scores on raising and passives. Rather, these theories predict that two groups of children should be observed. The first group would consist of children who have not undergone the relevant maturation, and who should thus score poorly on both raising and passives. The second group of children would be made up of those whose grammar has matured, such that these children are expected to comprehend both raising structures and passives. Before grammatical maturation takes place, comprehension of raising and passives is guided by relatively idiosyncratic and independent strategies (i.e. the *think* analysis for raising and the adjectival analysis for passives). Thus, there is no great expectation of a strong correlation between the actual scores on raising and passives, especially for the younger children. Rather, the strong prediction of UPR is that there will not be children who comprehend raising but not passives, and vice versa. That is, the maturation theories predict very strong correlations of above chance performance on raising and passives.

Before examining such correlations, it is necessary to remove from consideration those children who failed to comprehend the *think* and unraised *seem* trials during the raising experiment, as measured by performance on MR trials. Problems with theory of mind or simply in understanding *seem* guarantees problems with raising, even if the relevant linguistic maturation has taken place to make passives grammatical. Removing such cases leaves data from 53 children. The data for these remaining children is summarized in the scatter plot below (Figure 5), where lines at 75% indicate above chance level for raising and passives. Significant, and very high correlations obtain when either exact scores ($r(51) = 0.799$, $p < 0.0001$) or above-chance performance ($r(51) = 0.851$, $p < 0.0001$) are examined.

The scatter plot shows that in general, older children tend to cluster in the upper right quadrant (above chance on both structures), while children younger than seven tend

to populate the lower left quadrant (not above chance for either structure). As predicted by UPR, very few children seem to fall outside these two quadrants. There are only four apparent contradictions to the predictions of this maturation account.

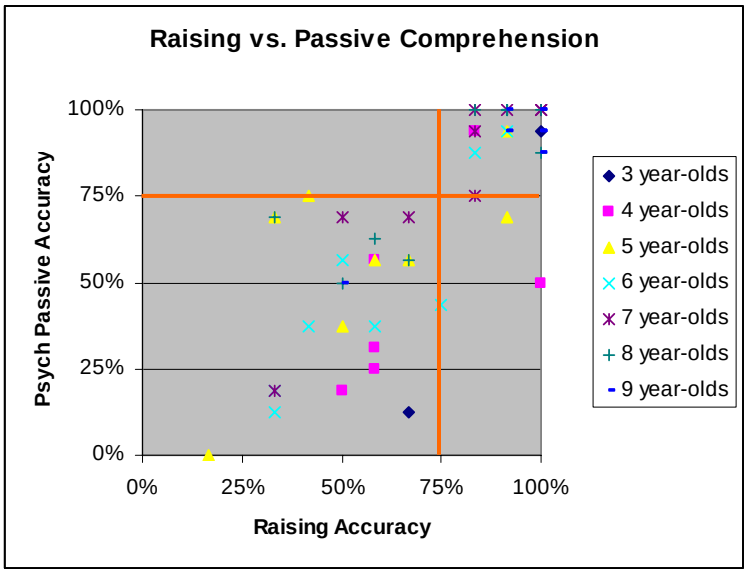

Figure 5

Upon further review, three of these turn out to be very marginal contradictions. Had one subject missed just one more passive item he would not be an exception (not above chance for either structure). Had another subject done one item better on passives, he would not be an exception (above chance for both structures). Had the third child done one item worse on raising, he would also not be an exception (not above chance for either structure). That is, had these three children scored just one point differently they could not be considered exceptions. That leaves only one true exception, a four-year-old child who got all of the raising items correct, but was at chance for the psychological passives.[20] In fact, it is amazing that the three-year-old who does well on raising also does well on passives, and likewise, that the nine-year-old who fails on raising also fails on passives.[21] While maturation theories predict that there should be few such children, it is telling that these apparent age "exceptions" are not exceptions to the correlation predictions of UPR. Despite the one counter-example, the maturation theories receive tremendous support from the near perfect correlation between raising and passives.

Raising over Experiencers, (Adult) Processing, and More Acquisition Findings

[20] Perhaps this child has undergone the relevant linguistic maturation, but for some unknown reason, fails to recognize the morphological markers of passives. If this were true, he would not constitute an exception.

