

Some New Perspectives on Lexical and Functional Categories: Revisiting Brown's 'Fourteen Grammatical Morphemes'[☆]

Joseph Galasso

California State University, Northridge
18111 Northridge, Ca. USA*

Abstract

This paper presents as a rough sketch what is currently believed to be the dual nature behind the morpho-syntactic processing made in formulating a [stem] + {affix} separation. In this paper, we revisit the classic Roger Brown 'Fourteen Grammatical Morphemes and their order of acquisition' and challenge earlier claims made suggesting that children have knowledge of stem+affix separation early-on in their morpho-syntactic development. Hence, past claims defining such early constructs as *decomposed* are challenged, and arguments are put forward rather suggesting that there is indeed an earlier stage during which such putative constructs actually get processed as *un-decomposed* lexicalized chunks. The paper utilizes recent theoretical advances as developed within the *Dual Mechanism Model* framework of morphological processing as a means to uncover what might have been previously overlooked regarding the initial sequences supposed in the Roger Brown study.

Keywords: Morpho-syntactic processing; stem+affix separation; Dual Mechanism Model

1. Introduction

I'd like to start off by sharing something my 14-year-old son said to his sister just this morning while I was preparing this talk. He said '*Why hasn't she *wearing her watch?*' I corrected him: 'you mean worn'. 'Yes, I know' he said: 'I just couldn't find the word'. I responded: 'too many wh-sounds got in the way, perhaps?'

What's funny about this little exchange is that my son's linguistic intuition is quite right. Irregular verbs such as 'worn' (for past-participle of 'wear') in fact have to be 'found' and 'retrieved' directly via brute memory. (For whatever reason, memory failed him at this instant and all he had recourse to was the ol' sure escape: the [stem + {ed}] rule by default). Also, the idea of other processes such as phonology (e.g., too many 'wh-sounds') getting in the way sits well within current psycho-linguistic modeling.

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* English Dept./Linguistics-TESL Program: email: joseph.galasso@csun.edu

What's particularly nice is that linguists are now in the unique position of being able to understand just how such mistakes take place in the brain.

(1) I have three points on my mind here:

- a. To talk about this [stem+affix] processing,
- b. To review the morpho-syntactic literature of the past 40 years, forming as our point of reference the classic Brown list of 'Fourteen morphemes and their order of acquisition',
- c. To question old assumptions as based on this list.

Finally, I conclude with some data.

Within the last fifteen years or so, a very short period of time, linguistics and linguistic theory has achieved more to put the 'language question' on a 'biological-basis' footing than in any other time. Naturally, this shift has come out of technological advances, many of which initially had no language based implications. Recent Brain Imagining (BI) Studies made using fMRI, and ERPs have shown for the first time, in real time, the activation and mapping that proceeds in the brain during specific language tasks, e.g., word retrieval and production, regular vs. irregular grammatical formations, semantic anomalies, differences between verbs and nouns, etc. Advances in any science are always welcome. However, something gained (on one hand) usually translates into something lost (on the other hand). It could be said that a tension has emerged due to this gain-loss exchange, whereby traditional theory might need to be reevaluated as evidenced by new theories proposed about the brain/language processing. This tension is perhaps most evident with regards to syntactic theory. In particular, the question that now emerges is (i) how to reconcile what has been long accepted in theory with (ii) differing facts about that theory as evidenced in brain processing. For instance, the production of an affix morpheme (e.g., [add {ed}] for past tense) has long been held as a 'rule', independent of any frequency-based association. This may now have to be reconsidered in light of some studies which show that *high frequency* {ed} process differently from *low frequency* {ed}. Another example might be regarding morphology itself. Studies now indicate that one shouldn't just group morphology together as one type of processing system which is rule-based throughout. BI studies now show, for example, that derivational morphology may in fact be frequency-driven and processed accordingly as opposed to inflectional morphology which is rule-based—notwithstanding the aforementioned quirky high frequency-driven {ed} which is indeed considered inflectional. You get the picture: tensions and overlaps in theory abound.

2. The separation question

The question as to how children come to separate [stem+affix] is just one of the many pieces of the learnability puzzle. Accounts to the problem vary, but most fall somewhere on the spectrum of either a 'bottom-up' account (which utilizes frequency and pattern association), to a 'top down' account (which makes use of rules). Any account will have to explain how the child comes to process *walk-s* as [stem+affix], but *dance* as [stem-only] (both being of a CVCC phonological 'stream' as found in the input). One commonsense approach might be to say that young children actually work backwards in realizing that there is a decomposed stem *walk*, but not a stem **dan*. (*A kind of statistical learning*)

If so, we might expect a young child to first produce such affix related items as *un-*

decomposed wholes, only to delete them at a later stage of development when separation takes place. (Note: the matter is not whether or not a child produces an affix, but whether or not the child is being productive with the given affix (i.e., they add or delete affixes in natural speech)).

(We might want to suggest that separation, the pulling apart of concatenate stem+affix is the result of differing modular brain processes).

