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Up close and personal: a case study of the development of three English fillers*

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ABSTRACT

As Peters (2001) has suggested, the young child's use of fillers seems to indicate awareness of distributionally-defined slots in which some as yet unidentified material belongs. One may view a filler as an emergent transitional form; as a slot that serves as an underspecified lexical entry for the accumulation of phonological and functional information; or as prosodic 'sentence padding'. We trace the development of three fillers in one English-acquiring child through seven months, from their first appearance about 1;9 through their re-analysis as English functors about age 2;4. We show how the description of these fillers requires an elaboration of the current framework for describing the emergence of morphology, from a one-dimensional to a multi-dimensional model. Finally, we argue that the neglect of such transitional and under-defined elements gives a false picture of development, making it appear as if language development takes place in discontinuous steps.

INTRODUCTION

During the early development of language in a given child there may be many elements that cannot be identified as versions of any adult target word. These are usually glossed as unintelligible syllables if they are transcribed at all. This case study finds order in such apparently chaotic elements, and argues that setting them aside, as is so often done, gives a false picture of the transition from pre-speech to speech. Many of these elements appear to correspond distributionally and phonologically to functors, and have been regarded as bootstrapping devices to early syntax (Peters, 1986; Morgan & Demuth, 1996).

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Fillers often preserve the prosody (number of syllables and/or intonation contours) of the input (Peters & Menn, 1993; Peters, 1997); the present study shows that some fillers have prosody that suggests content words as well as functors. Fillers may also appear as elements of formulas. Our approach, focusing on the emergence of morphology and syntax, extends the work of Peters (e.g. 1985, 1986, 1994, 2001), and complements the more phonological emphasis of Vihman, Macken, Miller, Simmons & Miller (1985), and Vihman (1996).

Accounts of language acquisition have to some extent incorporated protowords: vocalisations that are incompletely realized but based on identifiable adult targets or have definable meanings for the child, e.g. *na* used to indicate wanting an object, by Halliday's (1975) subject 'Nigel' (see also Braine, 1976; Painter, 1984; Peters, 1986). However, transitional forms without clear targets, which Peters calls 'fillers', are still typically ignored. The present paper elaborates Peters' framework (most recently, Peters, 2001; childes.psy.cmu.edu/fillers/index.html) for the description of fillers, using data from Feldman (1998) as well as earlier sources. We document in particular the gradual development from multi-syllabic fillers to several types of phrases containing functors, and we consider some implications of this developmental story.

As opposed to protowords, fillers – by definition – do not correspond to a particular word or morpheme in the input. More specifically, while adult language requires words to fall within a narrow range of consistency in at least three dimensions – phonetic, syntactic/distributional, and semantic – 'filler' refers to a string that the child uses relatively consistently in one or two, but NOT in all three of these dimensions. Unglossable utterances, i.e. strings of apparently meaningless phonetic material, have been given various names. We prefer Peters' term 'filler', because the items often 'fill' in for parts of the utterance the child has not yet mastered. The other terms have implications that we would like to avoid, because a given form may become a syntactic device, a word, a sequence of morphemes, or an inflectional morpheme, or it may die out. The term 'filler' does risk, however, one misinterpretation: the utterances or utterance segments that we are discussing are not hesitation noises, and they have only a little in common with the place holding expressions of the target language (English 'oh', 'well', 'like'; French 'alors'; Japanese 'eeto').

Fillers are found across languages, including English, French, German, Italian, Norwegian and Spanish (Veneziano & Sinclair, 1997; Peters, Feldman, Lléo, Lopez-Ornat, Menn, Simonsen & Veneziano, 1999). For example, Veneziano & Sinclair documented the presence of fillers – i.e. additional elements which do not approximate well-defined grammatical morphemes –in pre-nominal and pre-verbal positions: [əʔ ʃa] *əchat* 'ə cat'. They noted the presence of these fillers even between a noun and verb,

as in [ezwazo əvol] *eoiseau əvolent* 'ebirds əfly,' for words that began with consonants, but not with vowels.

These fillers do not (yet) have the distribution of French functors, because some of these environments do not require functors before the lexical item, and some do not even allow them. The authors conclude that the additional elements were not precursors to syntax, but rather surface phenomena. They state:

> … the child organizes, in her own way, surface sonoric properties of the language, rather than deep-seated structural properties, abstracting and generalizing the most frequent vocalic sounds preceding nouns, whose constellation of properties (regularity and environmentally adjacent recurrences) seems to particularly attract her attention (Veneziano & Sinclair, 1997, p. 26).

Fillers do not seem to be obligatory in development; some children move analytically, step-by-step, from single words to multi-word, grammatical utterances. Children who do use fillers may follow a variety of developmental paths. Peters (1986) notes that many children make use of both fillers and analytic strategies, and she suggests that each strategy aids the other. Some children use fillers in formulas, i.e. in partially analysed strings with at least one open-class slot: 'all gone X', 'more X', or 'X off'. The fixed items in formulas increasingly take on the distribution of their target morphemes over time.

Fillers are often hard to recognize because the forms tend to be transient and because the method of notation depends on the criteria of the investigator (Johnson, 2000; Peters, 2001). Even researchers whose transcriptions form the basis of CHILDES cannot be relied upon to document the presence or absence of fillers. For example, the first author (AF) had linguistics graduate students transcribe ten-minute segments of data from her son 'Steven' as an exercise; all but one of them either skipped the fillers or supplied an adult form for [nInInI] or [lala]. People fail to recognize even content forms that do not match the adult model fairly closely. AF observed a two-year-old whose mother said she had no words. During dinner, her daughter pointed to a bottle and said [baba]. When AF mentioned that [baba] seemed to be a word, the mother exclaimed, 'Oh, she always calls that 'baba'. If you count things like that, she has hundreds of words!' Apparently, unless the 'word' sounded very much like the adult target, this parent (and presumably others like her) assumed that her child was not yet talking.

Possibly because of problems with recognition and transcription, many adult-centered approaches still tend to ignore fillers as unintelligible syllables, or to render them into the transcriber's best guess at a function word. In this paper, we describe the crucial role that fillers play in one child's early language development, namely as a device that allows him to reach

for increasingly complex syntactic/semantic constructions. Building on previous work, we trace the development of three fillers and show how they require elaboration of the current framework for describing the emergence of morphology.

Towards a framework for classifying fillers: elaborating the Peters/Dressler classification

Peters (2001) classifies the continuum from fillers to early words/morphemes into three stages: phonological, protomorphological, and fully morpho-syntactic; these correspond roughly to Dressler's proposed stages of pre-morphology, protomorphology, and morphology (Dressler & Karpf, 1995; Dressler & Dziubalska-Kolaczyk, 1997). Our fine-grained data, however, suggest that at least five categories of early approximations to adult morphology can be described (see also Menn & Feldman, 2001). The importance of this elaboration is not to 'split hairs' – the categories overlap, and specific instances can be impossible to classify – but to make clear that the development from filler to morpheme is not necessarily linear. Instead, a child's primitive approximations to morphemes change along four axes: phonological, syntactic, semantic, and pragmatic – and in a variety of ways. All axes develop gradually, but the development need not be simultaneous or even correlated. Even within phonology, there are various dimensions, e.g. rhythm, intonation, quality of segments. Therefore we argue that this is a multi-dimensional continuum; it cannot be simplified to a line along which all forms can be placed.

Author AF observed types of fillers in Steven's early speech (Feldman, 2000) that were not accounted for in the Peters/Dressler classification. To account for Steven's fillers, we expand the classification with two additional categories: EMPTY PIVOTS and PARTIALLY ANALYSED FORMS. Integrating these two categories with those of Peters/Dressler produces a continuum (see Table 1) in which we identify five regions. The continuum does not represent stages that all fillers must go through, but rather gives names to regions along the varied paths that forms can follow in becoming words.

