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Does Emergentism Have a Chance?

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1. Introduction

For several decades the study of language acquisition has followed two separate tracks, one devoted to the idea that the language faculty includes an inborn Universal Grammar and the other committed to the idea that it doesn't.

A central thesis of UG approaches to language is the 'poverty of stimulus' claim: there are principles of grammar too abstract and/or too infrequently instantiated in the input to be induced from experience—hence the need for innate grammatical principles. Is there a comparable central thesis for those opposed to Universal Grammar?

Recently, a good deal of the anti-UG effort has coalesced around an approach to language and cognition known as 'emergentism.' Although emergentist work encompasses considerable diversity, there is arguably a consensus (or at least a near consensus) on the following point.

(1) *The emergentist thesis*
The properties of grammatical phenomena arise from the interaction of factors that are not themselves inherently linguistic.

As Haspelmath (2006:62) puts it, 'the ultimate explanation for regularities of language structure is in terms of substantive factors outside the language system.' This contrasts with the UG view, which (at least until recently) is that the properties of grammatical phenomena arise from the interaction of *grammatical* principles (theta theory, Case theory, and binding theory for instance)—a type of explanation that Stephan (1997:3) calls 'resultant' rather than 'emergent.'

The crucial challenge for emergentism with respect to language acquisition is to offer an account of how the properties of language, however they are construed, can be mastered in the course of development without the guidance of Universal Grammar. This amounts to finding a way to defeat the 'poverty of stimulus' claim.

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It's fairly clear from the emergentist literature that a two-fold strategy has been adopted, with hopes being pinned on two logically independent but nonetheless closely linked ideas.

One idea is that grammatical phenomena are simpler than previously thought and are best understood in terms of usage-based constructions (Tomasello 2003:5 & 99, Goldberg 1999) and/or pragmatic principles (MacWhinney 2005) rather than abstract algebraic rules.

The other idea is that the input offers more to learners than previously thought, especially when one takes into account item-based learning, contingency learning, stochastic learning, indirect negative evidence, the presence of infrequent exemplars, and so forth (Rohde 1999, Lewis & Elman 2001, Pullum & Scholz 2002, MacWhinney 2004, Ellis 2006, and so on).

My principal point is that neither of these ideas is likely to suffice, either on its own or in combination with the other, and that emergentism should focus on developing processor-based explanations for classic poverty-of-stimulus puzzles. I will draw on two case studies to illustrate this point—one involving the notorious phenomenon of *want to* contraction and the other involving quantifier–negative scope interactions.

2. *Want to* contraction

One of the most intriguing phenomena ever brought to light in the study of the syntax-phonology interface is the contrast between intransitive *want* and transitive *want* that arises in *wh* questions of the following sort.

(2) a. The intransitive <want to> pattern—*They want to see Mary.*
Contraction is permitted in *wh* questions:
Guess [who they want to/wanna see].

b. The transitive <want NP to> pattern—*They want Mary to stay.*
Contraction is prohibited in *wh* questions:
*Guess [who they want to/*wanna stay].*

The classic UG analysis (Jaeggli 1980) proposes that contraction in the second sentence is blocked by the (Case-marked) trace that intervenes between *want* and *to* after *wh* movement.[1]

blocks contraction
↓
(3) (Guess) who$_i$ they *want* **t$_i$** *to* stay. (= (2b))
(cf. They want Mary to stay.)

1. Following Gazdar et al. (1985), Sag & Fodor (1995), and others, I assume that the *want* in this pattern selects an NP complement and an infinitival complement rather than a CP complement, as in the classic UG analysis; see O'Grady (2005:152) for discussion.

In the acceptable cases of contraction, in contrast, the trace left by *wh* movement occupies a benign position far from *want to*.

(4) Guess who$_i$ they want to see **t**$_i$.
(cf. They want to see Mary.)

If such analyses are on the right track at all, the contrast for which they account can hardly be learned from experience. Generalizations involving invisible traces—let alone invisible *Case-marked* traces—are not particularly good candidates for inductive learning (e.g. White 1989:7, Crain & Thornton 1998:23). But is there perhaps an alternative to the trace-based analysis?

2.1 The simple grammar strategy

As observed by Ellis (2002:331-32), the roots of a simpler grammatical analysis for *want to* contraction can be found in the work of Sag & Fodor (1995), Pullum (1997), and others, who suggest that *wanna* is simply a lexical item that subcategorizes a bare VP—just like a modal.