There is some evidence for early un-decomposition to the extent that some children seem to follow a ‘U-shape’ learning curve for affix morphology. For instance, with plural nouns, there are data showing that some children pass from saying things like *two socks*, to saying things like *two sock*, returning later to *two socks* (similar to what we find with over-regularizations *went*→*goed*→*went*.) There is some evidence that nouns and verbs behave differently here. In any case, however, most children never pass through this u-shape learning, are rather conservative, and pass through an initial stage where they only delete the required affix (for both nouns and verbs).

(Phonological examples include the progression of pretty>bidi>pretty, taken from the Leopold study. See Appendix of this paper).

3. Other points and Overview

- There is a ‘brain-basis’ (biological basis) for language. This wasn’t always the case. Earlier linguists were mostly concerned with language as a ‘classificatory’ system.
- Child’s grammar is a real grammar onto itself. This wasn’t always the case. Earlier attempts to deal with language development squarely put the child’s grammar on the same footing with adult grammar, accounting for surface errors in an unsystematic way.
- Taking these two stands together, we now are in a position to account for the child’s autonomous grammar, (i) as a real grammar onto itself, and (ii) in ways that reflect the child’s maturational development of the brain.

In this brief paper, we unpack Roger Brown’s classic list of ‘fourteen grammatical morphemes and their order of acquisition’. We review the nature of this classic ‘Functional/Lexical’ dichotomy in light of the observed delayed onset of AGR(eement) morphology. The paper’s main goal is to question how we go about accounting for apparent affix-related morphology found in an otherwise ‘agreementless’ stage of child grammar. Finally, we question the mental processes involved in [stem+affix] realization and synthesize our findings within recent advances made in Brain Imaging Studies (BIS).

[Data: We won’t talk in percentages. We rather ask what might be happening in a particular instance. Data taken from (early) Braine and (recent) Galasso show a possible reinterpretation of what Brown suggested to be early instances of morphology found in his stage-2 data. (We will refer to Brown’s early multi-word stage-2 (MLU \leq 2.5) as our lexical stage-1).]

We begin by accepting as our point of departure the view that the brain partitions language into two fundamentally different processes, roughly correlating to Broca’s area (for more abstract rule-based/AGR computational tasks) vs. Wernicke’s area (for memory-based tasks) (Grodzinsky 2000). This partition is seen as a natural overlap onto what had been the traditional cut between Functional vs. Lexical Categorization (respectively). (See ‘Words &

Rules Theory' (Pinker 1999). The theory can be taken as a contemporary interpretation of the classic 'Skinner-Chomsky' debate (Chomsky 1959)).

The Functional/Lexical dichotomy can be easily captured by what I call the 'Sally Experiment':

- (2) a. Sally wear-*s* strange sock-*s* (not (final) positional deletion, cf. b)
 b. Mrs. Sally is a nice girl who walk-*s* to dance class once a day.
 /s/ /s/ /s/ /s/ /s/ /s/ /s/ /s/

In L2 contexts (ESL), the italic functional /s/ may optionally delete, but not the underlined lexical /s/. The experiment shows the processing distinctions between what is idiomatic/rote-learned (lexical) and what is a rule computation (functional).

Question: How is it that the child comes to 'know' that *walk-s* is a [stem+affix] product, but that *dance* is a [stem-only] product—both being a CVC{/s/} structure?

This 'functional/lexical cut' has been extensively written about in the child language literature, where theories have been posited claiming that young children initially go through a lexical stage-1 during which they omit functional inflection, only later entering into a functional stage-2 (Brown (1958), Brown, Fraser & Bellugi (1964), and more recently Radford (1990), Wexler (1994), Galasso (2003)).

It seems children start with the simple operation of 'merge stems' (forming an XP), and only later do they gradually come to the more abstract operation 'move affixes'. Broca's area seems to be exclusively implicated with *move* operations (not *merge*) (Grodzinsky, Friederici, (2006), Galasso (2007)). AGR(ement)-based affix-morphology is a *move* operation.

- (3) a. Merge $X \rightarrow Y$ ($V, N = VP$)
 b. Move $WX \rightarrow YZ$ (Agreement) (two items on left))

A lexical stage-1 is characterized by the absence of functional material such as Determiners (*the/this/that*), Auxiliaries (*do, be, have*) and Modals (*can/could, shall/should, etc*). In addition, AGR-based/movement inflection such as Tense, Case, Number is absent.

Problem: If a [-AGR] 'affix-less' lexical stage-1 model is correct, as assumed, we then have to explain how an apparent overlap exists whereby early MLU onsets of affix functional morphology manifest at the otherwise hypothesized lexical stage-1 (as shown in Brown's list below). (What we mean by 'overlap' is that it appears functional affixes come on-line at an otherwise assumed lexical stage of development. Stage-1: MLU 2.5/or below).