Criteria for classifying fillers

(1) *Phonological fillers*. Near the origin of this multi-dimensional space, we find little phonetic substance, and a good deal of segmental variation among the fillers. Syntactically, we may find each phonological shape appearing in a number of syntactic or morphological positions, although there may also be some distributional or positional consistency. Peters' subject Seth (Peters & Menn, 1993) produced a great number of such forms, such as pre-verbal [**m**, **n**, **ə̃**] in '**N** throw **ə** cup' and so did Steven (Feldman, 2000).

TABLE 1. *A multi-dimensional continuum of fillers*

1. Phonological fillers: [**m, n, ə̃**] *N throw ə cup*, subject: Seth; Peters & Menn (1993).
   These fillers reflect phonological (although not morphosyntactic) attributes of the input. They seem to preserve the number of syllables and/or the prosodic rhythm of a target.
2. Empty pivots: ([**widə**], subject: Allison; Bloom (1973); [**gogae**, **hoda**], subject: Steven.
   These forms are phonologically consistent and occupy a specific syntactic slot, but are semantically empty, and have no clear target morphemes.
3. Protomorphological fillers: [**əwə**] *go get it*,
   [I/you -will/wanna-] '*go get it*,' subject: Seth; Peters & Menn (1993); [**upigo/igo**], 'up [X] go(es)' 'here [X] go(es),' subject: Steven.
   These forms function as 'internally undifferentiated' morpheme classes (i.e. they do correspond to specific classes of morphemes, such as personal pronouns, but not yet to specific individual morphemes).
4. Partially analysed forms: [**bədIdæ**] 'Bud did-that,' subject: Steven.
   These forms are intermediate between 3 and 5 in that they show evidence of partial internal analysis.
5. Morphosyntactic forms [**menimama**] 'messy mama,' subject: Steven.
   These forms meet three criteria:
   (a) Their phonology matches that of an adult target well enough to identify it without much difficulty.
   (b) Their distribution matches that of the identified adult target.
   (c) They seem to be used for much the same function as the adult target.

Semantically, early phonological fillers do not refer to a lexical item, and pragmatically they are also under-defined. They have no clear adult target, nor is an adult meaning apparently intended.

Later phonological fillers may become better defined along one or two of these axes; this is the case for at least two of Steven's fillers, which developed pragmatic and distributional consistency while remaining fairly distant from the phonology of any likely adult target. At that point, they seem to be members of the next category, 'empty pivots', which we propose to add to the Peters/Dressler classification.

(2) *Empty pivots*. These forms are called pivots following Braine's analysis (1963) of some children's two-word utterances as containing two classes of items which differed in their privileges of occurrence: a proto-open class called 'open', which might appear in isolation, and proto-functors called 'pivots', which only appeared in combination with other words. Bloom (1973) famously documented a type of filler produced by her daughter Allison, the form [widə], which she called an 'empty pivot'. If this form had meaning, Bloom was unable to determine it. Probably [widə] evolved from the adult target 'reading' or 'read it.' (At age 1;4.1, Allison was looking at her father reading a newspaper and commented, [dada widə].) However, as time went on, it became apparent [widə] had no semantic consistency: it was used in contexts where there was no immediately clear referent, nor was there any consistency in the context. Empty pivots differ from phonological fillers

in being phonologically stable. Both of them appear to have some syntactic (or at least positional) consistency. However, semantically both are underdefined.

Bloom (1973) suggests that empty pivots help the child move to the two-word stage; that is, they allow a child to say two words together without using word order to encode semantic relationships. They may also ease the child into being able to plan the complex motoric pattern required for two-word utterances (Menn & Matthei, 1992). The distributional stability of empty pivots is not yet syntactic, because relative position or word order is not used to code meaningful relationships. However, distributional stability in itself indicates that the child is registering and responding to something about word order.[1]

(3) *Protomorphological fillers*. According to Peters (2001), protomorphological forms may resemble adult functors distributionally and phonologically. This type of protomorpheme increasingly takes on the syntactic distribution of identifiable target morphemes (determiners, prepositions or auxiliaries). In other words, distributionally, they do not occur in isolation. However, the forms are under-differentiated; there may be several plausible targets for part or all of the filler, e.g. Steven's [upigo], which he uses in contexts that might variously be rendered 'up we go' 'up she goes', etc.; or [igo], 'here you go', 'here I go', etc.; Seth's '[əwə] go get it', variously '[I will] go get it,' '[I wanna] go get it.' The forms at this stage correspond to multiple targets, usually including at least one functor, and thus incorporate more than one adult morpheme. As Peters notes, such forms incorporate aspects of adult morphosyntax which are not yet productive in the learner's grammar.

(4) *Partially analysed forms*. Protomorphological fillers – ones which have overall resemblance to a set of sequences of target forms (up she/we/they/he go(es)) – may undergo two types of development. Internally, some (but not all) parts of the filler show evidence of being analysed, and distributionally, they may be used as the 'pivot' elements of formulas (e.g. [nIsIz] *not the one*, [nIsIsI] *the highchair* – see example 10). The filler at this point thus has a more clearly defined adult target, but it is still often an amalgam of adult words and very limited in its distribution. The internal and external developments need not be simultaneous: as we see in Table 1, the open class elements in a formula may be accompanied by premorphological fillers, protomorphological fillers, or partially analysed forms.

[1] This is probably equivalent to the developmental stage reached by the chimp Lana, who preserved a formulaic word order in her button-push requests 'Please machine give Lana X,' with no indication that this string meant anything other than what she would have meant by simply pushing the button 'X'; Premack, 1986.

We propose referring to formulas that consist of a proto-morphological or partially analysed filler plus an optional open class element as 'filler frames', symbolized as 'filler+(X)' or '(X)+filler', e.g. Steven's [bədIdæ] 'Bud+did-that'. We distinguish 'filler frames' from the more primitive 'phonological filler+X' and 'empty pivot+X' combinations, because in filler frames, the filler has some meaning that combines with the meaning of X, whereas in the first two stages, no detectable meaning is carried by the filler. In some cases, filler frames, like pivot+open combinations and limited scope formulas, progress to true word combinations, i.e. syntax.

(5) *Morphosyntactic forms*. These, finally, are fully analysed forms, although they may still have phonological assimilation across word boundaries (*cf.* Donahue, 1986; Matthei, 1989). In the Steven corpus, the word 'messy' was realized as [mədi], [mAti], and [məni], e.g. [mənimama] 'messy mama', depending on context, as examples 1–4 below illustrate. Also, 'bye-bye' could be realized as [mama] in nasal context, e.g. [mamano], 'bye-bye snow', 1;9.1.

To claim that forms like 'messy mama' [mənimama] (example 1) and 'bye bye messy' [mamameni] (example 2) are fully analysed, there must be evidence that the child uses each part of the phrase independently and in combination with appropriate open class items. In the case of 'messy', we find 'messy+X' (examples 1 and 4), 'X+messy' (example 2), and also 'messy' in isolation (example 1). Because the range of items that can be combined is smaller than the adult range, we consider these forms as participating in limited scope formulas (Ewing, 1984).

(1) 1;9.5 Situation: Mother spilled some cereal.
STV: messy.
pho: mədi
MOT: That's messy, right.
STV: messy mama.
pho: məni mama
Com: points to mother

(2) 1;9.4 In booster seat after eating breakfast, Steven pointed to some cereal on his face and said 'bye bye messy' [mamameni], indicating that he wanted to have his face cleaned off.

(3) 2;0.16 'make all better messy table and chairs' [mekəbadi medi tubatʃeIz]

(4) 2;1.23 Situation: taking apart puzzle
FAT: is this a messy boy?
STV: no.
FAT: [laughter].
STV: no messy boy.

pho: no / mAti boi
FAT: no messy boy.