(5) a. Simple VP complement:
Guess who they wanna/will [$_{VP}$ see _].

b. NP complement + VP complement:
*Guess who they wanna/will [$_{NP}$ _] [$_{VP}$ stay].

Like Bybee (e.g., Bybee & McClelland 2005), Ellis suggests that the lexical item *wanna* is the product of grammaticalization, which is itself heavily influenced by frequency of co-occurrence: *wanna* is more likely in the <want to> pattern, he argues, because 'the sequence *want* + *to* happens much more often' there than in the <want NP to> construction.

I have no objection to the idea that there is a lexical item *wanna* in English—in fact one can discern its apparent presence even in very early child speech (Limber 1973:172, Peters 1983:43-44, Tomasello 2003:262-63).

(6) a. I don't wanna ride in dis car. (Adam–3;10.0)
b. Wanna write Fraser paper. (Eve–1;9.0)
c. I wanna do it again. (Eve–2;3.0)
d. I wanna ride. (Sarah–2;3.7)

However, the lexicon is arguably only ONE source of *wanna*; a reduced pronunciation of *want to* can also be produced 'on the fly' by contraction processes whose effects are heard in whole or in part in many different patterns.

It is well known, for instance, that the final /t/ of *want* is lost quite generally before a following consonant or vowel.[2]

(7) a. I wan' several.
b. I wan' four, please.
c. I wan' a beer.

In addition, the /t/ of *to* can be assimilated to a preceding nasal in a variety of cases.

(8) a. Do they planna stay long? (< plan to)
b. I'm tryin'na go. (< trying to)

There is apparently nothing to rule out the possibility that these two processes, acting in concert, could produce instances of *wanna* via real-time contraction of *want* and *to*. In other words, in addition to whatever else it might be, *wanna* could also be 'a fast way of saying *want to*,' as Hudson (2006:609) puts it.

A key class of examples in this regard involves patterns such as those below, in which *to* is preceded by a verbal participle whose *-ing* suffix is pronounced [ɪn].

(9) a. I'd been expectin'na stay for a week, but I changed my plans.
b. I'd been promisin'na stay for a week, but I have to change my plans.

These are not high-frequency collocations: the British National Corpus contains 362 instances of *expecting to* and 193 of *promising to*, compared to 28,676 instances of *want to* (a ratio of about 1 to 79 and 1 to 148, respectively). Moreover, there are NO instances of *expecting to* and *promising to* in maternal speech to Adam, Eve, and Sarah, compared to 363 instances of *want to* (including 29 that were transcribed as *wanna*). Crucially, however, a constraint on contraction parallel to the one for *want to* appears to apply to the transitive versions of these patterns.

(10)a. Contraction in the intransitive <expect to> pattern:
Who had you been expectin'na see while you're here?
(cf. I had been expecting to see John while I'm here.)

b. Contraction in the transitive <expect NP to> pattern:
?*Who had you been expectin'na stay for a week?
(cf. I had been expecting John to stay for week.)

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2. David Stampe (pers. comm.) observes that in the first two cases the /n/ may also be elided, leaving a nasalized vowel as its reflex; in addition, he suggests that the /t/ may leave a glottal stop reflex in these cases

(11)a. Contraction in the intransitive <promise to> pattern:
Who had you been promisin'na visit while you're here?
(cf. I had been promising to visit John while I'm here.)

b. Contraction in the transitive <promise NP to> pattern:
?*Who had you been promisin'na stay for a week?
(cf. I had been promising John to stay for week.)

A further contrast along these lines, first noted in a somewhat different form by Emonds (1977:242), involves *need*.

(12)a. Intransitive <need to> pattern (contraction is possible):
Who do they need to/needa see?
(cf. They need to see Mary.)

b. Transitive <need NP to> pattern (contraction is blocked):
Who do they need to/*needa stay?
(cf. They need Mary to stay.)

Here too, frequency seems unlikely to be a major factor: there are just 38 instances of the sequence *need to* in maternal speech to Adam, Eve and Sarah, compared to 362 of *want to*.

In sum, there is reason to think that there is more to the syntax of *want to* contraction than the forging of a new lexical item from two adjacent lexemes that happen to co-occur frequently. However, the failure of the lexical analysis need not be interpreted as support for the UG analysis. There is at least one other possibility that is worth exploring.