Solution: While such an overlap may be transparent enough, as Brown's list shows, it may be that dichotomies are never as strict as we wish them to be—viz., when what appears to be a 'functional' representation actually gets processed via 'lexical' means (and potentially *vice versa*). This is best illustrated by looking at Brown's first items on his list. There is good evidence in the child language literature to suggest that some of these early onsets of what appear to be functional affix-morphology can be called into question, opening-up claims that there needs to be a refinement over how to define seemingly affix-bound INFL(ectio)nal morphology early-on in an otherwise non-INFL, lexical stage of development.

In other words, we wish to make a distinction between seemingly (i) ‘Lexical’ Meaning INFL—resulting from mere frequency of input or via semantic marking—and (ii) true rule-based ‘Syntactic’ Meaning INFL. As we shall show below, when the child named ‘Eve’ (of the Brown study) says e.g., ‘*two chair*’, ‘*one blocks*’ or ‘*where mommy going?*’ we can’t equate Eve as having an adult target grammar for [‘number’ on noun] or [‘progressive’ on verb]. We can only claim for adult grammar when we have evidence of the appropriate AGR-relation (e.g., ‘**two chair-s**’, ‘**one block-ø**’, ‘**where is mummy going?**’). There fact that affixes {s}, {ing} emerge is not evidence in of itself for an AGR-based functional INFL.

Hypothesis: After close examination of the first items acquired on the Brown list, we suggest that a better way of describing the classic lexical/functional dichotomy is to redefine the underlying affix processing distinction as either belonging to an AGR(eement)–based computation (i.e., Functional INFL), or a NON-AGR-based relation (Lexical INFL).

4. The Literature

The literature over quite a span makes available to us such [-AGR] defining formulas:

- (4) a. **Autoclitic** (by 1st generation developmental linguists (Skinner, Brown))
- b. **Lexical Inflection** (by 2nd generation developmental linguists (Radford))
- c. **Undecomposed** (by neuro-linguists (Pinker, Clahsen)).

For example, Radford (1990) suggests that ‘Lexical’ inflections (as opposed to ‘Functional’ inflections) should be defined as scheme affix morphologies without recourse to the more abstract AGR relation. Functional inflection is triggered only by the appropriate features of the counterpart functional class. For example, ‘ing’ verb constructions without the necessary AUX(iliary) ‘Be’ might be one instance of a lexical inflection whereby the ‘ing’ may simply mark the semantics [verbal [present action]] (e.g., *Daddy working*).

Extending this, we informally define AGR has a morpho-syntactic mechanism which involves the ‘holding’ and ‘spreading’ of a syntactic feature across its relevant phrase (XP), from a lexical-to-functional constituent. (It is suggested in the literature that Broca activation is triggered by a *syntactic working memory over-load* due to this ‘holding’ and ‘spreading’ associated with ‘move’ across XP). Whenever one or more features match between two or more constituents, such as between ‘subject-verb agreement’, we define that as [+AGR]. AGR may also refer to functional words which enter into an AGR relation on their own basis. By this definition, for example, the possessive pronominal determiner *your* would be [+AGR] since it enters into an AGR relation with a noun. In fact, recent studies show that the once heralded classical distinction between lexical and functional categories may actually splinter-off along more finely grained computational processes, so that what we find is a two-prong splinter for each category:

- | | |
|----------------------------------|-----------------------------------|
| (5) <u>Lexical</u> | <u>Functional</u> |
| a. AGR-based, (ii) Non-AGR-based | b. AGR-based, (ii) Non-AGR-based. |

While target English may not show an AGR-based lexical category *per se*, due to its morphological typology—e.g., agglutinative languages may show such features—English does however show the functional splinter). It could be argued that Derivational morphology falls under ‘Functional Non-AGR’, and Inflectional morphology falls under ‘Functionalized

AGR')¹. (Derived [[teach]er] (teacher) incorporates {er}, 'merging' the affix into the stem).

5. Theory

Such a functional splinter could manifest as a singular affix form, though showing two different underlying processes: AGR and non-AGR based. In this context, language might be seen as 'degenerative' whereby competing factors may work simultaneously in producing a language result which falls within a *rule-based-to-memory-based* processing spectrum. (I refer to 'degeneracy' as linguistic instances in which seemingly similar surface outputs (i.e., affixes) are the result of differing internal processing). Degeneracy can explain how the functional affix comes to get processed lexically in certain environments. (See fn.3).

(Competing factors: A color blind person obeys traffic lights via position and not via color. On the surface, it may appear a color-blind and color-seeing person obey due to similar internal processes: not so! Also, see 'u-shape learning' found in the appendix. While the same child pronunciation of 'pretty' /prIti/ surfaces in both sides of the u-curve, the child's underlying processes are different—viz., non-segmental/memory vs. segment/rule-based. Early correct word order may be shaped by non-linguistic factors, though on the surface it appears the word order parameter is set).

We conclude that what is behind the degeneracy of processing is a rather prosaic distinction having to do with 'Frequency-affective' items on the one hand, and 'Movement-affective' items on the other hand, correlating to our [-AGR] vs. [+AGR] distinction (respectively). This redefined distinction forces a reclassification of what might constitute as functional *per se*, while allowing us to correctly interpret longitudinal case studies of child acquisition (such as the one focused on in this paper) which show a slow, maturational development of 'movement-affective' processes.