Tracing the development of Steven's fillers

AF's son Steven was studied from ages 0;5–2;9; AF videotaped Steven for approximately three hours a week in their own home, interacting with herself (his mother) and his father. Steven's language was tested formally by his pediatrician on a Verbal Language Development Examination (Mecham, 1959) and showed rapid development with a language age of 3;88 when he was two years old, and with a language age of 5;74 at age three. On the Denver Articulation Screening Exam (Drumright, 1971), he scored in the 98th percentile at age three.

Steven had many fillers that justify identifying these five regions in the developmental continuum. We will focus initially on two forms, ['nInInI] and [lala], that moved through these stages, and which illustrate another important point: even within a given stage, fillers can behave very differently. These two fillers 'stand in' for a number of surface elements. The filler ['nInInI], originally derived from the adult form 'here it is' (presentative function), eventually progressed to a deictic demonstrative function. In contrast, [lala] began with an existential function and then became an early complementizer. We will contrast these with a third form, [igo], which seems closer to an amalgam (MacWhinney, 1978), but which has several adult targets rather than a single one.

['nInInI]: the filler as place-holder for several functors

The first recorded steps in the development of ['nInInI] simply copy the intonation contour of adult 'here X is' (high pitch and stress on the first syllable), where X would be a third person pronoun, 'he,' 'she,' or 'it' (see example 5). (At the time ['nInInI] appeared, Steven had no third person pronouns in his output.) This intonation contour follows the typical adult pattern of 'here it is,' used as a 'discovery deictic' – i.e. what one says after a search has been successfully concluded.

(5) 1;11.2
STV: where Andrea?
pho: weə dia
com: FAT carried STV into MOT's room
STV: **nInInI!**
pho: stress and high pitch on first syllable

There is no way in which we can infer that Steven ascribed meaning to the individual syllables of ['nInInI]. Rather, it had a global meaning of

'discovery', which is more pragmatic than semantic. This global meaning is less specific than that of a proto-word. Therefore, in example 5, ['nInInI] comes closest to being a phonological filler, although with more pragmatic definition than the phonological fillers mentioned in Table 1.

When ['nInInI] first appeared, it was in isolation; however, in the next two examples, occurring almost three months later, it was used as a pivot.

(6) 2;1.23 (pointing to a different imaginary spot on the table)
STV: **nInInI** Boulder Park.

(7) 2;1.23
STV: **nInInI** the bagel.

In examples 6 and 7 ['nInInI] differs from adult 'here it is,' by developing a following X-slot, and by disregarding number distinctions. In summary, it still has the fixed prosody characteristic of the phonological (pre-morphological) category; it has the phonological and distributional stability of the 'empty pivot' category, and its stable pragmatics suggest that it can be called a protomorphological filler. In the next section, however, we argue that it has not yet reached the stage of 'partially analysed form'.

Is ['nInInI] an amalgam/partially analysed form?

Several considerations make it unlikely that Steven has analysed ['nInInI] as containing the word 'here'. First, Steven uses the word 'here' [hiyə] in phrases like 'right here' [wajt hiyə] and 'back here' 21 times on a one-hour tape at age 2;1.23; 'here' was quite stable semantically and phonetically across these instances. (This is second in frequency only to 'bagel', used 35 times.) Steven also had the phrase [igo] for 'here you/we go', used four times; the phonetic reduction of 'here' suggests that this is also unanalysed. He also had 'there' forms, although they do not contrast deictically.

Second, there is no nasal, either in the adult model for 'here it is' or in Steven's own pronunciation of 'here', that could give rise to the nasals in ['nInInI].

If Steven has the word 'here', why does he use '['nInInI] the bagel' rather than 'here bagel'? We suggest that Steven has tuned into the prosody of a 'minimum sentence length' appropriate for the discourse function of this utterance. He knew that SOMETHING comes before the NP in existential expressions, but not exactly what. Menn & Feldman (2001) proposed that this filler served to pad out sentences to a discourse-appropriate length, just as dummy syllables bring words up to appropriate length before morphology and phonology are sufficiently developed to provide the needed segments.

The evidence further suggests that ['nInInI] as a whole cannot be equated with any definite adult target. Syllabically, ['nInInI] does correspond

to 'here X is,' where X might be any pronoun. However, when Steven starts to combine it with a following X, the adult form would be 'here is/are X,' where X corresponds to a full NP. If ['nInInI] were just a mispronunciation of a fully analysed 'here X is', Steven would eventually have adjusted ['nInInI] to fit the adult target by inserting the X (open class) element within the filler.

A final point supporting the claim that ['nInInI] was unanalysed is the fact that ['nInInI] switches (by age 2;2.20) to a use appropriate for a different target, 'this is it'. This new target is similar in meaning, but it is closer in pronunciation to ['nInInI] than is 'here X is.' (We term this a 'side-stepping' development, and will discuss its implications after we present the evidence for the switch.)

Steven generally applies his fillers to functor slots, which contain words that have low content for adults as well. These fillers often coincide with those parts of the adult target that do not contain much informational import, but are grammatically required and occur in well-defined locations. Pronouns, in general, are low in semantic content from the child's perspective. They refer deictically in adult speech, but we have seen that Steven had no control of 'here/there' at this stage. The pronouns he used during this period of time (ages 1;11.2–2;3.11) are 'I, we, you, me, they, it,' but not 'he/she', and there are numerous instances of incorrect deictic reference.

['*nInInI*] *develops new functions and phonetic variants*

Example 8 illustrates an attempt to use a prosodic and segmental variant of the filler to ask where X is, when the object X being referred to is not present. In this example, Steven moved away from the filler, pronounced [nInI'nIs] in the question, but [nInInI] later in the example (see Appendix) to a more adult-like 'where is X?' in the context of trying to locate a yellow marker. This example also shows the first use of the copula, in a stressed context, as one would expect from Slobin's operating principle *Pay Attention to Stress* (Slobin, 1985, p. 1166).

(8) 2;2.13
FAT: you wanna do green or wanna do another colour?
STV: xx xx yellow? [xx refers to an unknown target word]
pho: **nInI'nIs** lelow
STV: where IS yellow?
pho: wey 'iz lelow

The use of [nInI'nIs] to ask questions indicates that the presentational function is no longer the only function of this form: the filler frame is now used both in question and assertion contexts. Such an increase in pragmatic flexibility is typical of the development of proto-words (Halliday, 1975;

Menn & Haselkorn, 1977; Painter, 1984). The different form [nInI'nIs] might indicate a new form for the new function; however, ['nInInI] is also used a question on the same day (see example 9).

(9) 2;2.13 act: looking for a picture of a flower he'd drawn in his book
STV: **'nInInI** flower?
STV: **'nInInI** the flower.
act: finds picture of flower he'd drawn in book

In summary, Steven has continued to use the filler ['nInInI]/[nInI'nIs] for the old function, locative + X ('here is X'), as well as for the new function, locative question + X ('where is X?'), as in [nInI'nIs lellow], or ['nInInI] flower (when he's looking for a flower).

The beginning of segmentation of [*'nInInI*]

A week later (example 10) Steven again uses the copula in stressed context, but in the unstressed context of 'here is/there is', we see the word 'this', pronounced either [nIs] or [nIʔ], which resembles the filler phonetically. We also see a progression of forms [nIsIsI], [nIsIz] and [nIs]/[dIs] for adult 'this is it,' 'this is' and 'this,' yielding a much closer correspondence to the sounds and morphemic distribution of the adult language than ['nInInI]. The close tie with the old ['nInInI] form is shown by the maintenance of the non-adult-like ['nInInI] + det + N of '[nIsIsI] the high chair' (example 10).

(10) 2;2.20
STV: this is not up here.
pho: **nIsIz** nat əp hiyr
STV: this one go right here.
pho: **nIs** wən gow wait hiyə
STV: this is it the high chair.
pho: **nIsIsI** thI hai tSeir

(11) 2;3.11 Situation: playing with toy cars, discussing traffic lights
STV: this bæk [=black] one.
pho: **dIs** bæk wən
act: points to toy traffic signal, whose post is black

At this point, [dIs] seems largely equivalent to target 'this', although there is no deictic contrast with 'that'.

