The nature of the input: Outline for talk

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Opening Remarks: As linguists, we are interested in modeling language in one way or another—I always remind students that for every tree diagram we draw, we model some 'brain-to-language' correlation (i.e., syntactic trees have real physiological relevancy). The differing models* found in the literature represent in some way divergent theories about this 'brain-to-language' mapping. I think it is also fair to say that in all likelihood, each of our modeling will turn out to be probably wrong in unique ways, as the brain equation is an extremely elusive component of the corollary. Though, I also think it is fair to say that in whatever model we adopt, it won't be entirely wrong, or, at least it will be wrong in interesting ways. This paper is about one interpretation of a 'brain-to-language' model, as it concerns child language acquisition…and it will most probably turn out to be wrong. The hope, as always, is that we can learn something about the unpredicted results.

Our model (a Morpheme-Paradigm Dual Mechanism Model (DMM)) roughly coincides with notions as advanced in the Minimalist Program and Distributive Morphology (though having said this, the two frameworks are more-or-less theories about the internal structure of language per se, with somewhat less emphasis placed on a theory of the 'brain-to-language' correlation). With whatever framework we do advance, any measure of success will ultimately have to be made by determining its consistency with what we are beginning to learn about the brain/mind relation to language processing. This is becoming more and more a fact as advances are being made every day with brain imaging techniques on language processing.

(*Some models include: dual route models, hybrid Baayen race models, connectionist models, single route models (rule-based or associative-based), along with sub-models which include word-paradigm or morpheme-paradigm models. At present, most modeling show a mixed picture—e.g., (i) nouns and verbs show distinctive processing even though they are both either lexical categories (when without inflection) or functional categories (when with inflection) (Perani et al. 1999; Shapiro & Caramazza, 2003; Tyler et al. 2004; Sahin et al. 2006), (ii) certain regular, rule-based morphological forms may be stored in memory, showing stem-like frequency effects (Alegre and Gordon, 1999; Pinker, 1999; Ullman 1999; Baayen et al. 2002), and conversely (iii) irregular morphology (once thought of as quintessential rote-learned associative formatives) can show rule-based behavior patterns (Sahin et al. 2006)).

Over the past few years, I have been promoting the Dual Mechanism Model (DMM) as a maturational input interface model responsible for the gradual syntactic development in children (following Radford 1990). The very idea that the DMM can be extended in such a way—from a mere adult *morphological* processing model to a child *syntactic* developmental model—has not gone without some criticism and a couple of points need to be made here.

> (i) Such criticism often comes from those proponents of the DMM who wish to restrict the DMM to the confines of morphology (the '*DMM is not about syntax*' argument). We disagree with this assessment of the DMM.
>
> (ii) We believe that when considered in light of Distributed Morphology (DM) (Halle & Marantz 1993), the case for a syntactic response to an otherwise morphologically-based DMM becomes quite natural, given in DM terms, morphological word formation is primarily a syntactic operation. All reduces to syntax.).

My more recent thoughts on the model have been refined by comments made to me in past lectures, most notably Hagit Borer's comments on child language continuity (as she sees it) and the emerging paradigm (based on her talk at USC, 3/92005).

Introduction

1. We take it that there exists a stage prior to the **Optional Infinitive stage** (Schütze & Wexler 1996). This is evidenced by reports found in the literature which indeed show the presence of an albeit short-lived early Non-INFL /Non-Finite stage. It is worth noting here that the seminal paper of Amy Pierce (1989) and (1992) based on the 'Nathalie corpus' demonstrates such a non-Finite stage. (See Atkinson for comments on Pierce. See Wexler (2001) on general comments citing work from Wijnen (1998) and DeJong (2002) for data regarding a pre-optional stage).

2. The possibility that such a Pre-OI stage might exist doesn't in any way impact or alter what we believe is otherwise correct concerning the OI-stage (save changing the status of OI from a first stage grammar to a stage-2 grammar).

