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PLURALS IN SLI: PROSODIC DEFICIT OR MORPHOLOGICAL DEFICIT?

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Abstract

Two accounts for the segmental and prosodic anomalies observed in plurals produced by five adult subjects with SLI, one prosodic and one morphological, are compared. The prosodic account proposed is that the grammars of these individuals do not tolerate extraprosodicity: indirect licensing by the prosodic word. While this account can capture a range of facts, it is rejected for several reasons, the most significant of which is that it cannot discriminate between anomalous outputs such as [dɒg.s] and natural-sounding outputs such as [dɒgz], both of which are produced by impaired speakers. In view of this, a morphological account is proposed: the grammars of these impaired individuals lack certain sub-lexical features, in particular [±plural]; the notion of 'plurality' is expressed at the level of conceptual structure. Consequently, plurals must be built through compensatory means. One, they may involve the concatenation of stems and thereby structurally resemble compounds, both morphologically and prosodically (yields [dɒg.s]). Two, they may be stored as morphologically unanalysed chunks (yields [dɒgz]). Evidence in support of both options is provided.

1. INTRODUCTION

Specific Language Impairment (SLI) is a non-acquired language disorder which is characterized by the absence of hearing loss, motor deficits, behavioural problems, gross neurological impairment, and low performance IQ (see e.g. Benton (1964), Eisenson (1972), Bloom and Lahey (1978), Zangwill (1978), Stark and Tallal (1981)). From these exclusionary criteria, one can discern that individuals with SLI may not in fact define a homogeneous group (cf. Leonard (1987), Cantwell and Baker (1987)). Nevertheless, there are some common problems which have emerged in the linguistic literature on this population, most clearly in the area of inflectional morphology.[1]

In this paper, I focus on English plurals. In the previous literature on English-speaking children with SLI, there is some disagreement as to whether or not plural marking is impaired. While there is clearly a delay in acquisition, the performance on plurals is often found to be higher than that on most other grammatical morphemes (Johnston and Schery (1976)). When impaired children's performance on plurals is compared with that of MLU-matched controls, the results across studies are contradictory. One body of literature finds that the two populations perform the same (Oetting (1992), Oetting and Rice (1993), Rice and Wexler (1996)); another finds that the impaired children perform significantly worse than MLU-controls (Leonard (1989), Leonard et al. (1987; 1992); but cf. Oetting (1992) where the interpretation of Leonard's results is disputed). For the most part, this literature has relied on the percentage of times that a plural-like element is produced in obligatory contexts, both in spontaneous speech and in experimental settings. It has not examined the segmental and prosodic shapes of plural forms produced by impaired individuals. Using evidence of the latter type, I will argue that plural marking is indeed impaired — at least in the grammars of those individuals under present investigation.

I will compare two accounts of the impairment: one prosodic and one morphological.[2] Previous research has argued that prosodic structure is impaired in some individuals with SLI (Piggott and Kessler Robb (1994); the findings of Leonard (1982; 1989), Kamhi et al. (1988), Gathercole and Baddeley (1990) are consistent with such a proposal as well). As some scholars who have focused on functional structure in SLI have argued that plural marking is not impaired, it is essential that we determine whether or not the patterns observed in the data discussed below can be attributed to an impairment at the level of prosodic structure rather than to one at the level of morpho-syntactic structure. After exploring various options for a prosodic impairment, I conclude that an explanation along these lines cannot account for the behaviour observed in plurals in the SLI subjects under investigation. In contrast, I argue that the patterns observed are due to an impairment in the morphological representation. The account that I will adopt is along the lines of that proposed in Goad and Rebellati (1995), Dalalakis (1996), and Gopnik and Goad (1997); cf. Gopnik (1990). The version of the thesis put forth here is that some individuals with SLI lack (some) sub-lexical features which mark inflectional information in languages, in particular, [±plural]; the notion of 'plurality' is expressed at the level of conceptual structure. As a result, plurals and perhaps other inflectionally-complex words are built through compensatory means; they involve the concatenation of stems and thereby structurally resemble compounds, both morphologically and prosodically.