Summary of [*'nInInI*]

Table 2 summarizes the development from ['nInInI] to 'this (is)'.

As Table 2 shows, the filler ['nInInI] begins as a primarily phonological filler (modelled on 'here X is') and ends up as a protomorphological filler

TABLE 2. *Development of* ['*nInInI*] *to* '*this (is)*'

Age	MLU	Form	Example	Stage
1;11.2	1·52	'nInInI	5	Phonological
2;1.23	1·56	'nInInI X	6–9	Empty pivot/protomorphological
2;2.13	2·77	nInI'nIs	8	Protomorphological
2;2.20	2·50	nIsIz/ nIsIsI	10	Partially analysed
2;3.11	2·68	dIs	11	Morphosyntactic (Fully analysed)

standing in for a well-defined set of morphemes which eventually become analysed (*cf.* Simonsen, 2001).

Prosodically, in intonation and number of syllables, ['nInInI] copied the target 'here it is,' but not segmentally. Initially, it also had some consistent semantic/syntactic content; that is, it had a general presentational meaning, used when finding something after a search has been conducted. Segmentally, ['nInInI] had phonological stability, but a very primitive form, consisting of three identical open syllables (*cf.* Waterson, 1987).

Table 2 also shows that the development of ['nInInI] from a purely phonological filler requires introducing the stages 'empty pivot' and 'partially analysed' into Peters' classification of fillers (Peters, 2001). Its second step, which we have called 'Empty Pivot/Protomorphological', involved developing external syntax, with an open class slot, and distributional consistency. The function developed also, hence the term 'protomorphological'. In brief, the original (presentative) function remained; but as the form changed, so did the function, gradually evolving into partially analysed questions ([nInI'nIs lelo?]) and a fully analysed deictic demonstrative ('this is it').

[*lala*] *: the branching filler*

During the same time period (1;11.2–2;3.11), but starting somewhat earlier, Steven uses another filler frame, '[lala]+X.' While ['nInInI] comes from a small group of adult targets, we find no clear adult targets or set of targets corresponding to [lala]. It may have been a conflation of 'look at' and 'there is,' which have stress patterns and semantics similar to early uses of 'lala'.[2] Other targets also seem plausible in specific instances (see end of example 12).

Relatively late forms, from 2;3.11, clearly show that Steven was substituting [l] for /ð/ in several functors (e.g. 'then', 'they', 'there', 'that'), so it

[2] Conflations of semantically coinciding terms have been documented: examples are 'button/snap' [næt] (Menn, 1971); 'hymn/angel' variously pronounced [ahaw/æhə/aɦ̃ũ], Waterson (1987).

TABLE 3. *Development of* [*lala*] *to* [*yala*]

Age	MLU	(['nInInI])	lala	Function of [lala]	Example	Stage
1;10.19	1·52		lala X	noun/formula	12	Phonological
1;11.2	1·52	'nInInI	lala X	noun	13	Empty pivot
2;1.23	1·56	'nInInI				
2;2.13	2·77	nInI'nIs	lala	comparative	14	Protomorphological
2;2.20	2·50	nIsIz	yala	sentence-initiator	18	Protomorphological
2;3.11	2·68	dIs	la/le		—	Morphosyntactic
2;3.26	3·01		yala/lala	requests	19–21	Protomorphological

is possible that /ð/ helped to determine its phonological shape from the beginning.

In its distribution at the beginning of an utterance, [lala] resembles ['nInInI], but at first it is limited in function to identification of states or objects new to the discourse ('here is/there is' functions; see examples 12 and 13); for further tokens of this and other functions, see Feldman, 2000).

(12) 1;10.19 Situation: playing with stopper plug from sink
STV: **lala** bulldozer car.
STV: here bulldozer car.
Situation: wants door of fire engine opened
STV: **lala** open door.
pho: lala opadoi

(13) 1;11.0
STV: **lala** mama.
act: points to Spot's mother, Sally, in book

Here [lala] precedes only NP's or word-specific formulas with fixed word order, such as [lala] + 'mama', and generally has an existential function. The utterance [lala opadoi] '[lala] open door' (where 'opadoi' is a formula), in example 12, is unclear in meaning. Steven could be calling attention to the fact that the door opens, or [lala] could be a filler for 'wanna' as in 'wanna open door.' This contrasts with presentational ['nInInI], because [lala] presents hearer-new information while ['nInInI] presents discourse-new information (Birner & Ward, 1998).

Table 3 shows the time frame for the two fillers ['nInInI] and [lala]. As the table and the cited examples show, [lala] assumes an impressive variety of new functions, compared to the relatively stable ['nInInI].

Example 14, two and a half months after example 13, illustrates Steven's first attempt at a full comparative; he uses his old filler [lala] for the sequence of functors 'than the.'

(14) 2;2.13
MOT: I bet the new green's better.
STV: new gi better **lala** old gi.

While example 14 shows a new direction, or branch, for [lala], example 15 shows [lala] filling in for multiple functions, each of which will be discussed below.

(15) 2;2.13
STV: this book over here, **lala** draw this book too Rolf.
STV: **lala** get a new one.
STV: yeah, **lala** any noodles on the new one.
STV: **lala** have it any noodles on the new one.

The instances of [lala] in example 15 show that, distributionally, [lala] may now precede a verb phrase, possibly filling the subject slot, especially when the adult language slot has a functor ('it,' 'there is/are'). Semantically, the first two instances (see Appendix) could be desiderative (i.e. 'wanna'), or [lala] could be functioning as a filler for subject position. In the last two instances of example 15, the mother interprets Steven's '[lala] any noodles on the new one' and '**[lala]** have it any noodles on the new one' as meaning '**there aren't** any noodles on the new one' (for context, see Appendix).

At 2;2.20, in examples 16 and 17, [lala] precedes a full sentence for the first time; it seems to be used to call attention to an exophoric, new (previously unmentioned) referent, much like the adult 'look at X/here is X' functions, where X is a complete sentence.

(16) 2;2.20
STV: **lala** Pooh bear sleeping.

(17) 2;2.20
STV: yeah, **lala** mine water bottle here.
act: notices water bottle and goes to pick it up

Example 18 'this **[lala]** open the car seat' could mean 'this **is how to** open the car seat' or 'this **is the way to** open the car seat,' two expressions that Steven has not yet produced. It could also possibly be some kind of future marker.

(18) 2;2.20
STV: no, this **lala** open the car seat.
pho: now lI lala opIn thə kaa sIt
act: picks up the car keys that FAT had thrown down

Example 19 shows a similar device for beginning to express a subordinate clause with the hybrid [yala]. Notice that 19 contains two propositions,

presumably ordered as Steven has expressed them; in adult English, '**after** we clean up, we can go outside.'[3]

(19) 2;2.20
STV: **yala** clean up go outside.
pho: yala kin əp gow awsaid

Example 20 seems to indicate that Steven is aware that something usually goes in the first slot in the sentence in English, even when it is somewhat optional in adult English.

(20) 2;2.20
STV: **yala** okay!

A month later, finally, Steven reanalyses his [lala] filler. In examples 21–23 we see two illustrations of synchronous self-correction of [lala] to a more adult-like form. Example 21 also shows a first use of existential 'there' and deictic 'here', and use of the monosyllabic [nIs] for 'this' (see Appendix). In example 21, [yala] is replaced by 'there'.

(21) 2;3.26
STV: **yala** go kaboomps a big house.
STV: **there** Lass **here**.

In example 22, [lala] is replaced by an approximation to 'can you'. Note that one cannot claim that the target of [lala] itself is 'can you' – it might have been any one of a number of polite desideratives. We wish to emphasize also that [lala] may have had no single fully-specified target, but was a filler for the entire category of polite desideratives.