2.1 Stages of Acquisition:

Stage-1: Non-INFL (only default grammars emerge)→ [øAGR, øTense]
Stage-2: Optional Infinitive stage-2 → [+/- AGR, +/-Tense]
Stage-3: Target grammar achieved → [+AGR, + Tense].

(Stage-1 speaks of a stage during which default grammars come directly out of UG).

2.2 The fact that the case study involved a bilingual child may have helped us in prolonging the duration of a non-INFL stage-1. (We find no evidence to suggest transfer between the two languages (French and English) of the type that would otherwise impact on our calling for an English Non-INFL stage-1).

3. We take it the **Dual Mechanism Model** (DMM) provides us with much more than a mere morphological analysis of word formation (a *narrow* interpretation of DMM). We rather claim, by extension of Distributional Morphology (DM), that the DMM provides us with additional powers of analysis in dealing with both word-level morphology and phrase-level syntax. Hence, via an extended DM treatment of DMM, we *broaden* our claim of the Dual Mechanism Model by ultimately extending it to the realm of syntax.

3.1 DM is a framework which seeks to define all lexical formations in the context of some syntactic operation. In this sense, there is only one generative operation behind language (per se) and that is *syntax*.

3.2 As a way to alleviate the usual *narrow* DMM analysis—*narrow* in saying the DMM exclusively deals with morphology—**we suggest that all *complex word* formations involve a syntactic operation in one manner or another and thus entail movement**. The only formation that escapes syntax is formative *roots* and potential *bare stems* (sometimes referred to as *phonological shells*).

3.3 Hence, in accepting a strong DM interpretation, it is our view that the same mechanism that generates morphological structure (a par with the usual *narrow* morphologically fashioned DMM analyses) naturally extends to phrasal syntactic structure (a *broad* DMM analysis).

3.4 In the paper, we make the claim that all *complex words* (merge-β) involve *movement* (computations of trace-theory, binding, copy & deletion follow).

4. **There are two *word formations*:**

(i) √**roots** (which may be represented as *Bare Stems*) → **Merge-α**

and,

(ii) **complex words** (which are √roots plus *vocabulary insertion*). → **Merge-β**

(Regarding the derivation leading to *complex word formations*, we believe there are two **'out-of-root' exit strategies** which involve vocabulary insertion, see §7, 9 below).

Note: It may be that (default) *roots* are not open to a DM analysis, (or any other analysis for that matter), or, at least, their status is such that nothing hinges on their presence or absence leading up to a derivation. *Roots* are abstract and phonologically unstable until *vocabulary insertion* takes hold which gives them a categorical status.

4.1 **Merge-α** consists of a free (a-category) root formative without a specific value set to it: roots don't assign range or enter into any configurational relationship other than a non-hierarchical 'sister-to-sister' relationship.

Merge-β then extracts the root (from merge-α) and assigns it a specific range/value: e.g., the phonological default '*me*' doesn't assign a syntactic value and only surfaces as a root formative. As a result of merge-β, default '*me*' becomes '*my'* and assigns range to D. It is only at merge-β that configurational relations hold.

4.2 Roots, due to their agrammatical status involving non-movement, often may suffer **deletion** at this first merger stage. Roots however may also surface as *formative shells*, bearing only idiomatic/phonological expression. (This is what we believe is happening at our very earliest of stage-1).

Note: The fact that children do delete functional categories at merge-β speaks to evidence for *syntactic cues*: viz., that /(*the*)/ /*cat*/ are two distinct terminals and not one idiomatic expression (see §6.4). At merge-α, both distinct terminals may go missing in the phonology (i.e., a stage during which children may recognize a verbal word but not be able to produce it (the 'comprehension outpaces production' hypothesis). In order for children to delete such functional items, they must know of them: B&R's argument for continuity. (See §§6.2, 6.3 regarding German –BVS status and outside phonological considerations dealing with root infinitives.