The paper is organized as follows. I begin in Section 2 by providing information on the subjects and sources of data. In Section 3, I review the three types of data under investigation:

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1. In fact, Rice and Wexler (1996) propose that high rates of omission on morphemes related to grammatical tense can be used as a clinical diagnostic of SLI.

2. Many works have argued that SLI is characterized by the absence or late emergence of particular functional categories; see Clahsen (1991) on Agreement; Rice, Wexler and Cleave (1995) on Tense; as well as Guilfoyle, Allen and Moss (1991) and Eyer and Leonard (1995) on functional categories in general. If plural hosts its own projection in the syntax, it may be possible that the morphological analysis to be proposed here could be subsumed under a more general problem with the projection of functional structure. There are two facts which make this possibility unlikely. One, unlike verbal inflection, plural morphology almost always surfaces in impaired outputs. Two, it is not immediately clear how the anomalous prosodic and segmental shapes of plurals could be accomodated within a purely syntactic approach.

plurals of sibilant-final stems, stress in three-syllable words, and plurals of non-sibilant-final stems. In Section 4, I summarize current views on prosodic structure and licensing in English. Two alternative prosodic accounts for the patterns observed in plurals for sibilant-final stems and in three-syllable words are discussed in this section as well. In Section 5, I turn to syllable structure in English, focusing in particular on rhyme shape and 'extraprosodicity' (in current parlance, licensing of material indirectly, by higher order prosodic constituents). One of the accounts offered in Section 4, that the grammars of some impaired individuals do not allow material to be indirectly licensed by the prosodic word, is extended to plurals of non-sibilant-final stems in this section. (As we will see, in the unimpaired English grammar, inflectional morphology requires this sort of licensing relation.) In Section 6, I point out three problems for an impairment expressed solely in prosodic terms. A morphological solution is outlined toward the end of this section. The analysis is more fully elaborated upon in Section 7, after my assumptions about word structure have been presented. Finally, in Section 8, I demonstrate how the prosodic anomalies observed in the plural data fall out directly from the morphological analysis earlier proposed.

2. SUBJECTS AND METHODOLOGICAL ISSUES

The analysis in this paper is based on data which come from five adult members of the same family who ranged in age from 20 to 78 at the time of testing. All have been diagnosed as SLI (Hurst et al. (1990), Gopnik and Crago (1991), Pembrey (1992)). With the exception of the eldest, all subjects attended schools for language-disordered children and received therapy for their impairment. The family speaks the Cockney dialect of London English.[3,4]

The cited examples are drawn from two studies. Plurals for monosyllabic stimuli come from a wug test reported on in Goad and Rebellati (1994; 1995). The trisyllabic stimuli were drawn from this same test (where they were included as fillers) as well as from a word-formation task which investigated stress placement in SLI (Piggott and Kessler Robb (1994)). To guarantee that the patterns observed were not due to some aspect of the experimental design of either study (see further note 6), supplementary data were obtained from spontaneous speech samples, from a repetition task, and from a sentence correction task; the patterns discussed here were amply attested in these other data sources, even though they employed quite different methodologies.

The wug test data were transcribed by two trained transcribers. Most disagreements were resolved in a session involving both transcribers; on the rare occasion when the final transcriptions were not concordant, the item was excluded from analysis. Piggott and Kessler Robb report that their data were transcribed by two trained transcribers, one of whom was ignorant of all aspects of the study.

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3. Some of the SLI individuals in this family have additionally been diagnosed as dysarthric. Nevertheless, it is highly unlikely that the patterns observed here can be attributed to such a motor impairment. Firstly, the data are drawn from adults; the dysarthria that accompanies SLI — at least in this family — dramatically improves with age. Secondly, the same patterns for the phenomena under present investigation were observed for all five subjects tested: the same profile was found for one subject whose speech was very fluent and another whose speech was slow and halting. Thirdly and perhaps most importantly, if the patterns observed were due to a motor impairment, subjects should perform better on stimuli which are segmentally and prosodically unmarked. However, no such patterns were observed. For example, it is not the case that subjects made more errors on plurals for stimuli which contained onset clusters or cross-linguistically marked consonants, or when the sonority profile between the stem-final consonant and plural was bad, e.g. [gz] in 'dogs' as opposed to [nz] in 'suns'.