(22) 2;3.26
STV: **lala** school bus stop house Tadi?
com: wants FAT to make a house out of the tapes that make up the school bus stop (he is familiar with a bus shelter made of wood)
STV: can you make a house Tadi?
pho: kəSu
STV: can you make house?

In example 23, [yala] is replaced by 'you'.

(23) 2;3.26
STV: **yala** open it, you open the stop sign.
com: FAT opens the folded stop sign on the side of the bus

[3] There is some additional evidence of this bootstrapping device. At age 5;7.4, Steven used 'that' instead of 'because' in incipient causative constructions; 'that we had to put sunscreen, I was scared.' His early pronunciation of 'that' had been [læ]. The use of filler [lala], and later 'that,' may be similar, a bootstrapping device for increasingly complex grammatical material.

As Steven's knowledge increases and the communicative pressure pushes him to ever more precise forms, [lala] is eventually discarded for those target forms which he has learned; the filler has served its purpose.

A proto-morphological filler: [*igo*]

We now turn to a simpler story, for comparison. The third and final filler that we discuss, [igo], was very much like an amalgam; the only reason to shy away from that term is that it had several adult targets rather than a single one. The form [igo] was used between the ages of 1;7.27 and 2;2.20, overlapping with the development of ['nInInI] and [lala]. It began as Steven's filler for 'here we go'/'here you go'. At 1;7.27 (the filler's first appearance), it was used as Steven pushed a toy vehicle. There were two tokens: [idigaw] 'here we go,' said as he pushed a toy truck, and [idigo.idi] 'here we go, Ernie,' said as he pushed a toy car with a doll Ernie in it. Both occurred as he played alone, talking to himself. Shortly thereafter (1;8.16), see example 24, it was pronounced [hidigo], and embedded into the 'bye bye X' formula:

(24) 1;8.16 Situation: playing with toy truck
STV: **here we go.**
pho: hidigo
act: picks up toy truck and pushes it along table
STV: **bye bye here we go.**
act: truck moves by itself along table away from STV
pho: baba hidigo

Over approximately seven months the filler expanded slightly to include target 'there' ('there we/you go') and became analysed. Functionally, [igo] also served as an activity start deictic – that is, one which focuses on the presence of the hearer at the beginning of the activity (Lakoff, 1987). We see such a use of [igo] when Steven handed an object to his caregiver in order to play a game (see example 25).

(25) 2;2.23
MOT: oh thank you sweetheart for the banana.
STV: yeah **lala** banana here we go.
pho: iyAh lala banana # **igo**ʔ **igoUwəigo**
com: 'here we go' is repeated three times
com: # refers to a pause
act: hands banana to MOT

Here, [igo] marked both the delivery of the banana and the start of the shopping game activity.

Of the three fillers, [igo]'s behaviour is most similar to that of a proto-word or an amalgam: it has a fairly clear multi-morphemic adult target, although it

is based on a small family of sequences of words rather than on a single target item. Phonetically, it's a rather good approximation to the adult target family; this may be due to the fact that it is based on the stressed initial and final syllables of the phrase, 'here we go'. Over time, it expanded in meaning, filling in for several very closely related adult targets. Therefore, it represents a filler with a modest branching pattern that becomes slightly more inclusive in meaning.

Approximately six months after it first appeared at 1;7.27, [igo] begins to break down and differentiate. At 2;2.20, examples 26–30, [igo] has been replaced by 'here we go,' 'here you go,' 'there we go,' and 'here we move,' respectively.

(26) 2;2.20
STV: here go.
pho: **higo**
STV: this box, this **here we go**.
act: STV hands box to FAT

(27) 2;2.20
STV: **here ya go** xx school!
pho: hiyə gow **ə** gul

(28) 2;2.20
STV: a stop sign **there go** xx people Rolf.
pho: ee stap sain deyr gow ə pepow rowf

(29) 2;2.20
STV: **there we go!**
pho: leir wi gow
STV: go back home.

(30) 2;2.20
STV: **here we move** xx books!

Only one example of the unanalysed filler [higo] remains (26); as we have seen, all the others from 2;2.20 are fully analysed morphosyntactic forms. Peters (1997) states that such an overlapping of unanalysed and analysed forms is common.

At the same time, Steven is also showing more contrast in his use of deictic 'here' and 'there'.

(31) 2;2.20
STV: go back **here**.
act: goes backwards in book
STV: **there** alligator?

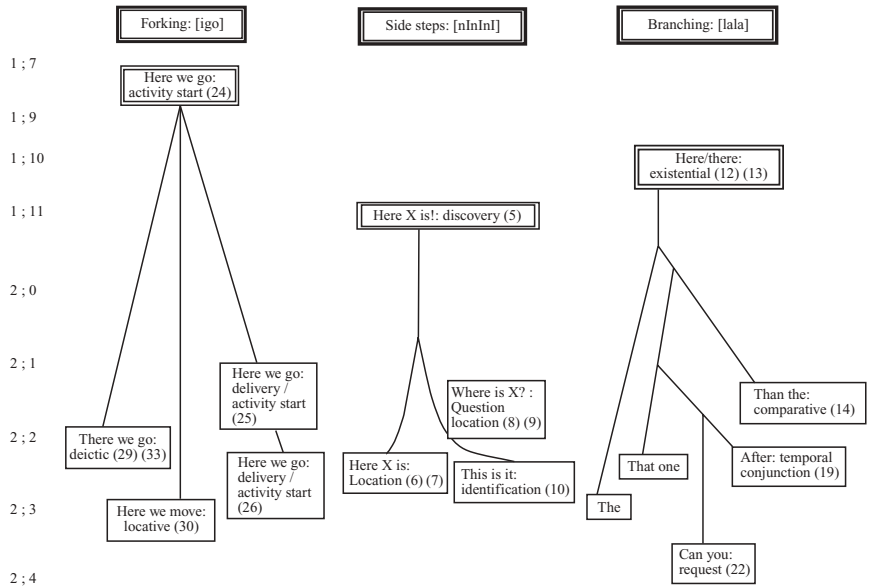

Fig. 1. Development of filler functions.

(32) 2;2.20
STV: **here** scrunchie.
pho: hiyə grənchi
act: picks up one of MOT's scrunchies from floor

(33) 2;2.20
STV: **there we go, here**.

Similar contrast occurs in the deictic pronouns 'we' (26, 29, 30, 33) and 'you' (27), which may have contributed to the filler's breakdown.

SUMMARY

Let us review the differences between the three pre-morphological fillers [igo], ['nInInI], and [lala] and their journeys to morphemic structure, represented graphically in Figure 1. (See also L. W. Fillmore's discussion of Nora (1979) for a similar developmental pattern.)

The simplest story is the case of [igo], which lasted for about six months (1;1.27–2; 2.20) before becoming analysed. Its phonology was a fairly close match to that of the adult targets from the beginning; its pragmatic function (activity-start deictic) was consistent and matched the adult uses of its

phonological targets. However, the semantic/syntactic target was vague, in the following ways: the adult forms that [igo] replaced included both deictic poles 'here/there', and all the personal pronouns ('we, you, she, he, it …'). The development into those distinct adult forms is represented on the figure as a forking pattern. Furthermore, [igo] did not mark the 3rd singular agreement (go/goes) required by some of its pronoun targets (e.g. 'here he goes'). Other than this vagueness, [igo] developed in a straightforward manner, much like many amalgams reported in the literature.

Steven's ['nInInI], which lasted almost four months (1;11.2–2;2.20), began as a filler for the deictic presentational 'here it/she/he is'. Then it took a semantic 'side step'; [nInInI]/[nIsIsI] was used for locative questions of the form 'where is X?' It then took another 'side step', leaving those functions behind as it evolved into or merged with the competing demonstrative determiner form [nIsIz] 'this is'. As the pieces of the filler were pulled apart, they became partially analysed, thus representing an intermediate step between protomorphological and fully analysed forms.