4.3 The fact that free functional formatives (Det, AUX) may go missing in early grammar suggests syntactic knowledge, or at least a tacit processing distinction—viz, a distinction that leads to the separation of terminals (/the/) /cat/. Subsequent free formative appearances in early grammar, when void of functional features, counter-intuitively may show only phonological realization. Hence, their classic absence early-on may prove such a processing distinction; otherwise, (as rightly noted in B&R), random functional T/AGR errors would manifest, as they indeed do in agrammatic speech. Regarding free functional formatives (D, Aux), our model posits that they (i) may either surface early-on as mere default phonological shells, or (ii) proceed gradually as their heads acquire phonological/paradigm-specific material relevant to their specific functional heads (the gradual development hypothesis).

4.4 The difference between free formatives and bound affixes, in this manner, is that free formatives may take on default phonological status as roots without undergoing movement. Hence, an unmoved Determiner can take-on the role of an empty shell, vacuous of any functional features (at the very least, vacuous of abstract [-Interp] features such as Case, Agreement). The cited disparity between the early onset of Det (as compared to the well known delayed emergence of Aux, as attested in the data) can be reduce to the observation that D can be realized base-generated as a default DP-object within VP, without ever undergoing movement to IP. The Auxiliary, on the other hand, while it too is a free formative, the difference is that it can only be generated directly from inside IP (Aux/Modals never undergo movement into IP as they can only be generated

directly from IP. A residual effect of this is that Aux/modals can never take-on the English equivalent to bare root stems, similarly to what we find with Dutch/German infinitives as expressed herein).

4.5 → As a consequence of the above assumptions placed on movement, we further assume that whenever T/AGR is projecting from a lexical head, that lexical head has undergone movement to IP (overt or covert).

→ As a consequence, functional heads are specified on lexical heads only when lexical heads have moved.

→ It may very be that all *complex words*—as they are understood in our model as free lexical and functional formatives alike—instigate movement all the time. This pervasive movement would be consistent with our theory. Hence, there is no syntactic stage free of movement as these are self-defining terms. If complex-words by definition imply movement, all we are left with in asserting a potential non-movement stage, is the possibility that roots don't engage in movement. It is only at this crossroads that we can begin to talk about a theoretical Non-INFL stage-1 of child language acquisition. *Lexical vs. Functional* categorical status no longer maintains a distinction, at least regarding movement: both categories, as defined as complex-word formations, involve INFL-related movement.

5. **Roots:** We take roots (merge-α) to be mere formative acategorical (√) projections of a (default) phonological shell:

(i) → $\sqrt{}^{v}$ $\sqrt{}^{n}$ (merge-α)

Roots then acquire their categorical status only after applying a second merge operation which takes the formative root and merges it with a particular functional head (v° n°) (forming verb/noun max-projections):

(ii) → V° (V^{max}), N° (N^{max}) (merge-β)

5.1 These two operations seldom get teased apart as it is usually assumed in the syntax that there is no instance of a single *merge-a* operation. We differ in assuming that the two operations are distinct and separable processes.
Stage-1: For very young children at stage-1 only the first merger operation applies. No movement and therefore no INFL: the merge-α stage fails to generate regular as well as irregular morphology.

No Movement: Movement becomes implicit only with the second operation merge-β: viz., the instance of merging a formative root with a functional head).

No INFLection: All Inflection requires movement all the time.

5.2 In our model, functional heads can simply reduce to being phonologically null (as bundle of syntactic features) which later then merge with the root.

5.3 We hypothesize that √roots may merge freely with each other under merge-α: roots maintain an abstract non-categorical status which serves to provide as a host for later spell-out of morpho-phonological material. Following a DM framework, we hypothesize that while roots may project as bare stems (i.e., phonological shells), roots otherwise exhibit no level of abstract grammar (roots

are quintessential defaults). We further hypothesize that such roots, prior to merge-β may endure stacking which could yield multi-item root mergers which in some sense resemble flat non-hierarchical structures. (Three word combinations at stage-1, though very short-lived, may be instances of multi-item *stacking* yielding mixed word orders. (See §44 of full paper: mixed word order).