[21] It is even more impressive that poor raising and passive scores correlate in the nine-year-old child, since it is known from other experiments in which the child participated that she has for her age above average IQ as measured by KBIT, above average vocabulary as measured by PPVT, and above average grammatical competency (at least for non-raising and non-passive structures!) as measured by TROG. In light of these facts, poor performance on raising and passives thus demonstrates the acquisition of these structures to be independent of other aspects of both general cognition and linguistic development, while nonetheless being dependent on one another.

In this section, we review how the experiencer *to*-phrase in the raising sentences might shape children's poor comprehension of such structures. Two general lines of inquiry will be pursued, one addressing processing costs incurred by raising over an experiencer, and another addressing grammatical implications of such movement. Upon review, it is our conclusion that neither processing nor a grammatical ban on raising over experiencers accounts for children's delay in raising.

Many theories of (adult) processing predict increased costs associated with forming long-distance dependencies across an intervening DP, as occurs in raising sentences with an experiencer (e.g. Gibson, 1998; Gordon, Hendrick, & Johnson, 2001). Could such processing costs coupled with an assumption about children having more limited processing resources (for which we know of no evidence) explain why children fail to comprehend the raising structures tested in our experiment? This appears to be unlikely for several reasons. First, even if processing limitations could account for children's general difficulty with raising, which will be addressed momentarily, it is utterly unclear how any such processing account could explain the specific problems children have with raising (i.e. chance performance for ER and MR foils, and below chance performance for DR foils).

To address the possibility of a processing explanation, though, we had 24 native English-speaking adults, half men and half women (18-24 years, mean age 19.0 years) complete the same raising test as administered to the children, with two small changes. First, the sentences appeared at the bottom of the screen for the adults to read. Subjects were free to respond at any time once the pictures and sentence were presented. Second, in addition to accuracy, subjects' reaction times (RTs) were also recorded from the time that the pictures were first presented to when the subject pressed the key to choose the picture matching the sentence. The task was therefore completely self-paced, other than the introduction, which was identical for the children and adults. In order to minimize the influence of outlying RTs, we eliminated all responses falling three SDs above the mean response time (calculated with respect to each subject's mean) and those faster than 900 ms, resulting in a loss of only 1.9% of the total data. We also eliminated these responses from accuracy counts, since it is unclear what to make of any sentences answered extremely quickly or slowly. The adult data is summarized in Table 7.

Table 7

Condition	Accuracy	Reaction Time (ms)
Actives	99.0%	2150
Think-DR	98.6%	3056
Think-ER	98.6%	2979
Think-MR	99.3%	2911
Mean Think	98.8%	2982
Unraised-DR	98.6%	3164
Unraised-ER	97.9%	3216
Unraised-MR	99.3%	3235
Mean Unraised	98.6%	3205
Raised-DR	94.9%	4028
Raised-ER	96.2%	4490
Raised-MR	95.7%	4344
Mean Raised	95.6%	4284

As is clear from these data, compared to their semantically-equivalent counterparts, subjects answered the raising sentences an average of 3.0% less correctly and 1079 ms more slowly. This is in line with the predictions of the processing accounts. What is also clear, however, is that there is no evidence of any foil effects, which were so important in explaining children's difficulties. While children had more difficulty with MR foils for *think* and unraised seem, no foil effect is found for either sentences structures in either accuracy ($F_{\text{think}}(2,429) = 0.201$, p = 0.818; $F_{\text{unraised}}(2,429) = 0.505$, p = 0.604) or RT ($F_{\text{think}}(2,429) = 0.387$, p = 0.679; $F_{\text{unraised}}(2,429) = 0.088$, p = 0.916). Furthermore, while children had much greater difficulty with DR foils for raised sentences, again, no difference is found by foil type in the adults for either accuracy ($F_{\text{raised}}(2,408) = 0.132$, p = 0.876) or RT ($F_{\text{raised}}(2,408) = 1.57$, p = 0.208). The lack of even minute RT effects by foil type for the adults in light of children's striking comprehension differences according to foil type is powerful evidence against processing explanations for the children's data.