The 'side-stepping' pattern is unexpected; we know of no analog in the literature. Notice that, by the time it took place, Steven must have been using phonological surface features (stress and intonation) to convey a general meaning, rather than aiming at a specific segmentally well-defined adult target. In other words, whether or not ['nInInI] initially had had a more specific target (e.g. 'here it is'), its connection with the segmental phonemes in that phrase must have been lost, in order for its distribution to have shifted towards the distribution of 'this is it'.

Finally, let us compare the development of [lala]. For about five months (1;10.19–2;3.26), [lala], in various uses, replaced increasingly complex sentence-initial material. Phonologically, [lala] may have begun as a conflation, or a phonetic neutralization of several adult functor targets. These probably included /ð/-initial words, since his later well-defined use of [ler] for 'there' indicated a pattern of replacing /ð/ by /l/. Although we cannot identify all the functions of [lala], it clearly branched into multiple functions. At age 2;2.13 and 2:2.20, [lala] was still filling in for existentials (examples 12, 13, 16); at 2;2.13 [lala] also filled in for the comparative (example 14), and for a subordination marker (example 19: [yala] clean up, go outside!). A few instances remain enigmatic, e.g. example 18, 'This [lala] open the car seat' (picks up car keys) and example 20 '[yala] okay!' The variety of self-corrections for [lala] is astounding (see examples 21–23). This leads us to argue that it is in fact a mistake to try to identify particular semantic/pragmatic targets for [lala] (existential, desiderative-imperative, desiderative-request, information questions, comparative, subordination, etc.).

Instead we account for [lala] this way: assume that the child's task initially involves associating form with function. Many of the adult forms that [lala] apparently filled in for ('there's a', 'want a', 'do you have a', 'that's a', 'there

aren't any'…) would have been used to accomplish the perlocutionary function of getting someone to act on something for the child's benefit. It seems unlikely that Steven had distinguished among these forms yet; to this extent, [lala] in these utterances represented a general imperative/request-softening form, a pragmatic social step away from the direct imperative which he had used earlier.

But there were also uses, such as the comparative and the subordinating conjunction, which defy even this pragmatic-level categorization. We conclude, therefore, that [lala] was Steven's all-purpose filler, his word for all mysterious adult forms on the threshold of his competence. It saved him from having to master phonological, syntactic, and semantic specifications as he was making his first attempts at communicating many complex relations; it allowed him to move from the two-word to the three-word stage, and from simple propositions to complex embedding, using an 'old form for new functions' in the manner first clearly stated 35 years ago by Slobin (1966).

DISCUSSION: MODELS OF DEVELOPMENT AND IMPLICATIONS OF TRANSITIONAL FORMS

Regardless of whether a child constructs all of his/her grammar or whether some of it is innately specified, there is a lot to learn about each individual language, including identifying its grammatical morphemes. Grammatical morphemes are famously difficult to segment; for a discussion of the factors involved, consult Peters (e.g. 1985, 1997, 2001). The process of starting to use grammatical morphemes is demonstrably gradual for all children that we know of who have been studied longitudinally. If their output has been transcribed phonetically, the gradualness and variability are even more evident.

Again regardless of whether a speaker has an abstract grammar underlying the production of language, or whether there is no grammar apart from dispositions to use certain words and constructions in particular semantic/pragmatic situations, language production is the outcome of language processing, involving a sequence of psycholinguistic events such as lexical retrieval. Events in this domain are affected by phonological and semantic priming, so any model that accounts for them must use the basic notion of 'associative link', and must allow the frequency of associations to strengthen such links.

In short, no matter how far the reader might be from agreeing with an emergentist theory of language development, it is not possible to account for what children or adults actually say and their problems in saying it without using a production model that talks about connections forming, strengthening, and weakening over the course of acquisition.

The models that seem most plausible for language acquisition are the ones that are often called 'self-organizing systems', since the basic goal of these

models is to describe how fairly regular behaviour can emerge from complex, unpredictable underlying behaviour. The simplest kind of case might be one you learned in high school physics: the laws relating gas pressure, temperature, and volume arise from the unpredictable but statistically describable behaviour of millions of energetic gas molecules striking the walls of their container.

Thelen & Smith's dynamic systems theory (1994) is a prominent example of the application of such a model to the development of cognition and motor development; they provide a theory of how regular, rule-describable behaviour can emerge from the interactions between a structured but naïve organism and a world which also has structure. Their model does quite a good job of providing a framework for the variable behaviour data we have described, especially for two problematic phenomena: the fact that a single form can be the precursor of several forms with different functions, and for the fact that an early form can appear side-by-side with a paraphrase using a later form that has the same function.

Why do children have fillers? Especially since not all of them do, this question needs careful consideration. It can be addressed from several perspectives, all of which are valid.

Perspective A: Fillers are natural emergents as the intermediate forms expected from continuous development

There are so many kinds of fillers because there are at least four quasi-independent dimensions along which language development must occur.

Development is continuous. It is also multi-dimensional, as we have argued in Menn & Feldman (2001). The multiple dimensions – phonological, semantic, syntactic, pragmatic – all develop over time, but a given form may be more advanced along some axes than along others, so description of the development of a filler may require separate consideration of these several axes. The different types of fillers can be thought of as lying in various regions of this multidimensional space.

For example, Allison's [widə] was phonologically rich, but meaningless. In contrast, Seth's unanalysed *didja* had content: he used it as a past tense declarative first person marker. Steven's ['nInInI] was phonologically simple; morphologically/semantically, it also was primitive (indeed, virtually meaningless). Its distribution was rigidly utterance-initial, so it was positionally well-defined, but it had little syntax, because there seemed to be no constraints on what followed it. Pragmatically, it was well specified, although it did not match any adult model. These different types of fillers, then, represent transitional forms emerging in different regions of the multidimensional space.

Perspective B: Fillers are 'placeholders' or 'holding tanks' (*Peters, 2001*)

Peters has raised the question of whether or not a filler can serve as a 'holding tank' – more formally, as a massively underspecified lexical entry – for the accumulation of phonological and functional information, as appears to be the case for her subject Seth. Although Steven's fillers are quite different from Seth's preverbal and postverbal fillers, which replaced only functors that were bound to open-class items, they also can be viewed in this way. For example, we can interpret the filler ['nInInI]/[nInI'nIs] as an utterance-initial point of accumulation of information; it gradually was replaced by [nIsIsI] 'this is it' with the same position, intonation contour, and discovery-deictic usage; and finally, it developed into demonstrative 'this is', 'these are.'[4]

Similarly, the filler [lala] initially filled where an adult would use existentials. It competed with the presentative filler ['nInInI]; both occurred in sentence-initial position, with increasingly complex accompanying material. As the copula and deictic locatives and demonstratives began to appear in Steven's speech, they replaced [lala] in those positions. But [lala] kept on showing up in new places: it moved on to fill in for comparative 'than' and incipient relative clause functors.

In the movement to multi-word, grammatical utterances, a filler like [lala] may well help, by being an initially empty lexical entry that can serve as a place-holder for the accumulation of phonological and functional information, which in turn serves as a basis for further analysis of its internal structure.

However, we suggest that, from the child's point of view, a filler is not distinguished from other words – in some sense, all words are points for the accumulation of more information. Consider the gradual progression of learning a new content word, starting with an initial fast mapping and eventually attaining an adult-like syntax and semantics via the accumulation of information extracted from many context-rich examples. More gets learned about each content word and each filler in quite the same way – more about sound, syntax, semantics, and pragmatics. The only difference is that the visible (or rather, audible) starting point of this learning is more primitive for fillers that it is for items which adults can recognize as attempts at words.