2.2 A processor-based emergentist account

The version of emergentism that I have been developing (e.g., O'Grady 2005) places an efficiency-driven processor at the heart of the human language faculty, assigning it primary responsibility for explaining the core properties of language as well as the ability of children to master those properties so quickly and successfully. Such a processor is motivated by a single overriding concern *in both production and comprehension*—namely, minimizing the burden on working memory. No reference is made to grammatical principles; in fact, it is assumed that there are no grammatical principles per se.

One of the ways that the processor goes about minimizing the burden on working memory is to resolve *wh* dependencies (the relationship between a *wh* word and the verb with which it is associated) at the earliest opportunity. This is achieved by linking the *wh* word to the first available 'open' position in a verb's argument grid, as illustrated in (13).

(13) The resolution of a *wh* dependency:
Who$_j$ do they$_i$ usually meet at the library.
| <i _>
|_____↑

The idea that *wh* words are associated with the first open position in the course of processing is often dubbed the Active Filler Hypothesis (e.g., Crain & Fodor 1985, Clifton & Frazier 1989, De Vincenzi 1991). There is a great deal of independent support for this idea, including the mild garden path effect that arises in reading sentences such as (14), where an attempt is made to link *which book* to the expected object position in the argument grid of *read*, which is actually intransitive in this case (Fodor 1978).

(14) A consequence of the Active Filler strategy:
Which book did you read to the children from?
|_____*↑_____↑

The propensity to dispense with *wh* dependencies as quickly as possible turns out to be crucial to the syntax of *wanna* as well, as we will see shortly.

Also crucial is the fact that contraction itself is subject to a 'quickness constraint,' consistent with the fact that the various underlying phonological processes are motivated by the demands of rapid connected speech. (See Stampe 1984:295 for a detailed discussion of the processes themselves.)

(15) Phonological reduction is most natural when the elements involved combine without delay.

Keeping in mind these two propensities for quickness, let us now consider how the processor might go about assembling *wh* questions containing the sequence *want to* in the course of sentence production. As I have proposed elsewhere, I assume that the processor operates in a strictly linear manner, carrying out whatever operations it can at the first opportunity as it produces and assembles a sentence's component words.

The pattern in which contraction is permitted

In the case of intransitive *want to*, which allows contraction in sentences such as *(Guess) who they wanna see*, the processor begins by bringing together *who* and *they*.

(16)a. Combination of *who* and *they*:
[who they]

Since there is no opportunity for further syntactic or semantic processing at this point, the processor goes immediately to the next step, which involves addition

of *want*.

b. Combination of *they* and *want*:
[who [they want]]

Next the infinitival marker *to* is added, combining with *want*. Because this happens as soon as the processor finishes with *they* and *want* (i.e., without delay), contraction is possible.

c. Combination of *want* and *to*, with the possibility of contraction:
[who [they [want to]]]
↓
wanna

The contracted form *wanna* then combines with its complement *see*, permitting subsequent resolution of the *wh* dependency.

d. Combination of *wanna* and *see*:
[who [they [wanna see]]]

e. Association of the *wh* word with *see*:
[who [they [wannna see]]
|_____↑

The pattern in which contraction is prohibited

Now consider the transitive <want NP to> pattern *Guess who they want to stay*, in which contraction is blocked. Once again, the first step is to bring together *who* and *they*.

(17)a. Combination of *who* and *they*:
[who they]

Next comes combination of *they* and *want*.

b. Combination of *they* and *want*:
[who [they want]]

At this point, an opportunity arises to associate the *wh* word, previously stored in working memory, with the open direct object position in the grid of transitive *want*. Consistent with the Active Filler Hypothesis, the processor is compelled to take advantage of this opportunity.

c. Resolution of the *wh* dependency:
[who [they want]]
|_____↑

Next comes combination of *want* and *to*, but without the possibility of contraction because of the delay associated with step (c), in which the linear progression of the processor is halted to permit resolution of the *wh* dependency.

d. Combination *want* and *to*; no contraction:
[who [they [want to]]

Finally, *to* combines with *stay*, completing the sentence.

e. Combination of *to* and *stay*:
[who [they [want [to stay]]]]

The key observation here is that, in contrast with what happens in the case where contraction is allowed, the computational system fails to combine *want* and *to* immediately after finishing with *they* and *want*. Instead, as depicted in step (c), its linear progression is delayed by the need to resolve the *wh* dependency by linking *who* to *want*.