5.4 We believe it is at this juncture of 'complex word' formation that the acquisition of functional INFL projections is triggered by the relevant INFL morphology—hence, at first glance, it may be interpreted here that we are claiming that *bottom-up* word-level morphology triggers phrase-level syntax.

5.5 However, we stray from such a pure bottom-up treatment and follow a Cartesian argument and rather suggest a *top-down* approach at least in the sense that it is the DMM which ultimately determines and selects appropriate vocabulary insertion of relevant morpho-phonology material which would go into the construction of a paradigm: unless the child has top-down knowledge to separate stem from affix, how would she know that the decomposed is in fact not a lexical idiom?

5.6 **Response to Borer & Rohrbacher (B&R)**

5.6.1 *B&R*: How do children come to know what the bare stem is (given our missing INFL theory)? In order to know/realize what to leave off, thus creating bare stems, children must first work backwards through the paradigm to deduced the bare stem—thus *child-to-adult continuity* is assumed..

Note: As mentioned in (§6.5), this backwards paradigm deduction may be what is happening in [-BVS] German regarding the realization of a root, but note that it also implies *a priori* knowledge of the paradigm.

5.6.2 ..*Only if the child has a prima facie reason to assume that differences between present and past are morpho-phonologically marked* (off of the √root), *will she attribute to tense the difference between 'move' and 'move-d'*... otherwise, the two forms could be handled by the child as being two separate though semantically related stems (italics B&R, p. 6).

5.6.3 **Top-down**: The words don't generate the syntax, but rather the syntax selects the words: the same mechanism (DMM) that generates morphological structure also extends to complex phrasal structure. **Continuity:** There is necessary child-to-adult continuity in the sense that the same mechanism (DMM) which generates the target language likewise generates child inter-language grammars leading to L1. That Children know of decomposed stem+affix suggests adult knowledge.

5.6.4 **Our Model:** In our model, the DMM naturally provides (via lateralization of brain/language processing) the child with a way to knowing root + affix separation 'first hand' without the prerequisite backwards engineering from the paradigm. Paradigms (top-down) are the result and manifestation of the DMM (not vice versa).

6. **Optional Infinitives: English proves the rule, not the exception**

Instead of saying that English constitutes as a 'special case' in which OIs are a 'less obvious phenomenon' in an otherwise pervasive OI-stage, our model rather suggests that English, being a [+Bare Verb Stem] (BVS) language, is in fact the perfect language to show the rule of bare root mergers (under merge-α). In other words, English proves the rule, not the exception.

6.1 Dutch, German showing of initial verbs morphologically marked by infinitive {*-en*} (instead of bare roots—'e.g., German *sprech-en* vs. *sprech-ø*) does not necessarily imply that child German morphological inflection can never be in question of deletion (which would go against cross-linguistic-based maturational hypotheses). (Recall there are other language types such as Spanish/Italian that can never even enter into the OI-stage due to INFL-licensing of their null subject, etc). Surely, an affix is an affix no matter what language we speak of. However, morphologies are not the same across the board, even though each respective example of 'affix' would share in equal status of 'INFL-morphology'. Rather, the fact that Dutch/German are –BVS languages suggests that roots are simply unavailable in the input and/or are unavailable directly from UG as defaults. Thus, to our model, roots in Dutch/German are equivalent to infinitives given their –BVS parameter status. What we can say is that there is a second overlapping strategy that tries to reconcile merge-α with that of a [-BVS] parameter thus triggering initial root infinitives.

6.2 It's clear that e.g., Dutch/German {-en} affixes surface outside of a grammatical paradigm (i.e., they are inappropriately placed on the stem). Early Dutch/German (inappropriate) preference for infinitives, therefore, might not be explained on syntactic grounds, but more so on phonological grounds: e.g., German *Sprechen* ('to speak') may not actually be initially segmented as /v/+/{en}/ (under syntactic assumptions) but might be cued by *phonological constraints* i.e., the [-BVS] constraint.

6.3 Note the above phonological assumption holds conversely for stage-1 children who initially do drop functional words. For instance, the fact that children do delete functional categories speaks to there being *syntactic evidence* (without outside phonological constraints preventing the deletion of the word or morpheme).