A further argument against processing explanations is the observation that children have no difficulties mediating long-distance dependencies across intervening DPs when A-bar movement, as opposed to raising's A-movement is involved. Children as young as three have no difficulties producing or comprehending object-extracted *wh*-questions (Stromswold, 1995; Hirsch & Hartman, 2005). Also, children are known to comprehend object-extracted relative clauses, which involve forming a dependency between an object gap and a filler which crosses the intervening subject, as long as relevant pragmatic conditions are taken into consideration (Hamburger & Crain, 1982).

Finally, processing theories working over surface structure relations predict children should perform much better if the experiencer *to*-phrase is fronted (e.g. *To X, Y seems to Z*). While we have not yet fully completed an experiment examining this issue, we do have pilot work from 30 subjects (4-6 years) testing just such structures, with the experiencer fronted for both unraised and raised sentences with *seem*. Children have no difficulties comprehending the unraised sentences with a fronted experiencer. Even with the experiencer fronted, children continue to have difficulties with the raised sentences. Difficulty is greatest with MR foils, which is to be expected, since with DR and ER foils, children need only look past the fronted PP to determine the correct picture.[22]

Having considered and found inadequate processing explanations for these data, we turn now to a possible grammatical ban in children's early grammar on raising over experiencers. It is well established that many languages that allow raising nonetheless prohibit raising over experiencers (e.g. Icelandic, Spanish, French, Italian, amongst many others). This ban has often been taken to reflect a strong locality requirement on A-movement (McGinnis, 1998; Torrego, 2002; Collins, 2005). Perhaps English-speaking children assume they are speaking Icelandic, at least with respect to rules about raising

[22] Perhaps most striking is the finding that many of the children even have difficulties with DR and ER foils in the raised condition. This means, for example, that when presented the sentence *To Lisa, Bart seems to be playing an instrument* many of the children are willing to (incorrectly) choose the ER foil in which Lisa is playing an instrument while thinking about Bart. These same children never make such a mistake with the unraised sentence *To Lisa, it seems that Bart is playing an instrument*.

over experiencers. That is, perhaps children's early grammar simply rules out raising over experiencers, and not raising generally as predicted by UPR.[23]

What would such an account look like? Presumably the idea is that raising over experiencers is "marked", that children start out with the unmarked value of the parameter (no raising over experiencers) and "learn" or "reset" the parameter with experience. Such an account goes up against Borer and Wexler's (1987) Triggering Problem. Why should it take seven years for the child to reset the parameter, given that the child has the relevant experience? Why do most children suddenly set it at exactly the same age (but not sooner)? In other words, even if this were the correct account, we would still need a maturational theory to explain the slow development. This would be even more surprising since learning language-specific parameter settings is accomplished very early (Wexler's (1998) *Very-Early Parameter-Setting*).

More difficult for the idea that children's only problem is with raising over experiencers is that on such an account the incredibly strong correlations between the acquisition of raising and passives is completely unexpected. On UPR, however, not only is the correlation not unexpected, it is strongly predicted. Ultimately, though, the best evidence that children's difficulties are not determined by raising over an experiencer comes from new experimental evidence that children have difficulties with raising even when the experiencer is absent.[24]

Comprehension of raising structures without experiencers was examined in an experiment by Hirsch, Orfitelli, and Wexler (2006). The crucial scenario involves a character (Mary) looking for something (e.g. her hat), but unable to find it. Unbeknownst to Mary, however, she is already wearing the hat! Meanwhile, a second character (John) who is some distance away, is watching all of this. He cannot quite make out what is on Mary's head, but he is pretty sure it is her hat. Mary meanwhile recognizes that her hat is at least not on John's head. An impartial puppet who has himself been watching all of this is then asked to comment on what he has seen. The puppet may answer using one of four sentence types: sentences with *think*, unraised sentences with an experiencer, raised sentences with an experiencer, and raised sentences without an experiencer. Children must then judge the truth of the puppet's statement.