(Out of the German plurals (e, er, en, s), {s} seems to be the default rule-based plural despite the fact that it is the least frequent in the input. Phonology patterning seems to play a role for all German plural affixes except for {s} (Marcus et al. (1995)).

This 'affix splinter' would, for example, allow the nominal/plural {s}, the progressive {ing}, as well as past participles {en}, {ed} to split into either AGR-based or Non-AGR-based modes of processing. If this is so, we should find some evidence early-on in child language data demonstrating that what appears to be a functional representational affix is actually a bi-product of 'rote-learned' memory processing.

¹ BI studies have shown that the derivation affix {er} in the bi-morpheme word 'teacher' may not be decomposed of a [stem+affix] as compared to, say, tense which decomposes 'teach-es' into [stem+{es}]. In brain studies, the word 'teacher' has been found to carry a signature identical to the word 'brother', a single morpheme item. In addition, whereas L2 students of English often delete rule-based inflectional affixes, they never delete derivational affixes, suggesting that item [stem+affix] remains undecomposed and processed as a single idiomatic chunk. To a certain extent, agglutinative language types may follow this procedure. (See Baker 2001) for language typologies which use such incorporation of grammar.

At the moment, there is still relatively few child case studies—of child data recorded ‘early enough’—to show a maturational development of AGR-related movement analogies². Such an early stage would reveal, among other things, a stage-1 of Non-AGR across the board. The data presented in this paper show such a (non-Inflectional) Non-AGR stage-1.

6. A brief history on the classic Lexical vs. Functional distinction

Let us take as our historical starting point the classic Brown, Braine studies in forming an analysis of the lexical/functional distinction. Moving beyond the basic word-level classification of Lexical vs. Functional (lexical making-up the substantive *Noun, Verb, and Adjective*, functional making-up the more formal *Determiner, Auxiliary*), perhaps the most important tangible result coming out of these early studies was Brown’s list of fourteen grammatical morphemes and their order of acquisition. The (partial) list is broken down into two parts, with the first part composing of early acquired morphemes which are potentially lexicalized (Brown’s stage-2, MLU 2.25):

(6) Lexicalized [stem-only]

1. present progressive {ing}
- 2-3, prepositions *in, on*
4. plural {s}
5. past irregulars *went, came*

Functionalized [stem+affix]

6. possessive {‘s}
9. past regular {ed}
10. 3pers/sing/present {s}

(I have always been somewhat suspicious of this first part of the list. We know prep and irregulars pattern as lexical. So too might early {s} and {ing}).

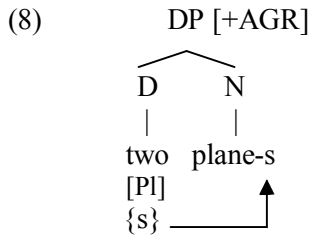
The question here is whether or not all of Brown’s fourteen morphemes (along with their order of acquisition) should be cast together as inherently signaling the onset of AGR-based morphological representation in children’s early speech. Most traditional analyses do suggest that these onsets do signal some kind of an agreement mechanism in grammar whereby rules enter into the computation.

We counter this by suggesting that functional affix-morphemes 6, 9, 10 have a potentially distinct processing signature, say, from that of affix-morphemes 1, 4. While all tend to be equally bunched together as constituents of functional grammar, we believe only morphemes 6, 9, 10, as attested in most child corpora, are unambiguous and signal rule-based AGR.

Let’s review some of Brown’s data found in list one, starting with plural, and see if there might be evidence of lexicalization. (We define ‘lexicalization’ here as a formation when an otherwise decomposed [stem-affix] processing—as in [verb+ing]—allows the affix {ing} to go undecomposed by incorporating the affix into the stem, having the whole construct be realized as a single [stem-only] structure [verbing]).

² This fact has prompted Wexler into claiming an early stage-1 as an ‘Optional Functional’ stage where there is [+AGR] albeit optionally produced. We counter this by showing a true lexical Non-AGR stage-1, with the optional stage being relabeled as our functional stage-2 (Radford & Galasso 1998).

that AGR is established when and only when we have evidence that whatever feature involved (in this case the ‘number’ feature) *holds* and *spreads* across the phrase from Determiner to Noun—e.g.,



In this case, it is the emergence of a number sensitive determiner that tells us that an AGR relation has been built between D and N, with {s} signaling AGR. In other words, when both emerge simultaneously, we can except as the null hypothesis that AGR has been established. This was not the case in the early $MLU \leq 2.5$ stage.