In sum, contraction in *want to* patterns is blocked by the interaction of two independently motivated propensities:

- A preference for contraction without delay
- The need to resolve the *wh* dependency at the first opportunity, which creates a delay that interferes with contraction in the *want to stay* pattern

Interestingly, there is independent psycholinguistic evidence for the idea that a delay of some sort takes place at the predicted place. Based on data collected from an elicited production task involving adult native speakers, Warren, Speer, & Schafer (2003) report that *want* has a consistently longer duration in patterns where contraction is blocked. In addition, patterns of this type are more likely to manifest an intermediate prosodic break after *want* than are patterns in which contraction is permissible.

(18)
longer duration
↓
(Guess) who they want to stay. (*wanna)
↑
prosodic break more likely

It seems reasonable to interpret these effects as reflexes of the way in which *want to* sentences are built: contraction is a bonus that becomes available when the processor moves forward without delay, whereas the prohibition against

contraction is a penalty that arises when the processor has to look back. (For a discussion from the perspective of comprehension, see O'Grady et al., in press).

Two things follow from all of this, I believe. First, the failure of the lexical analysis of contraction does not mean that children are drawing on principles of Universal Grammar when they avoid phonological reduction in sentences such as *Who do you want to stay?* Rather, the contraction facts appear to follow from the combined effects of the processor's compulsion to resolve *wh* dependencies at the first opportunity and the articulatory mechanism's need to proceed without delay in cases of phonological reduction. Neither of these is a 'grammatical' property, even though their interaction yields a very important grammatical effect—the syntax of *to* contraction.

Second—and just as crucially, there is no need to extract a generalization from the input. This is a good thing. After all, Rohde (1999:18-19) found only nine instances of the crucial non-contractible *want to* pattern (e.g., *Who do you want to stay?*), in the entire CHILDES data base, and my search of maternal speech to Adam, Eve, and Sarah turned up NO examples of this type.

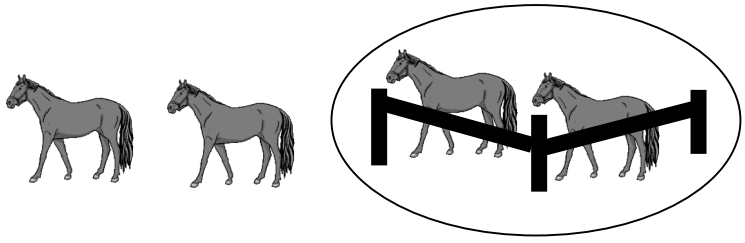
On the view I propose, this just doesn't matter. A predisposition to treat contraction in a particular way emerges from general cognitive and physiological resources—a propensity to resolve *wh* dependencies at the earliest opportunity (in order to minimize the burden on working memory) and a propensity to execute contraction without delay (for phonetic reasons). That is how children come to accept contraction in some patterns but not others. And, equally importantly, that is why a constraint on contraction exists in the first place.

3. Scope

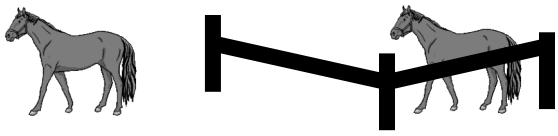
Let us turn now to the phenomenon of scope. The particular scopal facts that I will concentrate on here involve the relationship between negatives and numeral quantifiers, as illustrated in (19). (QNP = quantified NP)

(19) Two horses didn't jump over the fence.

a. Specific interpretation of the QNP (*two* > *not*):
'There are two horses that didn't jump over the fence'—true in a situation such as the following where there are two particular horses (circled) that did not jump over the fence.



b. Non-specific interpretation for the QNP (*not* > *two*):
'It's not the case that any set of two horses jumped over the fence'—true in a situation such as the following, where there is no set of two horses that jumped over the fence. (This interpretation is most easily accessed in contrastive contexts: 'Two horses climbed the hill, but two horses didn't jump over the fence—only one did.')



A comparable contrast arises in the case of direct objects QNPs.

(20) *The mice didn't eat two pizzas.*
a. Specific interpretation of the QNP (*two* > *not*):
'There are two pizzas that the mice didn't eat.'

b. Non-specific interpretation for the QNP (*not* > *two*):
'It's not the case that the mice ate any set of two pizzas.'