6.4 **Deletion of 'x' equals knowledge of 'x':** B&R (p. 14) correctly point out that if child language is not continuous with that of the adult grammar, what type of analysis would lead a child to know to drop a functional item while sparing a lexical one: e.g. /D the/ /N cat/ = (/D the/) /N cat/. The only possible alternative account would be a non-syntactic phonological segmentation which seems highly unlikely given that true inflections [CVCC] often mimic final consonant stem-based [CVCC] phonology as in the examples *seek-s vs. dance* /si:ks/ vs. /dæns/).

We could counter-argue the fact that German children never drop infinitive/functional morphemes at such an early stage (of an otherwise pre-functional grammar) as an attribute to phonological considerations and not to syntactic (or lack thereof) considerations.

6.5 Of course, Dutch/German children later do come to realize that there is a decomposed root separate from an affix (Agr/T) only as a result of the verbal paradigm being mastered. The deduction of a root separate from an infinitive only comes via the AGR/T paradigm (as a result of top-down syntax).

7. **Vocabulary Insertion: two 'out-of-root' exit strategies**

7.1 In our model, **a regular verb** (Bare stem) √*visit* undergoes (**rule-generated**) Vocabulary Insertion and gets spelled-out in the phonological default past tense [past, {ed}] → [√verb + ed] (e.g., *visited*).

7.2 In our model, **an irregular verb** (Bare stem) √*keep* undergoes (**list-generated**) Vocabulary Insertion, searches the list of appropriate stems, and gets spelled-out in the phonological list of past tense [past, {t}] → [√verb + t] (e.g, *kep-t*).

Note: both default {-ed} (*walk-ed*) and list insert {-t} (*wen-t*) share equally status as being abstract affixes.

7.3 What DMM based theories might capture regarding distinctions of regulars vs. irregulars (as seen in fMRI studies) is the fact that with irregular list-generated formations, the internalized INFL-related material is phonologically associated within the stem and thus a kind of pied-piping operation ensues triggering the stored stem when affix-level retrieval tasks are called upon. (While there may be a kind of an associative rote-learned memory-task operating internally between stem+(irregular)affix, which speaks to attested frequency effects with irregulars, we don't believe irregular stems are *wholes* as a simple bi-product of rote-learned chunking. There are no memory-tasks which deliver irregulars as wholes. We believe there is in fact a real morpho-phonological presence of an INFL-related affix embedded within the stem). Or conversely, when word-level tasks are performed, irregulars surface due to their behaving like rote-learned stems. Irregulars have an fMRI signature close to that of stored stems and for this reason the analogy holds between irregulars and lexical chunks. However, what is important is that *stored* information can be information about complex syntactic structure.

8. **Regular vs. Irregular:** Hence, the current model is in no position to make any real processing distinction between *regular* and *irregular* inflected complex words. By compounding their status as one in the same instance of a complex-word formation, we capture the fact that they both undergo via merge-β a vocabulary insertion equivalent to our DMM interpretation. In other words, both regulars and irregulars alike are instances of stem + INFL-related affix. The question of whether or not the abstract affix surfaces as decomposed or not is akin to artificial (theory internal) distinctions placed on, say, overt vs. covert verb movement, etc.—viz., theoretically, there is no real distinction in processing.

8.1 The real distinction lies with Bare Stems vs. INFL-related affixes. (There may however be a distinction at our hypothesized PF 'out-of-root' formation leading to spell-out as suggested below, but as it is understood, PF is relegated to phonological constraints and it doesn't pertain to other levels of language dealing with abstract morpho-syntactic processes).

8.2 Of course, any argument for *no distinction* largely goes against the grain of what typical DMM analyses seek regarding the distinct processing behind rule-based vs. idiomatic-based formations. For the time being, let is suffice to say that whatever theoretical distinction may exist, DMM or otherwise, it does so not at the expensive of what we are proposing in the current model.