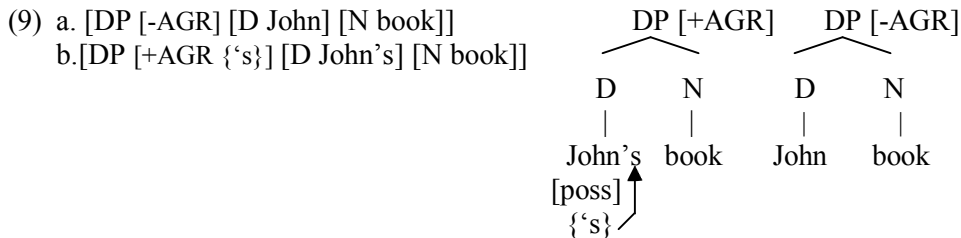
However, what we can claim about this early emergence of the determiner system is that determiners are correctly used in the grammar (i.e., determiners introduce a noun—e.g., ‘@Two the book’ is unattested). While the syntactic organization may indeed be correct—although the linear ordering may be only phonologically based—the determiner itself would be viewed as void of any AGR-material: (viz., a DP phonological shell).

Regarding the DP, there is a dual way of telling whether or not AGR has been established:

Firstly, in examples where there is the determiner (*two*) but not the plural {s}, what we can say is that no AGR has been established and the determiner *two* is empty of its AGR properties. In other words, the determiner gets generated as an empty phonological shell.

Secondly, if the plural {s} does indeed surface with a non-matching determiner (e.g., *one raisins*), or surfaces at a stage where there is no further evidence of the emergence of functional categories, what we can then suggest is that the {s} has lexicalized and has become part of the stem. (The /s/ gets realized much in the same manner as the /s/ in the word *dance* /dæns/ as cited in our Sally Exp. It becomes part of the stem).

An interesting side note here is that foreign language students often report having little difficulty with processing plural {s} on semantically rich nouns (e.g., *book* vs. *book-s*, *car* vs. *car-s*, etc) but complain of difficulty (and often produce {s} deletion) with more abstract nouns (e.g., *motivation-s*, *impression-s*, etc.). This same treatment of AGR ‘feature spreading’ extends to possessive {‘s} formations:



(Possessive utterances like ‘Mummy car’ are fully attested in Brown’s stage-1 data).

(Simple Merge can be applied for ‘John book’ $N \rightarrow N, NP$)

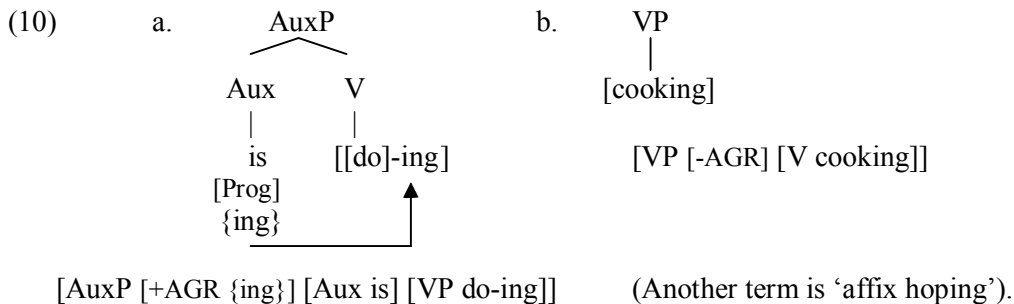
Verbs with {ing}. Let's begin by saying that 'ing' verb forms have only one allomorph, are highly regular and constitute a very high frequency in the input—(they model after irregular verbs as well as the special case of the high frequency regular verb e.g., [walk] → [walked], where the {ed} affix in such high freq. items don't prime for the stem (as opposed to the low frequency item 'stalk-ed' which does prime the stem ['stalk']) (Alegre, Gordon).

(Current studies show that 'ing'-nouns get processed lexically: children don't seem to delete the (ing)-affix for ing-noun structures, as opposed to ing-verbs. Early children 'ing'-verbs may likewise model lexically like 'ing'-nouns (when without AGR)).

Thus, similar to irregular verbs (*went, bring*), 'ing'-verbs don't signature a priming effect. Early stage-1 onsets of the present progressive {ing} can thus be attributed to frequency effects found in the input and may not be a product of an AGR formation [Be+Verb+{ing}]. Note that a true AGR-based {ing} would be triggered as part of the auxiliary rule. Note, the AUX 'Be' typically doesn't emerge until late in MLU 3.5, a classified functional stage of development—e.g., *What daddy doing? Mommy cooking*, etc. (Brown, Radford).

(Irregulars prime faster reaction times since they are drawn directly from the lexicon as wholes. Concatenated products [stem+affix] show slower reaction times (since there is a computation), and where the affix primes for the stem. Irregulars show no such priming).

This suggests that early MLU [verb+ing] is idiomatic and rote-learned, as made apparent by frequency of 'ing-verbs' found in the input. The same children at this lexical stage seem to incorrectly analyze 'ing-verbs' as roots and therefore often fail to produce the counterparts *Daddy do, Mommy cook*, etc. (In fact, 'ing-verbs' occur much more frequently in the input as compared to bare verb stems. 'ing'-nouns process more like (b)).