The literature on this phenomenon is too vast to permit a thorough review here. Suffice it to say that both children and adults exhibit a very strong preference for the specific interpretation of the quantified NP (*two* > *not*) in (19), while favoring the non-specific reading (*not* > *two*) in (20) (e.g., Musolino & Lidz 2003). For reasons of space, I will focus on the former preference, which provides an excellent illustration of how proponents of UG and emergentism confront poverty-of-stimulus puzzles.

3.1 A UG-based theory

The UG theory (or at least one version of that theory) holds that interpretive preferences in scope reflect the relation between S-structure and LF (Anderson 2004, Musolino 1998, Lidz & Musolino 2002, 2005/2006). The key idea is that scope relations are represented at LF as c-command asymmetries: an operator's scope corresponds to its c-command domain (e.g., Szabolcsi 2000 and the references cited there).

On this view, the specific (*two* > *not*) reading is preferred for (19) because its S-structure is 'isomorphic' with its Logical Form, with the quantified NP structurally higher than the negative in both cases. (The informal LFs suggested below are deliberately simplified for expository purposes.)

(21)a. *Two > not* interpretation: (isomorphic—easy)
S.S.: [$_{IP}$ **Two horses** [$_{VP}$ did**n't** jump over the fence]]
LF : 'There are **two horses** that did**n't** jump over the fence.'

b. *Not > two* interpretation: (non-isomorphic—difficult)
S.S.: [$_{IP}$ **Two horses** [$_{VP}$ did**n't** jump over the fence]]
LF : 'It's **not** the case that **two horses** jumped over the fence.'

3.2 An input-based alternative

Gennari & MacDonald (2005/2006) offer what they call an 'experience-based' emergentist alternative, arguing that children's scope preferences reflect their 'sensitivity to distributional patterns in their input.' These in turn are taken to reflect the 'production preferences' of adults (p. 134). Thus when children fail to access a particular scopal interpretation, it is

> because they have not had sufficient language experience in which quantifiers were paired with such interpretations. Instead they access the interpretations that happen to be consistent with the most frequent patterns in their input and the most frequent interpretations of the structures at hand. (p. 129)

Gennari & MacDonald's corpus study of parental speech to children provides apparent support for their view: the vast majority of sentences containing a negative and an indefinite NP (including those containing numerals) exhibit isomorphism in that the first 'logical word' has wide scope. Here are two examples involving a numeral-bearing NP and negation.

(22)a. You do**n't** have **two** tummies. (Adam's mother–2;3.18)
(means 'It's not the case that you have two tummies,'
not *'There are two tummies that you don't have.')*

b. You have**n't** got **two** heads. (Sarah's mother–2;7.5)
(means 'It's not the case that you have two heads,'
not *'There are two heads that you don't have.')*

However, there is a potentially serious problem here since few, if any, sentences in the input have the numeral in subject position. In fact, my search of maternal speech to Adam, Eve, and Sarah uncovered NO sentences of the form *Two horses didn't jump over the fence*—with either scope reading. (There were no such cases involving the numeral *one* either.)

So how precisely do children develop a preference for the specific reading (*two > not*) in the rarely occurring subject pattern? An emergentist analysis certainly can't posit an isomorphism parameter that gets set for the entire

language based on exposure to Neg + Direct Object patterns. At the same time, it's unclear how an experience-based generalization would work either. On the face of it, sentences such as those in (22) are just as compatible with either of the following two very different generalizations (among many others):

- The first LOGICAL WORD has wide scope—in which case the preferred reading of *Two horses didn't jump* will be *two > not*.
- NEGATION has wide scope—in which case the preferred reading of *Two horses didn't jump* will be *not > two*.

The first generalization is the 'right' one for Gennari & MacDonald's purposes, but it is unclear how language learners could realize this without exposure to negated sentences with a numeral-bearing subject,[3] or how they could retreat from an incorrect generalization if they initially erred.

Might a generalization about the interpretation of numerals be based on a more commonly occurring pattern, such as one involving indefinite articles, along the lines suggested by Gennari & MacDonald (pp. 151-53)? There are hundreds of indefinite NPs in direct object and oblique positions within negated sentences in the maternal speech directed to Adam, Eve, and Sarah.