4. While the data in this paper all come from one family, strikingly similar patterns are observed in data presently being analysed from SLI subjects who speak standard Canadian English. Whether the patterns observed here are characteristic of the SLI population in general or whether they are instead limited to a subset of impaired individuals remains to be seen.

3. SUMMARY OF THE DATA

To situate the discussion, I will briefly summarize the patterns which must be accounted for. Each pattern will then be elaborated upon in subsequent sections. We begin with SLI plurals for sibilant-final stems. These forms exhibit an unusual stress contour, one which is also observed in three-syllable words which we turn to second. Finally, we consider plurals for non-sibilant-final stems.

3.1. Plurals in Sibilant-final Stems

Melodic constraints on plurals for sibilant-final stems in English require epenthesis of [ɨ] between the stem-final consonant and plural marker: English does not tolerate adjacent sibilants at word edges, e.g.*[pɪitʃs] is not the plural of 'peach'.[5] Characteristic of epenthetic vowels, [ɨ] does not bear stress, as demonstrated by the unimpaired examples such as [pʹíitʃɨz] in (1). In the impaired data, however, a different pattern is observed. Representative examples are provided in the second column in (1). The most important feature of these data is that the *-es* allomorph of the plural bears stress; related to this, the vowel is 'upgraded' to the nearest stressable vowel in English, [ɪ] (see Goad and Rebellati (1994; 1995) for details).[6,7]

(1)

Unimpaired Target	Impaired Output	Gloss
[pʹíitʃɨz]	[pʹíitʃʹís:]	'peaches'
[rʹóʊzɨz]	[rʹɜozʹìs·]	'roses'
[tʹɔ́:tʃɨz]	[tʹɔ́:tʃʹɪs]	'torches'

In order for the syllable containing *-es* to bear stress in the impaired outputs, it must define its own metrical foot. This suggests that the footing for 'peaches', indicated by parentheses, is [(pɪi)(tʃɪs:)], in contrast to the unimpaired footing, [(pɪi)tʃɨz]. As it is possible that an impairment at the level of

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5. All unimpaired targets are transcribed in accordance with the segmental properties of Cockney. The properties which occur in the data discussed in this paper are as follows. (These are based on my own observations of the unimpaired members of the family; they were subsequently checked against the information provided in Sivertsen (1960) and Wells (1982).) Concerning the consonants: (a) syllable-initial [r] may be produced as a labialized rhotic glide, transcribed here as [rʷ]; (b) [h] is often deleted in favour of (or perhaps hardened to) [ʔ]; (c) final [ɬ] often vocalizes to [ʊ] or [o] with concomitant laxing of the preceding (high) vowel, e.g. 'wheel' → [wɪʊ]; and (d) palatal glides are often fused with or deleted after alveolars, e.g. 'tune' → [tʃu:n], [tu:n]. Concerning the vowels, the following Cockney (C) vowels correspond to the Received Pronunciation (RP) equivalents provided:

RP iː	=	C	ɪi					RP uː	=	C	uː ~ ʉː
RP ɪ	=	C	ɪ					RP ʊ	=	C	ʊ
RP eɪ	=	C	əɪ ~ ʌɪ	RP ɜː	=	C	ɜː	RP əʊ	=	C	əʊ ~ ʌʊ
RP ɛ	=	C	ɛ	RP ʌ	=	C	ʌ	RP ɔː	=	C	oː ~ ɔː
RP æ	=	C	æ					RP ɒ	=	C	ɒ
								RP ɑː	=	C	ɑː

6. As mentioned in the text, the examples in (1) are drawn from a wug test, one where subjects are required to pluralize both real and novel forms. Given that this task probes for plurals, one might be tempted to conclude that the methodology favours outputs where the plural is enhanced; consequently, the presence of stress on the syllable containing *-es* would not be due to some property of the grammars of these impaired subjects but would, instead, be a task effect. The fact that outputs of the same shape are found in other situations — in a variety of testing situations as well as in spontaneous speech — reveals that this cannot be the case.