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[23] Notice that the "simplest" processing explanation, namely, that the mere presence of an experiencer-phrase (i.e. extra linguistic material) accounts for children's particular comprehension difficulties is surely not correct. First, this processing notion makes no predictive distinction between the raised and unraised conditions studied, since both contain an experiencer, yet children's difficulties are confined to the former. Second, with respect to studying comprehension differences between raising sentences with and without an experiencer-phrase, it is not the case that merely adding more material, *ceteris paribus*, results in detrimental processing overload. As noted by an anonymous reviewer, the addition of a *by*-phrase to actional passives does not result in poorer comprehension (e.g. Fox & Grodzinsky, 1998; Hirsch & Wexler, 2004a, 2006). The relevant possibilities explored here are that raising over an experiencer causes either (i) processing difficulties in establishing a long-distance dependency across the experiencer, or (ii) ungrammaticality (in the standard representational sense).

[24] In addition to the experiment by Hirsch, Orfitelli, and Wexler (in progress), which argues against problems with raising being due to the presence of an experiencer, Hirsch & Wexler (2004b) found that while children have difficulties with raising (over an experiencer) in declarative sentences (e.g. *Bart seems to Lisa to be playing an instrument*), the same exact children have no difficulties with raising (again, over an experiencer) when *wh*-movement is also involved (e.g. *Who seems to Lisa to be playing an instrument*). With certain assumptions about Improper Movement, this is expected on UPR (see Wexler, 2004)

We will discuss data from 10 four-year-old children who have completed the experiment (average age 4.7 years)[25]. These children perform brilliantly on the *think* sentences (96.3% correct) and unraised sentences (97.5% correct). The task was designed such that children could not have performed well on either condition by simply parsing the embedded predicate, which in the unraised condition requires children to comprehend the verb "seem". Every child performed well on these two conditions, such that any subsequent problems with raising, either with or without the experiencer-phrase, cannot be attributed to a problem not knowing the raising verb, since children consistently comprehended all of the unraised sentences. When presented with a raised sentence with an experiencer (e.g. *John seems to Mary to be wearing a hat*), children always get such sentences wrong (5.0% correct). This is further evidence for the *think* analysis, since with respect to the scenario discussed, while it is not true that *John seems to Mary to be wearing a hat*, it is true that *John thinks that Mary is wearing a hat*.

What then to expect for the raised sentences without an experiencer (e.g. *Mary seems to be wearing a hat*)? At first blush, a *think* analysis seems impossible:

(12) *Mary thinks to be wearing a hat.

Yet structures like (12) are quite grammatical in other languages, where *think* can take a non-finite complement:

(13) Jean pense porter un chapeau. [French]
Jean thinks PRO to wear a hat.
$Jean_i$ thinks he_i is wearing a hat.

(14) Franz denkt, einen Hut zu tragen. [German]
Franz thinks PRO a hat to wear.
$Franz_i$ thinks he_i is wearing a hat.

If English-speaking children extend their *think* analysis to *seem* sentences without an experiencer, then they should consistently get such sentences wrong. Given this same scenario involving Mary searching for the hat she happens already to be wearing, it is true that *Mary seems to be wearing a hat*, but false that *Mary thinks she is wearing a hat*. On such sentences children show mixed performance. As a group, accuracy is 40.0%. Already this demonstrates that children have difficulties with raising independent of the experiencer, in support of UPR. Individual subject analyses, however, reveal two groups of children, those who get all of the raising without experiencer items correct and another group which gets them all wrong. From the children's explanations, it is clear that the latter group is getting the wrong answer by means of a *think* analysis.[26] The other group of children, who all failed on raising with an experiencer, then might just be ignoring the verb in the cases without an experiencer, and treating them as copular constructions,

[25] In all 40 children were tested, with ten children in each one year age range from four years of age to seven years of age. Similar results obtain for the five and six year-olds, while seven year-olds perform much better on the raised items.

[26] One child, when directly asked "When I say 'Barbie seems to be carrying a pineapple' what does it mean?" answered: "Barbie thinks she has a pineapple". This provides direct insight into children's analysis of *seem* sentences as *think* sentences.

which derives good performance when the experiencer is absent, but would not work when the experiencer is present, thus their use of the *think* analysis in those cases.[27]

This study demonstrates that children's difficulties with raising structures are not tied to a grammatical ban on raising over experiencers. Even when no experiencer is present, at least half of the children misunderstand such raising sentences. The particular pattern of comprehension further suggests children treat *seem* as *think*.