(23)a. Cromer isn't doing a thing. (Adam's mother–2;5.0)
b. We're not gonna have a cheese sandwich today. (Eve's mother–1;7.0)
c. I can't make a bow if you're not gonna # if you're gonna hold. (Sarah's mother–2;3.22)

Crucially, however, there are only six cases in which such NPs appear in subject position (five in speech to Adam and one in speech to Sarah). All six cases involve a generic (i.e, non-specific) interpretation of the indefinite NP—which is at best irrelevant to the question of how to interpret numeral-bearing NPs in this position.

(24)a. A house can't dance. (Adam's mother–3;0.25)
b. A bulldozer doesn't fly. (Adam's mother–3;9.0)

3.3 A processor-based emergentist account

Although an input-based account of scope appears to be problematic, this should not be interpreted as an argument in favor of Universal Grammar. As we will see directly, a promising processor-based explanation for the facts is also

3. According to the size principle of Tenenbaum & Griffiths (2001; see also Pearl & Lidz 2006), a Bayesian learner would adopt the most restrictive hypothesis in the absence of evidence to the contrary. According to the proposal that I make below, language learners do not consider alternative hypotheses, let alone compute superset-subset relations for their predictions.

available. That account, which is fully compatible with the emergentist thesis, draws on two simple ideas.

(i) As the processor works its way through a sentence, it assigns NPs tentative initial interpretations, based on 'local' clues such as position, determiner type, case marker, context, and so forth.

(ii) The revision of a previously assigned interpretation is computationally costly since it disrupts the normal linear operation of the processor, which forms and interprets sentences in real time under conditions that value quickness.

The effect of these assumptions can be represented schematically as follows.

(25)a. An NP is encountered and assigned an initial interpretation, based on its position and other local properties:

NP
[x]

b. Based on the properties of a subsequently encountered element, the NP's interpretation is recomputed:

NP . . . Z . . .
[~~*~~] -->[y]

Following O'Grady (2007), I propose that the computational cost of this reinterpretation, not scope isomorphism per se and not the input per se, is responsible for children's difficulty with certain quantificational patterns.

Turning now to a concrete case, I adopt the widely held view that subjects tend to be specific (if not definite) in their reference—a requirement in some languages and a preference in others (Aissen 2003:444-45 and the references cited there).[4] Thus we can assume that, all other things being equal, the processor will initially interpret the subject NP as specific in a sentence such as *Two horses didn't jump over the fence*.

(26)a. Combination of *two* and *horses*; interpretation of the NP as specific:

Two horses
[spec]

4. An obvious question here has to do with the underlying motivation for this tendency. Aissen follows Farkas (2002) in attributing it to the fact that the reference of specific (and/or definite) NPs is 'relatively fixed'—a state of affairs that fits well with Davison's (1984) observation that subjects, as typical topics, must have referential properties that enable them to be linked to an explicit or implicit 'antecedent' in the discourse.

In the absence of evidence to the contrary, that interpretation is maintained as the rest of the sentence is interpreted.

b. Two horses didn't jump over the fence.
[spec]

In contrast, wide scope for the negative (the reading 'It's not the case that any set of two horses jumped over the fence.') requires an additional step: the processor has to revise its interpretation of the subject from specific to nonspecific upon encountering the negative auxiliary.

(27) Combination of the subject NP and the negative auxiliary; reinterpretation of the subject NP if the negative is to have wide scope:

[Two horses] didn't …
[~~spec~~]-->[non-spec]

On this view then, the increased processing burden associated with recomputing the reference of *two horses* underlies the difficulty of the negation wide scope reading.[5] The specific interpretation for the subject NP (i.e., *two* > *not*) is preferred simply because the processor is able to proceed in a linear manner without having to retrace its steps.

This does not mean that that processor is insensitive to distributional patterns and their relative frequency—that would be impractical and unrealistic. But more than anything, the response of the processor to the input seems to be shaped by the demands of working memory, especially the cost of having to recompute the interpretation of previously analyzed expressions. If I'm right, this is why certain interpretations are so difficult—and also why sentences with those interpretations are so rare.

If this idea is on the right track, then frequency is not the explanation for why children have particular interpretive preferences when it comes to scope. In fact, in most cases, it would be more accurate to say that frequency is a CONSEQUENCE of those preferences. More specifically, inverse scope in *Numeral N + negated verb* patterns is infrequent because of the demands it places on a linear efficiency-driven processor.