Past Participle {ed} {en}. Similar to our findings regarding 'ing' verbs, likewise early onsets of the past participles {ed}, and {en} can be attributed to frequency affects found in the input and may not be a product of a rule formation, such as the perfect rule [Have+Verb+{ed}/{en}]. Again, note that a true AGR-based {ed/en} would form as part of the auxiliary rule. The auxiliary 'Have' is typically missing at the earliest lexical stage of these formations—e.g., *Daddy all gone?*

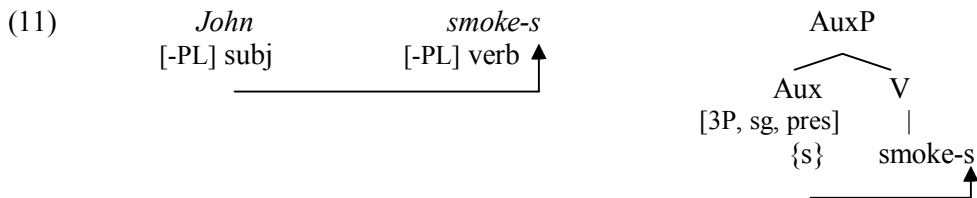
8. Functionalization

The upshot to all of this is that we believe it is only with the onset of morphemes 6-10 of the Brown list that we can provide evidence for procedural, rule-based functionalization. One way to think about the differences here is to examine the role of frequency within the respective paradigm. For instance, ‘ing-verbs’ (*walking*) and ‘bare stems’ (*walk*) enter into the child’s morphological paradigm as potentially competing forces since both forms approach equilibrium in sharing a common semantic field, as determined by the input. (Children commonly misread the two forms as involving the same semantics as well as the same morpho-syntax. This makes both forms linguistically ambiguous). In fact, ‘ing-verbs’ hold a higher frequency count over bare verb stems). The same equilibrium does not seem to hold however for the [noun + possessive]{‘s} [stem+affix] and the bare proper-noun stem [stem-only]—where the frequency and distribution of e.g. [[*John’s*] *book*] and [[*John*] *book*] would not share a common semantic field, nor rest in competition with one another. Based on this, the attested possessive {‘s} exclusively found at a latter stage of development is indeed the result of a true rule-formation.

Using the same criterion, present and past tense inflectional morphology {s} and {ed} respectively do not enter into a frequency based competition and are thus purely of a rule-based formation³.

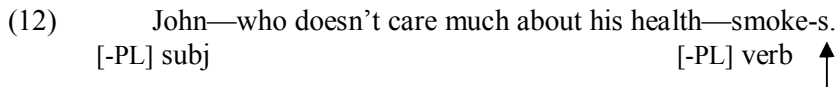
Verbal {s}. The verbal 3Per/sing/present {s} on the other hand is both morpho-phonetic (the sound /s/) and morpho-syntactic (crossing word boundaries) due to this holding and spreading across the phrase. Hence, the verbal {s} is a quintessential AGR-based affix.

Consider this AGR-based processing showing agreement between two constituents across the phrase (i.e., subject-verb agreement):



The AGR mechanism results in the affix {s} being spread over the phrase. Broca’s area is activated in such spreading. It is believed that this extra processing load of AGR ‘holding’ and ‘spreading’ triggers Broca’s activation (Grodzinsky).

Consider a longer AGR spread:



³ Though see the Alegre and Gordon study showing possible {ed} as declaratively processed, based on frequency. For instance, they claim that a frequency paradigm can be created whereby two otherwise phonetically similar verbs *walked* and *stalked* get processed differently as dependent upon frequency differences, with the former *walked* holding a much higher frequency count and thus potentially formed idiomatically as a [stem-only] lexical item—viz., [*walked*] as compared to [[*stalk*] *ed*].

9. Intermediate Summary: Inflection

The computational system responsible for inflection in morphology utilizes dual *declarative* and *procedural* routings, the former dealing with memory-based word formations having to do with [stem-only] undecomposed constructs, and the latter with agreement-based [stem-affix] decomposed constructs (Ullman et al.).

It has been suggested that the level of frequency a construct holds (a ‘frequency effect’) helps to determine the processing route involved. Based on this newly defined frequency effect, it may no longer be entirely accurate to rely solely on the long-held view that distinctions should be drawn between classic lexical vs. functional categories, as was indicative of earlier approaches which sought to categorize child speech into a lexical stage-1 and a functional stage-2. A computational line of reasoning requires a finer-grained analysis. By looking at early child speech, as well as recent brain imagining studies, we conclude that this dual computational process separates in young children’s developmental morphology whereby a maturational lag exists between the two stages.

We conclude with three basic points:

1. That children pass through an initial Non-AGR stage-1 of speech development whereby they omit all AGR related functional/affix material. Such a stage may or may not contain affix forms, however. If affix forms do surface at this stage, we claim that they are instances of non-AGR idiomatic constructions.
2. That what had been traditionally a ‘clean-cut’ between lexical and functional categories now may collapse quite differently when refashioned in BI terms.