In the next two sections we discuss the relevance of other types of long-distance structures to theories of linguistic development, in particular the structure of control.

Acquisition of Control: Previous Research

UPR (as well as ACDH and EARH) predicts that raised structures will be quite delayed for children. In the spirit of the original ACDH, an important consideration is that A-bar relations are not delayed in nearly the same way; this fact underlay Borer and Wexler's (1987) proposal. There is another class of long-distance structures, though, that are important to consider, because they seem to involve relations between argument positions. This is the class of control structures. In a sentence like (15), PRO is "controlled" by the subject *John*. Let us call these cases of "obligatory control" (OC).

(15) John tried [PRO to leave]

The standard analysis of control does not take the relation between *John* and PRO in (15) to be an Agree relation (much less a Move relation). Rather *John* and PRO are co-indexed or made co-referential (or PRO is made to be referentially dependent on *John* in some other way, perhaps in the semantics). Thus UPR does not predict any difficulties with OC cases like (15).[28] Nevertheless, in some structural respects, the relation between the controller and PRO in a sentence like (15) seems similar to an Agree or Move relation; the controller c-commands and is fairly local to the controlled element. Similarly a moved element c-commands and is fairly local to the position from which it moved. The same holds generally for Agree. The major difference seems to be that the Control relation is not sensitive to phases in the way that Agree and Move are. There is a non-defective, phasal *v* in (15), the *v* that selects the VP *tried PRO to leave*. PRO is in the complement of this phasal *v*, yet there is no problem in relating it to its controller. Phases do not seem to play the same type of role in Control as they do in Agree or Move. Thus, UPR does not predict a problem for Control. But we can ask: is this prediction correct? Does Control develop earlier than structures that depend on non-phasal (weak) *v*? If so, this would be further evidence for UPR. Alternatively, if OC develops as late as the

[27] In the original raising study by Froud, Wexler, and Tsakali (in preparation), they, too, included raising sentences without experiencers (*Bart seems to be wearing a hat*). They found children performed well on such structures, but noted that this is to be expected if children merely ignored the verb *seem*. Of relevance, none of the foils used in this experiment were felicitous with the non-finite *think* reading suggested by Hirsch, Orfitelli, and Wexler (2006). That is, there were no foils in which the subject thought he was doing the relevant action (e.g. Bart thinking that he was wearing a hat).

[28] EARH also does not predict any difficulties for (15) since even the embedded sentence has an external argument, PRO, which has referential content (it is not an expletive).

structures with non-phasal *v*, then we would have evidence against UPR, and in favor of a problem with all relations that appear to involve local c-command.[29]

Reviews of the development of Control can be found in Wexler (1992) and Guasti (2002). McDaniel, Cairns, and Hsu (1990) argue on the basis of their experiments that, "there is a stage, previously unattested as far as we know, during which children lack control." Wexler (1992), surveying the data, concludes, "there is an early stage in which children don't know that the empty subject in complements and adjuncts must be controlled." This holds, though, only at very young ages. Wexler notes that of 20 children from 3;9 to 5;4 years-old, only one of the four youngest children (3;9-3;10) lacked complement control (OC) and only one of the older 16 children (3;11-5;4) lacked OC.[30]

Sherman (1983) conducted a comprehension study using an act-out task with sentences like *Mary told John PRO to leave*. The group from 5;0 to 5;11 had a mean accuracy of 81%. These numbers are much better than what we see on raising sentences, where in our experiment the group at this age answered at chance level. Guasti (2002) reviews many studies and agrees that initially children lack control in certain complement constructions, but, "by 3 years children know that PRO is distinct from lexical pronouns."

The consensus seems to be that OC is in place at about three years of age. Before this, external control is possible for children. This is a much earlier age than the seven-year-old age range in which raising appears to become mastered. Wexler (1992) proposed that until about age three, children over-extend the case filter, due to a maturational process, requiring that all NPs have case. This would outlaw PRO. Whatever the explanation, control of complements by objects is mastered much earlier than raising (or verbal passives of psychological verbs in English).[31]

Of course, children also use control verbs like *try* quite often. Pinker (1984) argues that in natural production, the use of an external controller for PRO is almost non-existent in the data that he analyzed.[32] It would be somewhat difficult to determine the correct interpretation from transcripts of natural production, so elicited production studies would be desirable. Nevertheless, we know of no evidence that past around the age of three, children comprehend or produce PRO with an external controller when the sentence involves complement control.