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5. Both interpretations are in principle available without the need for recomputation in sentences such as *Mary didn't see two horses.* Because the negative appears before the quantified NP in such patterns, the processor has the option of immediately computing a non-specific interpretation for the NP rather than being drawn into an initial specific interpretation and subsequently modifying it. The preference for the non-specific interpretation that has been reported for children (it disappears by age 5, according to Lidz & Musolino 2002:144) must therefore be attributed to factors other than recomputation—possibly the typological tendency for direct objects to be non-specific (see section 3.4).

The same considerations almost certainly underlie an apparent typological asymmetry. Whereas there are apparently no languages that prohibit a wide scope interpretation for the subject of a negated sentence (*two* > *not*), there are languages that disallow wide scope for the negative (*not* > *two*) in such constructions. Chinese and Korean apparently work this way (Cl = classifier).

(28)a. Chinese (data from Karen Huang)
Liang pi ma mei tiao guo zhalan.
two Cl horse not jump over fence
'Two horses didn't jump over the fence.' (*two* > *not* only)

b. Korean (data from Hye-Young Kwak)
Twu mal-i wulthali-lul an nem-ess-ta.
two horse-Nom fence-Acc not jump-Pst-Decl
'Two horses didn't jump over the fence.' (*two* > *not* only)

3.4 Further cross-linguistic considerations

Facts from a variety of other languages shed further light on the nature of scope and how the ability to interpret quantifiers in negated sentences emerges in the course of language acquisition. I will briefly discuss three such sets of facts, drawing on data from Dutch, Kannada, and Korean.

Dutch

A particularly instructive phenomenon comes from Dutch, where Krämer (2000) reports that, unlike adults, children (38 subjects, aged 4;0-7;7) overwhelmingly *reject* a specific interpretation for the indefinite NP in sentences such as (29).

(29) Context: A boy caught two of three fish.
De jongen heeft een vis niet gevangen.
the boy has a fish not caught
'The boy hasn't caught a fish.'

Adults permit only the specific reading (*a* > *not*):
'There's a particular fish that the boy didn't catch.' (True)

Children prefer the non-specific reading: (*not* > *a*)
'It's not the case that the boy caught any fish.' (False)

This disputes the idea that early grammars require isomorphism, since children in this case prefer the interpretation in which the negative has scope over a structurally higher indefinite NP to its left. Moreover, this preference also undermines the role of frequency: children favor the interpretation that is not found in adult speech (see also Gualmini 2005/2006:364-65).

However, the facts are perfectly consistent with my idea that computational cost arises when a previously interpreted NP must be reinterpreted. As noted by de Hoop & Krämer (2005/2006:105ff), children strongly prefer to interpret subject *een* phrases as specific and non-subject *een* phrases as non-specific even in the absence of negation, consistent with the typological generalization that subjects tend to be topical, definite, animate, of high discourse prominence, and referential/specific, whereas objects tend to be indefinite, inanimate, of low discourse prominence, and non-referential/non-specific (e.g., Aissen 2003).

If this is right, then children will automatically assign the *een* phrase in (29) a non-specific reading as its *initial* interpretation. The specific reading favored by adults is the one that requires recomputation in this case—which is precisely why it is difficult for children to access.

On this view then, it is the adults, not the children, who produce the 'unexpected' interpretation of sentences such as (29). The obligatory specific reading for the direct object NP in adult speech is idiosyncratic and language-particular, and must be learned on the basis of experience, just as the admissibility of syllable-final voiced obstruents must be in those languages that permit them.

Kannada and Korean

Lidz & Musolino (2002) report that children (24 subjects aged 4;0-4;11) learning Kannada show a strong preference for the non-specific interpretation of the direct object (i.e., the *not* > *two* reading) in sentences such as the following.

(30) vidyaarthi eraDu pustaka ooD-al-illa.
student two book read-Inf-Neg
'The student didn't read two books.'

Lidz & Musolino interpret this result as evidence for isomorphism on the assumption that the negative c-commands the direct object in S-structure. But the picture changes somewhat when we consider Korean.

Working with 29 children (mean age 5;2), Kwak (2007) uncovered a strong preference for the specific reading of the NP (*two* > *not*) in sentences such as (31)—the precise opposite of what was reported for Kannada. (Su 2003 reports a similar preference for children learning Chinese.)