This new BI perspective pulls distinctions away from the classic linguistic categorization of lexical vs. functional *per se*, and turns to examining the role of Declarative vs. Procedural brain routing in morphological word formation, as evidenced in recent BI studies. To a certain extent, this leads to a tension between traditional morpho-syntactic theory, on the one hand, and recent discoveries made in Neuro-Linguistics, on the other hand—throwing the classic lexical/functional ‘cut’ into potential dispute. Evidence of the sort comes from BI studies which show that lexical items can at times be ‘functionalized’ (as in **over**-regularization of [stem+affix]—e.g., *[[bring]-ed], *[[draw]-ed] (Brown & Bellugi, Marcus et al.), and functional items can at times be ‘lexicalized’ (idiomaticity of [stem+affix] into [stem-only]—e.g., *[raisins] (Braine), *[walked] ((Alegre and Gordon, Pinker, Ullman et al.). This ‘cross-over’ effect parallels distinctions between Declarative vs. Procedural processing, triggering activity in according areas of the brain respectively. In fact, it is precisely this kind of tension that has promoted the now widely accepted view that inflectional morphology is quite different from derivational morphology, notwithstanding the fact that both are singularly defined as a morphological process.

3. It is hypothesized that brain maturation in children affect language processing whereby the latter onset of (pre-frontal-left-anterior) ‘functional/affix’ procedural activity lags slightly behind the early onset of declarative ‘lexical/idiom’ (temporal lobe) activity.

**10. Data. The lack of Functional Agreement at stage-1 of child language acquisition:
A Non-AGR stage**

Two-and three-year-old children generally go through a stage during which they sporadically omit possessive 's, so alternating between saying (e.g.) *Daddy's car* and *Daddy car*. At roughly the same age, children also go through a stage (referred to by Wexler 1994 as the 'optional infinitives' stage) during which they sporadically omit the third person singular present tense +s inflection on verbs, so alternating between e.g. *Daddy wants one* and *Daddy want one*. The question addressed here is whether children's sporadic omission of possessive 's is related to their sporadic omission of third person singular present tense s—and if so, how. Furthermore, by extension, we suggest the proposed relation is implicated in the maturational progression between 'under-specification' in the child's grammar, leading to optional AGR projection (at stage-2), and the 'un-specification' leading to exclusive omission of AGR (at stage-1).

(13) OCCURRENCE IN OBLIGATORY CONTEXTS

AGE	3sgPres s	Poss 's
2;3-3;1	0/69	0/118
3;2-3;6	72/168	14/60

- (14) a. That *Mommy car* (2;6). No *Daddy plane* (2;8). Where *Daddy car?* (3;0).
b. *Daddy's turn* (3;2). It's the *man's paper* (3;4). It's *big boy Nicolas's*.

- (15) a. Baby *have bottle* (2;8). No *Daddy have Babar* (2;9). The car *go*. (2;11).
b. Yes, this *works*. This car *works*. It *hurts*. The leg *hurts*. (3;4).

The data suggest a parallel between the acquisition of third person singular +s and possessive 's, and raise the obvious question of why there should be such a parallel. Both possessive 's and third person singular s are reflexes of the same functional AGR relation—the former being of a nominal AGR, the latter being of a verbal AGR. (The notation 'IP' refers to Inflectional Phrase).

- (16) a. [_{IP} Mommy-'s [+agr {'s}] driv-ing] (= Mommy is driving)
b. [_{IP} Mommy [+agr {s}] drive-s] (= Mommy drives)

In much the same way, we might suggest that possessive structures like *Mommy's car* contain an IP [+AGR] projection, whereas non-inflectional s-less possessives like *Mommy car* contain an IP [-AGR] projection which is non-specified with respect to agreement:

- (17) a. [_{IP} Mommy-'s [+agr {'s}] car] (= Mommy's car (possessive))
b. [_{IP} Mommy [-agr {∅}] car]

Consider English as having the following Case system:

- (18) An overt (pro)nominal is:
a. nominative if in an AGR relation with a verb
b. possessive if in an AGR relation with a noun
c. objective otherwise (by default) (e.g., 'me' subjects).

If we assume that two and three-year old children go through a stage during which AGR is optionally underspecified with respect to the features they encode, we can provide a straightforward account of why two-and three-year olds alternate between forms like *I'm playing* and *Me playing*. The two types of clause would have the respective (partial) structures (19a/b) below:

- (19) a. [IP I'm [+agr {'m}] playing]
 b. [IP Me [-agr \emptyset] playing]

Since IP is fully specified for AGR in (19a), the overt auxiliary 'm is used, and the subject is nominative by (19a). But since IP is underspecified with respect to AGR in (19b), it remains null and has a default objective subject by (18c). If possessive nominals contain an IP that may either be fully specified or underspecified for AGR, we would expect to find a similar alternation between nominal structures like (20a) below with genitive possessors and those like (20b) with objective possessors:

- (20) a. [IP My [+agr \emptyset] dolly]
 b. [IP Me [_I -agr \emptyset] dolly]

In (20a), IP is fully specified for AGR with its possessor-specifier and so the possessor has (genitive) possessive case by (18b); but in (20b), IP is underspecified for agreement, and so its possessor-specifier has objective case by (18c). In both structures, IP is null because 's is used only where the specifier is proper noun, third person).