Given this strong asymmetry between the ages at which good performance on Control and on raising develop, UPR is supported, as it predicts this asymmetry. Thus we can take the development of control as further support for UPR.

Control as Raising: Hornstein's Proposal and Implications for Acquisition

Hornstein (1999) argues that Minimalist considerations lead us to eliminate the control module, and that obligatory control is best understood as raising. There is

[29] Of course, such local c-command structures would include Principle A of the binding theory, and we know that reflexive binding develops much earlier than passive structures, roughly around age three, depending on the quantitative standards and types of experiment used (Wexler & Chien, 1985; Chien & Wexler, 1990; amongst many others). Such phenomena already suggest that UPR is more on the right track than difficulties with local c-command relationships.

[30] We are ignoring adjunct control, which complicates the picture somewhat, but for different reasons. See Wexler (1992).

[31] We return to the question of the very small set of subject control verbs like *promise* in the next section.

[32] Pinker's observations are written in terms of Equi, but the observation is equivalent to what we note.

controversy in the syntactic literature on this point: Culicover and Jackendoff (2001) and Landau (2003) argue against Hornstein's proposal, and Boeckx and Hornstein (2003) reply. Obviously we cannot get into the details of this argument. We will simply attempt to see how Hornstein's proposal meshes with the developmental results. What does control as raising predict about development and how do these predictions fit the facts?

Initially, one would think that if control is raising, then the prediction is that control and raising should develop at about the same time. Since this is greatly at odds with the acquisition facts (see the previous sections for the developmental comparison of OC and raising), we could conclude that the developmental data do not support the control as raising hypothesis.

But let us do a bit more justice to the control as raising hypothesis. Let us look at the proposal in detail to see if we can be more explicit about the relation between the proposal and the developmental principles (like UPR) that are known.

Hornstein's (1999) analysis is illustrated in (16) (his (19)):

(16) a. John hopes to leave
b. [IP John [VP John [hopes [IP John to [VP John leave]]]]]

We follow Hornstein in his explanation of the derivation (16b). *John* merges with *leave*. *John* then raises to the embedded [Spec, IP]. *John* raises again to [Spec, VP] of *hope*. By principles that Hornstein adumbrates, the chain that *John* heads has "two theta-roles, the leaver role and the hoper role." *John* then raises to [Spec, IP] of the matrix clause.

Clearly there are A-chains here, but ACDH is not under discussion, UPR is. Is UPR violated by this analysis? It is hard to tell because Hornstein does not discuss an analysis incorporating phasal considerations, that is, any kind of strong cyclicity. There is no *v*P, only VP. But let us see what seems reasonable if we attempted to understand the derivation in phasal terms. Suppose there is a phasal head *v* between the embedded IP and the lower VP. The first raising, from [Spec, VP] to [Spec, IP] would be the movement of a phrase in the complement of *v* (after all, it is in the VP that *v* selects) to the next higher phase. If *John* is actually merged into [Spec, *v*P], then raising to [Spec, IP] is licit given PIC because *John* comes from the edge of the next lower phase. So far no phasal violations are incurred on the adult analysis, similarly for the child analysis, since no defective phases are involved.

Now *John* raises to [Spec, VP] of *hope*. Let us assume again that *hope* is introduced in a VP that is a complement of a *v*. This *v* is phasal, since *hope* assigns an external argument. Since the raising of *John* allows it to check the external theta-role feature of *hope*, let us assume that the raising goes to [Spec, *v*P].[33] Then at phase CP, T can attract *John*, in the edge of the lower phase, and it can raise for the last time. Under this analysis it looks as if no defective phase is needed in the derivation. The strict cycle can be followed, with all material except edges shipped off to interpretation and not available at the next stage, except the edge of the lower phase. Thus for the child, UPR is not violated. The child will be able to compute the (raising) derivation for control.