(31) Dora-ka cokay-lul twu-kay an-cwuw-ess-e.
Dora-Nom seashell-Acc two-Cl not-pick.up-Pst-Af
'Dora didn't pick up two seashells.'

How can this be?

Obviously, there are a variety of possibilities, including some compatible with Universal Grammar. For example, one might assume that the negative c-commands the direct object in Kannada, but not in Korean. Indeed, it has been

suggested that direct objects are structurally higher than the negative in the grammar of *some* Korean speakers (Han, Lidz, & Musolino 2007).

However, a different possibility is perhaps worth exploring, namely that numeral-bearing NPs in direct object position have different initial interpretations in the two languages—non-specific in Kannada (the unmarked case cross-linguistically, as we have seen) and specific in Korean. If this is right, then the typologically unexpected initial interpretation in Korean (specific, rather than non-specific) requires explanation, presumably with reference to case marking, the post-nominal position of the numeral, and/or the presence of an accompanying classifier, none of which is present in the corresponding Kannada pattern.[6]

Case *Post-nominal numeral*
↓ ↓ *Classifier*

(32) Dora-ka cokay-**lul** **twu**-**kay** an-cwuw-ess-e.
Dora-Nom seashell-Acc two-Cl not-pick.up-Pst-Af

If this is on the right track, then local clues—syntactic position, case marking, quantifier type, and the presence of a classifier, as well as discourse context, where appropriate—play the key role in determining a QNP's initial interpretation. The viability of that interpretation (i.e., whether it can be maintained throughout the sentence) is what determines the relative difficulty of particular scope interpretations—not frequency in the input and not the mapping between S-structure and LF. In particular, a scopal reading is difficult when it requires the processor to retrace its steps and recompute a previously assigned interpretation—a fundamental and costly affront to the on-line, real-time nature of processing.

4. Concluding Remarks

So, does emergentism have a chance? It does—but only if emergentists are willing to give up on the input as a strategy for addressing the poverty of stimulus problem.

This not to deny that frequency effects are real, or that many, many phenomena have properties that can and must be induced from experience. That is simply not the point, and I can't see how or why the input should matter more

6. It is worth mentioning in this regard that case-marked direct objects tend to be higher in referentiality than their non-case marked counterparts in Korean (Lee 2006). Lidz & Musolino (2005/2006) report a similar contrast in Kannada, noting however that their four-year-old subjects seemed not to be aware of its effects on scope interpretation (p. 96) since they assign a non-specific reading to all bare indefinites in direct object position—including those that are case marked and have a specific interpretation in the adult language.

for emergentist theories than it does for UG-based theories. At best, the input is just one of many factors that must be considered.

In the end, both types of linguistic theory are responsible for more than just figuring out how language is acquired. Their ultimate objective is to figure out how language works, including an account for why language has the particular properties that it does. That means an explanation for why American English has the particular system of *want to* contraction that it does, for why inverse scope in indefinite subject + negative patterns is relatively difficult to access in English, for why it is typologically marked across languages, and so on.

My proposal is that these sorts of facts can best be explained along emergentist lines by appeal to processing considerations. Moreover—and this is the key point—this sort of analysis has an unanticipated but extremely interesting consequence. In particular, not only do we find ourselves with a deeper understanding of how the extraordinary complexity of language arises from the interaction of very simple cognitive properties and propensities, we find that the input isn't as important as we first thought and hoped it would be.

This should be a welcome result. There is clearly much that has to be gleaned from experience, as everyone agrees, but nothing is lost by easing the demands on the inductive mechanisms where possible. As Lewis & Elman (2001:369) observe, 'determining the potential worth of ... stochastic information is difficult.' In many cases, there is too much; it's hard to know where to start. And in other cases, like those I've been considering, there is too little (there are no instances of non-contractible *want to* in maternal speech to Adam, Eve and Sarah, and no instances of Numeral + N subjects in negated sentences either).

In sum, children's acquisition of the constraint on *want to* contraction is not dependent on a chance encounter with the very rare patterns in which it is prohibited. Nor is children's aversion to certain types of inverse scope contingent upon exposure to highly improbable sentences in which this interpretation COULD have occurred but didn't. Rather, the details of *want to* contraction, scope, and many other intricate features of language EMERGE from the interaction of the sorts of simple processing factors that belong at the center of the emergentist program for language.

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