11. Other Agreement Data

(21) Frequency of occurrence of first person singular possessors

AGE	OBJECTIVE ME	POSSESSIVE MY/MINE
2;6-2;8	53/55	2/55
2;9	11/25	14/25
2;10	4/14	10/14
2;11	5/24	19/24
3;0	4/54	50/54
3;1-3;6	6/231	225/231

Examples of first person/sing possessive structures produced by the child are given below:

- (22) a. That *me* car. Have *me* shoe. Where *me* car? I want *me* car. (2;6-2;8).
 b. I want *me* duck. That *me* chair. Where *me* Q-car? No *me*, daddy (= It isn't mine, Daddy). *Me* pasta. *Mine* pasta. *My* pasta. In *my* key.
 c. It is *my* TV. Where is *my* book? Where is *my* baseball? Don't touch *my* bike

(23) **Frequency of *I/me* subjects in copular sentences**

AGE	NOMINATIVE I	OBJECTIVE ME
2;6-2;8	10/14	4/14
2;9	15/19	4/19
2;10-3;0	51/55	4/55
3;1-3;6	105/111	4/111

- (24) a. [_{IP} I'm [_I +agr { 'm }] sick]
 b. [_{IP} Me [_I -agr { ø }] wet]

(25) **Frequency of second person possessors**

AGE	YOU	YOUR
3;2-3;4	14/16	2/16
3;5	7/34	27/34
3;6	2/29	27/29

- (26) a. No *you* train. (=It's not your train). No it's *you* train, no (idem).
 b. That's *your* car. Close *your* eyes. No it's *you* house. Where's *your* friend? (3;4)

- (27) a. [_{IP} your [+agr { ø }] car]
 b. [_{IP} you [-agr ø] car]

Third person singular subjects produced at 3;6 are illustrated below:

- (28) a. Him is alright. Him is my friend.
 Him is a big woof-woof. Him is hiding. What's him doing?
 b. Where's him going? Where's him?
 c. He's happy. He's bad. He is a bad boy. He's in there.
 d. He happy. He a elephant.

12. The emerging view as seen via advances in brain imaging technology

Any linguistic theory which embraces a brain-basis of language must not only attempt to reconcile but also begin to incorporate those recent insights made in BI studies which other go against the grain of more traditional norms of theory. It's only natural that a tension has emerged between the two approaches. Recent language based BI studies using fMRI and ERP have forced us into considering new ways of thinking about old issues. The once heralded Lexical/Functional cut may perhaps be better understood within this new framework of brain computation. I see much that can be gained by this new perspective on lexical vs. functional processing. Other BI implications, as I see it, involve how linguists understand and classify language typology in general. Implications to child language development are enormous.

13. Conclusion

This paper represents an early attempt to discern what we are beginning to learn from brain imaging studies and to apply the findings to current linguistic theory. These new applications challenge linguists into new ways of thinking about old paradigms. While the

data presented herein support traditional claims that children begin their speech development without AGR, attempts are made to highlight what might be behind such a delay. Questions as to whether or not a 'Non-AGR' stage-1 is due to brain maturation as specific to a delay of neuro-connectivity in Broca's area are still open. But it seems to me the biological null hypothesis calls for some form of maturation behind the delay. Nonetheless, in theoretical terms, the data suggest there to be an interesting symmetry between the development of [subject + verb] structures on the one hand and [possessor + noun] structures on the other. Both considered AGR-based formations. Likewise, Case as determined by AGR also shows delay. The overall data show a stage characterized by the use of objective possessors/subjects and the omission of possessive { 's } and third person singular { s }.

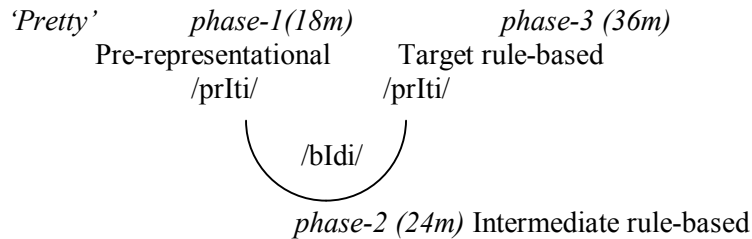
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(*Portions of this text were pulled from an earlier paper written by Andrew Radford and Joseph Galasso, 1998)

Appendix: Phonological ‘U-shape’ learning



Stage-1 is idiomatic and pre-representational—non-phonemic.

Stage-2 shows an immature phonological/representational stage:

- Representational target stage showing phonetic and syllabic representation
- The double consonant CC is reduced to a sole consonant onset C (= CV stage of development)
- The default voicing rule applies assimilating the [-voice] bilabial plosives /p/ to [+voice] /b/ and alveolar /t/ to /d/.

Stage-3 shows CCVCV syllabic development.

Only stages 2-3 are considered rule-based. Stage-1 is idiomatic. While /prIti/ surfaces both in stage-1 and in stage-3, they don't have the same underlying processing. The error in stage-2 shows rule-based productivity.