[4] Edy Veneziano (personal correspondence) reports that her French subject, Gael , at 27;4 produces utterances that approximate *qu'est-ce que c'est*, [kɛskI sé] *qu'est-ce que c'est que ça*, [kɛskI sé kI sa] 'what is this?', or *est-ce que c'est* [ɛskI sé], 'is this…?', typically while showing an object to someone: [*t*sè], [étésé], étésèsa], [oh! # sa # ete:sè], [ete'sèsa], [etesè? sa], [etétè] and [asédedan] '[asé] inside' while showing someone a box. These are clearly protomorphological fillers.

Perspective C : Fillers as prosodic sentence padding

Children have been shown to be sensitive to the ambient language's prosodic 'minimum word length' constraint (Demuth, 1996) for content words. Similarly, Menn & Feldman (2001) have proposed that children tune in to the prosody of a 'minimum sentence length' that would be appropriate for the discourse function of a particular type of utterance. Both Steven and Peters' Seth had utterance-initial two- or three-syllable fillers in imperatives. We suggested above that these utterances in Seth were based on his father's attested models of polite locution ('Wouldja pick that up for me?' 'May I please have the diaper?'). Similarly, Steven's father provides functor-heavy model utterance-initial phrases like 'Do you need the' before the content-rich 'keys for the school bus' (18). Steven's [lala] appears to fill in for such functor-heavy utterance initial phrases, which he has probably not yet interpreted semantically.

We suggest that such fillers are found when the child is limited to utterances of very few words (MLU less than 3·0), but where the model utterances are considerably longer, often because they contain politeness formulas or other strings of low-content words. The children know that SOMETHING comes before the imperative strings, but not exactly what. We suggest that their fillers pad out sentences to a discourse-appropriate length before their syntax is up to putting in words for the job, just as dummy syllables bring words up to appropriate length before morphology and phonology are sufficiently developed to provide the needed segments (Vihman, 1996).

We hope that these examples convince fellow researchers to pay attention to child-created fillers, rather than assuming that they can safely be ignored as babble or expressive jargon. 'Unintelligible' forms like [lala] and ['nInInI] are seldom reported – but discussions with colleagues suggest that they are not really rare. The problem is that if one is not looking for them, they are invisible. But they are worth looking for, because the consequences of ignoring transitional forms are theoretically even more profound than we have argued above: they reach to the heart of theoretical differences in the field today. If we ignore fillers, it can indeed look as if the child had learned to speak very quickly, setting discrete parameters automatically. Conversely, if we include underdetermined transitional elements in our data and analyses, we find strong grounds for the view that learning language is a continuous process, observable over time. These 'noises' are not noise in the data; they ARE data (*cf.* Thelen & Smith, p. xviii: 'these variable, fluid, task-sensitive local effects are not just noise in a grand developmental plan, but ARE THE PROCESSES THAT ENGENDER DEVELOPMENTAL CHANGE' [emphasis original]. Fillers, like proto-words, need to be transcribed phonetically and analysed using whatever contextual information is available, difficult though that may be.

The fact that the targets of many fillers are indeterminate should be expected. It is not a weakness of the data or the analysis; rather, it is a fact about transition – one which gets ignored in analyses that insist on a complete categorical breakdown. The essence of development is that it can't be put into discrete boxes, especially not boxes that are defined with reference to the eventual developmental end-points. The child's brain does not have information about what those endpoints are, and in fact the child will arrive at a grammar and lexicon subtly (or not so subtly!) different from the grammars that describe the utterances she hears from thousands of people over the course of a lifetime.

The continuous and multidimensional descriptive data we have presented seem to fit best with an emergentist, item-based approach. Information about language is, initially, rather imprecise information about what noises other speakers tend to utter in a particular rough category of contexts. The last forty years of research on infant perception and language comprehension have shown that long before (hearing) children utter intelligible sounds, they are accumulating information about human speech; well before producing grammatical utterances, they have learned to associate some types of action semantics with frequent word orders. Connectionist modelling still has a long way to go before it can model rich natural data in a neurally and developmentally plausible way; but as we said above, no one can do psycholinguistics without using the basic metaphors of connectionism and self-organizing (dynamic) systems theory.

Connections are made in the brain between memories for events and memories for sounds, between instances of 'the same' sound, between instances of sequences of 'the same' sound. Connections are strengthened, typically by repetition; long before phonetic information is represented securely enough for saying a target word, it is represented well enough to permit recognition in context; at a later point, it may be represented well enough to permit saying a crude approximation of the word, perhaps one whose shape is dictated as strongly by links within the phonological system (word templates; Vihman, 1996) as by the adult model. The road from dim awareness of a grammatical morpheme through reliable production to (in some instances) overgeneralization is a very long one, which is why identifying the 'point at which a form has been acquired' is so frustrating for the researcher.

Each form Steven uses is the result of a compromise among constraints – not 'innate constraints' in the sense of standard Optimality Theory (OT) (Prince & Smolensky, 1993), but constraints which are created by processing costs, experience limitations, the cost of not sounding like the model (we could call this 'emulation failure cost'; *cf.* OT faithfulness constraints), and communication costs. Processing costs are determined by such factors as the cost of controlling articulation on-line (*cf.* OT naturalness constraints), and

the relative weakness of stored phonetic representations. The representations are weak for many reasons, including relatively limited exposure to exemplars and the absence of experience in producing the words in a way that will reproduce the target sound accurately.

Each time Steven says a word in a linguistic and real-world context, the cost of saying it that way in that context decreases, helping to create a cost local minimum, i.e. a stable behavior pattern. But incremental increases in his motor skill and in the extraction of phonological patterns from phonetic storage decrease the costs of accurate articulation, and exposure to each input word in more contexts leads to increased differentiation of word semantics and pragmatics. The increases in his knowledge of phonological patterns and word meaning contribute to increased 'emulation failure costs', since the difference between what he is saying and what the adult says becomes more apparent to him. All these changes in relative costs eventually shift the locus of the cheapest solution. For the fillers that we have been following, the shift is typically to several new minima, not just one, producing the differentiation of meanings/uses that we have seen as well as changes in pronunciation. Side-by-side instances of old and new forms are consequences of the persistence of the old local cost minimum, worn deep by repeated use (habit), even as a new minimum has developed near it.

Self-organizing systems theory as presented by Thelen & Smith is an intellectually satisfying model, but is it the right one? Can we test it? Not quantitatively, in the foreseeable future; but qualitatively, yes. We should look to see if it gives satisfying retrospective analysis of earlier longitudinal studies that contain adequate transition data; hopefully this article will encourage the collection of new data at an even more detailed level, so that some of the specific interpretations of the model that we have made can be further evaluated.

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APPENDIX

EXAMPLES FROM STEVEN (FELDMAN, 2000)

(1) 1;9.5 Situation: Mother spilled some cereal.
STV: messy.
pho: mədi
MOT: That's messy, right.
STV: messy mama.
pho: məni mama
Com: points to mother

(2) 1;9.4 In booster seat after eating breakfast, Steven pointed to some cereal on his face and said 'bye bye messy' [mamameni], indicating that he wanted to have his face cleaned off.

(3) 2;0.16 'make all better messy table and chairs' [mekəbadi medi tubatʃeIz]

(4) 2;1.23 Situation: taking apart puzzle
FAT: is this a messy boy?

STV: no.
FAT: o [= ! laughter].
STV: no messy boy.
pho: no / mAti boi
FAT: no messy boy.

(5) 1;11.2
STV: where Andrea?
pho: weə dia
com: FAT carried STV into MOT's room
STV: **'nInInI!**
pho: stress and high pitch on first syllable

(6) 2;1.23
MOT: is this Boulder Park there? (pointing to an imaginary spot on the table)
STV: no, yep.
STV: **'nInInI** Boulder Park. (pointing to a different imaginary spot on the table)

(7) 2;1.23
FAT: here're the bagels.
FAT: Tadi has got the bagels in the car.
com: Tadi is STV's name for himself
FAT: yeah.
STV: **'nInInI** the bagel.
pho: 'nInInI də begəl
com: showing the bag of bagels
MOT: here it is the bagels.