[33] Chomsky's system does not allow movement to the first [Spec, *v*P], but presumably this could be allowed in another system. Details would have to be worked out.

If there is any reason that the first raising of *John* must go to [Spec, VP] of *hope* rather then to [Spec, *v*P] then we are in a different situation. Since *John* is then in the complement of the highest *v*, T cannot attract it, and the highest *v* will have to be non-phasal. This seems to be against the spirit of phase theory, since *hope* assigns an external argument feature. At any rate, if this were the case in the derivation, then there would be a UPR situation for the child; the child would take the highest *v* as phasal and the derivation would crash, predicting difficulties for control structures like (16).

But it seems most reasonable, till further considerations come in, to take the former analysis, with movement to [Spec, *v*P]. If this is indeed correct, then UPR predicts no trouble for control, even with a raising analysis of control. In such a case, the development of control cannot distinguish the control module versus raising analysis, at least not in these terms. Raising, presumably, would still look the way it traditionally does, a defective *v* will be needed, and raising will be predicted to be late.

It is quite interesting, then, that UPR, a theory of acquisition that relates to phases rather than to chains, seems to predict no problems for children on control, even with a raising analysis. The chains are not what matter; only the phases and their conditions (PIC) matter. This should be a familiar lesson: labels ('raising') are not as important as analyses.[34] On deeper inspection, even with a raising analysis, control might not demand extraordinary conditions on movement; raising does, passives do, and unaccusatives do.

We make these observations quite tentatively; deeper syntactic analysis might contradict us, but it will take that. For the moment, we predict good control and poor raising until UPR matures, whether control is a control module or a raising analysis of the sort that Hornstein provides. These predictions are in strong concordance with the developmental data.[35]

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[34] Confusion over labeling versus analyses might be at the heart of claims for early passive acquisition in some languages (e.g. Sesotho, Inuktitut). Crawford (2005), in reviewing the literature and in her own novel contributions, notes that the "passives" in such languages might not be counter-examples to UPR. Regardless, all claims of early passive acquisition are based solely on natural productions studies. To date, there is no experimental evidence for the early acquisition of passives in any language.

[35] Boeckx and Hornstein (2003) argue that the late development of subject control with verbs like *promise* (when taking an 'object'; e.g. *A promised B to do Z*) supports the movement analysis of control because object control is expected given the Minimal Link Condition and the movement analysis. Thus subject control is "marked" and late development is expected. This analysis, however, does not account for the extremely late development of subject-to-subject raising. Why should it take such a huge amount of time for subject-to-subject raising to develop given that it is possible and is in the adult input? Further, as Boeckx and Hornstein themselves note based on informal observations; *promise* with an object and non-finite complement is ungrammatical for lots of English-speakers. If this is true, which we think it is based on some of our own recent pilot studies, then poor comprehension by many of the children cannot be taken as evidence for late acquisition, but merely as a reflection that such structures are ungrammatical for many speakers. Also, it bears noting that the relevant structure (*A promised B to do Z*) never appears in the child-directed speech for any (of 1051) English-speaking children on the CHILDES corpus. That is, children are never presented evidence in the form of adult speech that *promise* is a possible control verb when an object is also present. Wexler (1992, 2004) suggests that Larson's (1991) account, which involves an A-chain (and presumably defective *v*) in the analysis of *promise* subject control, together with ACDH (or UPR) predicts the late development of such structures. A reasonable research strategy would be to see if the correct analysis of *promise* involves a non-phasal *v* so that UPR would predict that the computation would not converge for the premature child.

Crosslinguistic Evidence: A Note on Control into Finite Clauses in Greek

In Modern Greek, it is well-known that obligatory control occurs into certain finite (in particular subjunctive) complements (that is, with particular matrix verbs). Varlakosta (1993) argues that these structures are in fact control structures, offering an analysis in terms of PRO. To the extent that the correct analysis of these structures does not demand any defective phases, we expect that children will not be strongly delayed in their development.