Note: Though our data regarding stage-1 of child language acquisition concerns itself more-or- less with the omission of regular affixes, the more pervasive view is that at stage-1, children exclusively produce merge-α bare stems (regular or otherwise). This observation is consistent with our current model and has no bearing on notions of sensitivity regarding the regular vs. irregular distinction.

8.2.1 It is in this case that while the stem *my* as in [DP *my book*]—as compared to [DP *John's* book] which is decomposed—may appear differently as an idiosyncratic root, it nonetheless embodies the relevant morpho-phonological material due to vocabulary insertion. It is for this reason the root of *my* is actually √*me*,the default form which comes directly out of UG via merge-α. (See § of model).

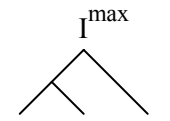
8.2.2 The classic regular vs. irregular distinction (as proposed by the DMM analysis) may be better understood as involving an earlier phase of computation which deals with spell-out at the level of merge-β. (See 'Out-of-root formation' below).

9. **'Out-of-root' formation (exit strategy at merge-β):**
We hypothesize that all complex words must generate an 'out-of-root' exit formation. There may be two distinct processes or exit strategies for this:

(i) **list-generated (irregular)**
and
(ii) **rule-generated (regular)**

9.1. **List-generated** vocabulary insertion: default *me* → vocab insert → *my*:

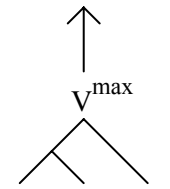
[Possessive] (ii) [Merge-β: my + dolly] Merge-β



[$_{IP}$[DP My [+AGR] dolly]]

< *me* undergoes [Merge-β] → my: >

(i) [Merge-α: me + dolly], Merge-α

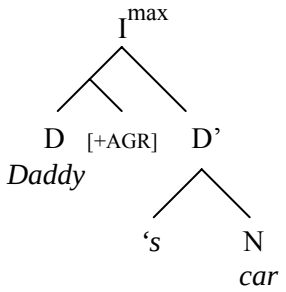


[$_{VP}$[DP Me [-AGR] dolly]]

(See paper for full disclosure of model. The same list-generated insert would apply for irregular verbs, etc. What we are claiming here with the above structure is that the DP [+Agr] instigated by merge-β would necessarily have to raise above VP (a DP>IP) and situate in IP which licits Agreement of the Determiner and between the determiner and the Noun (e.g., *My dolly*), acknowledging that the noun equally partakes in +Agreement (e.g., dolly [+Pl, {s}] → *dollies*)).

9.2 **Rule-generated** vocabulary insertion: default *John* → vocab insert → *John's*:

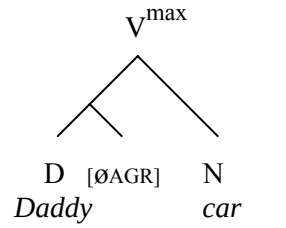
[Possessive] (ii) [Merge-β: Daddy's + car]



[$_{IP}$[DP Daddy's [+AGR] car]]

<*Daddy* undergoes [Merge-β] → *Daddy's*: >

(i) [Merge-α: Daddy + car],

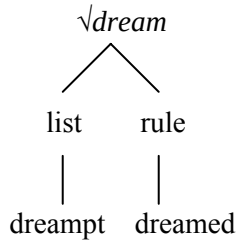


[$_{VP}$[DP Daddy [-AGR] car]]

(See paper for full disclosure of model of rule generated verbal IPs. The same processes could be said to work with regularly inflected verbs *goes, sings, reads, played* and irregularly inflected verbs *went, sang, read*).

Note: **DMM Race models**. Sometimes, the dual forms of vocabulary insertion enter into competition with one another for processing rights. This is seen in examples where both forms may correctly surface: (*dreamt* vs. *dreamed, dove vs. dived*) or where frequency may take an item from being rule-generated to list-generated (as in the past tense *walked* /wakt/ as opposed to *stalked* /stakt/ with the former crossing over to a 'list-generated-like' processing leaving the verb open to factors of frequency).

9.2.1 Consider √*dream* in the above context:



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