(8) 2;2.13
FAT: you wanna do green or wanna do another colour?
STV: xx xx yellow? [xx refers to an unknown target word]
pho: **nInI'nIs** lelow
STV: where IS yellow?
pho: wey 'iz lelow
STV: where IS yellow?
pho: wey 'iz lelow
FAT: where IS yellow?
STV: there.
pho: ler
com: points to yellow marker

FAT: here it is!
STV: **'nInInI** yellow.
pho: 'nInInI lelow
act: holds yellow marker and draws in book with it

(9) 2;2.13
STV: **'nInInI** flower?
pho: 'nInInI fawə
com: equal stress, even pitch
act: looking for a picture of a flower he'd drawn in his book
STV: any flowers in this book.
pho: eni fawəz In nIs bUk
com: 'any' is a negative
FAT: a flower's in that book [yawns]?
STV: **'nInInI** the flower.
pho: 'nInInI də fawə
act: finds picture of flower he'd drawn in book
FAT: oh, ok.
MOT: there IS a flower, um hum.
MOT: you made a little flower in there.

(10) 2;2.20
FAT: is this the other budleyley?
com: budleyley was used for 'doll' or 'baby', from Yiddish 'bubbeleh'
STV: this is not here.
pho: **nIsIz** nat hiyr
MOT: xxx [whispers].
STV: this is not up here.
pho: **nIsIz** nat əp hiyr
act: sees, picks up toy doll to put in school bus
FAT: oh, ok.
STV: this one go right here.
pho: **nIs** wən gow wait hiyə
STV: this one go.
pho: **nIs** wən gow
***
STV: me in the highchair?
FAT: oh, ok.
STV: this is it the high chair.
pho: **nIsIsI** thI hai tSeir
STV: this is.
pho: **nIs Iz**

FAT: oh, over here?
STV: yes, Rolf.
FAT: ok.

(11) 2;3.11 situation: playing with toy cars, discussing traffic lights
STV: the bæk [=black] light is go too.
Pho: dɘ bæk laIt gIgow tu
MOT: what black one?
STV: this bæk [=black] one.

(12) 1;10.19 sit: playing with stopper plug from sink
STV: **lala** bulldozer car.
STV: here bulldozer car.
FAT: the bulldozer car?
FAT: what about the bulldozer car?
act: MOT enters
MOT: that's from the bathtub.
FAT: what's **lala**?
add: MOT
MOT: Laura.
FAT: not Laura.
FAT: he was saying something like **lala** bulldozer car.
MOT: oh, I … unless I heard it I … when I look at the tape I'll check.
***
sit: wants door of fire engine opened
STV: **lala** open door.
pho: lala opadoi
FAT: wanna open that mangimangi door?
com: mangimangi is STV's word for fire engine

(13) 1;11.0
FAT: there's Spot!
STV: **lala** mama.
act: points to Spot's mother, Sally, in book
FAT: and that's mama, that's Sally, mama.

(14) 2;2.13
MOT: old green.
STV: old gi (child's word for 'green').
MOT: I bet the new green's better.
STV: new gi better **lala** old gi.
com: opens old green marker

(15) 2;2.13
FAT: wanna do giya (child's word for 'crayon') at the table?
STV: this book over here, **lala** draw this book too Rolf.
pho: nIs bUk ovə hiyə, lala daw nIs bUk tu ralf
***
MOT: it IS empty, excuse me.
STV: yeah.
STV: **lala** get a new one.
MOT: get a new one!
STV: **'nInInI** a new one.
MOT: here it is a new one.
STV: new one any noodles.
MOT: it doesn't have any noodles.
com: noodles refers to STV's name for squiggly lines on markers
STV: new one any noodles.
com: 'any' = 'there aren't any' – *cf.* example 9 from the same day
MOT: any noodles on the new one huh?
STV: yeah, **lala** any noodles on the new one.
STV: any noodles the new one.
MOT: there aren't any noodles on the new one.
STV: **lala** have it any noodles on the new one.
MOT: no noodles.
STV: no noodles the new one.

(16) 2;2.20
STV: **lala** Pooh bear sleeping.
pho: lala puw baer sipIn
FAT: yeah, Pooh bear's sleeping in one of those, isn't he.

(17) 2;2.20
STV: yeah, **lala** mine water bottle here.
act: notices water bottle and goes to pick it up
FAT: uh huh.
FAT: oh, that's your water bottle.

(18) 2;2.20
FAT: do you need the keys for the school bus?
FAT: or not?
STV: no.
FAT: no?
FAT: ok.
FAT: this thing goes down there too.
FAT: ok.

STV: no, this **lala** open the car seat.
pho: now lI lala opIn thə kaa sIt
act: picks up the car keys that FAT had thrown down
FAT: oh, we gotta open the back seat with this, the school bus?

(19) 2;2.20
STV: go back home now?
FAT: ok, back home is the other way, back from school?
FAT: school's all finished and we're going back home?
STV: yeah.
FAT: ok.
STV: **yala** clean up go outside.
pho: yala kin əp gow awsaid
FAT: you're going to slide?
STV: yeah.
FAT: ok.

(20) 2;2.20
FAT: they're going to school now!
STV: **yala** ok!
pho: yala owkey
FAT: ok, they're off to school!

(21) 2;3.26
STV: **yala** go kaboomps a big house.
STV: **there** Lass **here**.
STV: **this** a school bus stop.
pho: nIs

(22) 2;3.26
STV: **lala** school bus stop house Tadi?
com: wants FAT to make a house out of the tapes that make up the school bus stop – (he is familiar with a bus shelter made of wood)
STV: can you make a house Tadi?
pho: kəSu
STV: can you make house?

(23) 2;3.26
STV: this the big adiadi (child's word for slide).
STV: stop.
STV: **yala** open it, you open the stop sign.
com: FAT opens the folded stop sign on the side of the bus

(24) 1;8.16 Situation: playing with toy truck
STV: **here we go.**
pho: hidigo
act: picks up toy truck and pushes it along table
MOT: here we go!
STV: **bye bye here we go.**
act: truck moves by itself along table away from STV
pho: baba hidigo

(25) 2;1.23
MOT: oh thank you sweetheart for the banana.
STV: yeah **lala** banana here we go.
pho: iyAh lala banana # **igoʔ igoUwəigo**
com: 'here we go' is repeated three times
com: # refers to a pause
act: hands banana to MOT

(26) 2;2.20
STV: here go.
pho: **higo**
act: toy dolls are now in bus and STV pushes it to start it moving
FAT: ok.
FAT: what is that?
STV: this box, this **here we go.**
act: STV hands box to FAT
FAT: that goes in there too?
STV: yeah.

(27) 2;2.20
STV: **here ya go** xx school!
pho: hiyə gow ə gul
FAT: they're going to school now!

(28) 2;2.20
STV: a stop sign **there go** xx people Rolf.
pho: ee stap sain deyr gow ə pepow rowf

(29) 2;2.20
STV: **there we go!**
pho: leir wi gow
STV: go back home.

(30) 2;2.20
FAT: is the bus all ready?
STV: yes.
FAT: ok.
STV: **here we move** xx books!
pho: hiyə wI muf ə bUks
FAT: we have to move the books now, huh?
FAT: is it off to school now?
STV: yeah.

(31) age 2;2.20
STV: go back **here**.
pho: go bak hiyə
act: goes backwards in book
STV: **there** alligator?
pho: theyə agIgeytə
FAT: alligator.

(32) 2;2.20
STV: **here** scrunchie.
pho: hiyə grənchi
act: picks up one of MOT's scrunchies from floor

(33) 2;2.20
STV: **there we go, here.**
pho: ðeə wI gow hiyə
act: STV successfully puts toy doll in seat in school bus
FAT: oh, that's better, huh?