Goodluck, Terzi and Chocano Díaz (2001) study the development of these structures and conclude that they are not delayed.[36] They write that "…there is evidence that four to five-year-olds have a grasp of the patterns particular to their language. Such crosslinguistic contrasts support the view that children aged four and older have a category PRO available for the subject of sentential complements." Thus we might take the evidence on this variational possibility to confirm our prediction that raising (i.e. defective phase type raising), but not control, are late in development. This fits neatly with the data confirming that passives (both actional and psychological, as discussed earlier) are delayed for Greek-speaking children.

Kapetangianni and Seely (this volume) offer an account of the Greek finite control facts in terms of a raising analysis in the spirit of Hornstein (1999). To the extent that this analysis does not demand defective phases (which seems to be the case), there would be no more reason to predict that Greek "control" in finite clauses is delayed than under Hornstein's analysis for control (as raising) in English, which we discussed in the previous section.

On the other hand, Kotzoglou and Papangeli (this volume) provide an analysis of Greek that accounts for some control into finite clauses phenomena by positing an extra thematic role. They ask whether the control facts are ECM-like and conclude that they are somewhat different. Wexler (2004) argues that ECM constructions should not be delayed in children because the Universal Phrase Requirement will not apply, so if these phenomena are ECM we predict that they should not be delayed in acquisition. On the other hand, if they involve an extra thematic role, there is still no reason to suppose that there is a defective phase, so again we predict that there should be no delay. Either way, the data on development is consistent.

Spyropoulos (this volume), argues that control in Greek does not involve PRO, nor that it involves raising the subject from a lower position. He argues that the subjunctive is finite and that even pronouns can be controlled. In the spirit of Varlakosta (1994) and Landau (2000), he argues that "it is the licensing of the temporal [properties of the subjunctive clause] that regulates the control pattern." One of the advantages of this analysis, he points out, is that "As a consequence, we maintain and strengthen the assumption that [NOM] case is the by-product of agreement valuation…"

Under Spyropoulos' analysis there does not appear to be the need for a defective phase in order to account for the finite control facts in Greek. Thus UPR does not predict a delay in control into finite clauses, and the Goodluck et al results thus are consistent and expected. In addition, we know full well that children at an even younger age know that nominative case is the by-product of agreement valuation. As Schütze and Wexler (1996) argue, non-finite root clauses produced by children ("Optional Infinitives" in the

[36] We would like to thank an anonymous reviewer for pointing out the relevance of this paper.

sense of Wexler (1993)) can be missing either agreement or tense. When they are missing tense, and agreement is present, nominative case is used on the subject. When they are missing agreement and tense is present, the default case for English (non-nominative) case is used. Children almost never produce sentences of the form "him goes", that is, agreement on the verb and a non-nominative subject, although they do produce many examples of "him go". Thus we can conclude that the ingredients (at least with respect to agreement and case) are present for children's analysis of finite control in Greek. The fact that the development data imply that children do well on these forms suggests that, to the extent that this is the correct analysis, children are aware of the temporal licensing properties of the subjunctive and how this relates to control. Needless to say, the topic deserves further study.[37]

What it All Seems to Mean

This paper represents a collaboration of linguistic theory (UG), the theory of linguistic development, and the experimental study of acquisition. We tested a crucial case – the development of raising, comparing raised to unraised sentences. Until now, the literature has been fairly quiet on the empirical facts relating to this issue. We demonstrated that raising is delayed until about seven years of age, whereas similar sentences without raising were acquired much earlier. The result follows from the Universal Phase Requirement and the theory of UG. None of the other developmental theories we considered can capture this new result, except for ACDH, which has other empirical problems. Thus we confirm UPR in a new domain, raising. Furthermore, we showed that there is a strong correlation between the development of passive and raising; any theory of development will have to derive this fact. UPR is the only candidate on the horizon; moreover, UPR is a very natural theory given a Minimalist approach. Raising constructions should provide another tool with which to probe the genetic basis of language. We can look forward to studies integrating genetics and phasal computation.

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[37] Note that Avrutin and Wexler (1999/2000), in an experiment, find that Russian-speaking children make errors on obviation of the subject in subjunctive embedded clauses. They argue that children know the syntactic properties of the subjunctive, but make discourse errors. This whole issue of obviation and control in subjunctive clauses would make an intriguing topic for further study.

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