7. Another property observed in the impaired outputs in (1) and elsewhere is that the plural is very often realized as voiceless; see further Section 3.3.

prosodic structure underlies the two-foot forms in (1), we turn to briefly investigate stress in three-syllable words.

3.2. Stress in Three-syllable Words

The data in (2a) were included as fillers on the wug test of Goad and Rebellati (1994; 1995). Those in (2b) were drawn from Piggott and Kessler Robb's (1994) investigation of stress in SLI; subjects were required to produce adjectives ending in *-al* when provided with the corresponding underived noun.[8]

(2) a.

Unimpaired Target		Impaired Output		Gloss
σσσ	[pətʌ́ɪtəʊz]	σσσ́	[pətʌ́ɪtə́ʊz]	'potatoes'
	[kəmpjú:təz]		[kəmpjú:tíz]	'computers'
σσσ	[éləfənts]	σσσ́	[éləfɪ̋ts]	'elephants'
	[énvələʊps]		[énvələʊ̀ps]	'envelopes'

b.

Pattern	Unimpaired Target		Impaired Output		Gloss
P-Compounding[9]	σσσ	[rɪ́jənʊ]	σσσ́	[rɪ́jən # nʊ́·]	'regional'
Flattening	σσσ	segméntal	σσσ́	ség # mént # ʔál	'segmental'
Truncation	σσσ	[pɘ́sənʊ]	σσ	[pɘ́sʊ·]	'personal'

A comparison of the data in (2a) and (2b) reveals that similar prosodic contours are found. Specifically, with the exception of Truncation which is discussed in Section 4.3, the final syllable in P-Compounding and Flattening bears stress, suggesting footing along the lines of [pə(tʌɪ)(təʊz)] and [(rɪ̋jən)(nʊ·)], in contrast to the unimpaired [pə(tʌɪ)təʊz] and [(rí:j̆ə)nʊ].[10] Furthermore, the stress patterns here are similar to those seen earlier in (1); compare, for example, [píitʃɪs:] with [rɪ́jən # nʊ́·].

3.3. Plurals in Non-sibilant-final Stems

We turn finally to the shape of the impaired outputs for stems which do not end in sibilants. Several patterns are observed in the data; these are provided in (3). Firstly, there is often no voicing assimilation between the stem-final consonant and the plural. As can be seen from the output for 'dogs' in (3a), this pattern is not restricted to sonorant-final stems such as 'hem'; pluralization of voiced-obstruent-final stems thus yields outputs which are illicit in English and highly marked across languages (Greenberg (1978), Mohanan (1995)).[11] Secondly, there may be a pause,

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8. The transcriptions in (2b) are those of Piggott and Kessler Robb with three differences as follows. One, all syllable boundary symbols (.) have been removed when the syllabification is predictable from the string of segments. Two, # indicates a prominent pause between syllables, where Piggott and Kessler Robb use both # and =. Three, stress marks have been added, on the basis of the description provided by the authors in the text. Note finally that the forms labelled as Flattening were not transcribed by Piggott and Kessler Robb.

9. Piggott and Kessler Robb refer to the pattern exhibited in forms such as [rɪ́jən # nʊ́·] as 'Compounding'. Henceforth, I will refer to this pattern as P(rosodic)-Compounding, in contrast to M(orphological)-Compounding which will be discussed later.

10. The unimpaired footing given for 'regional', [(ri:j̆ə)nʊ], is consistent with Piggott and Kessler Robb who allow for HL (heavy–light) trochees (cf. Hayes (1987); see further Section 4.2). The argument is not affected if the unimpaired footing is instead [(ri:)j̆ənʊ].

11. We might be attempted to attribute the final devoicing observed in the plural to the dialect of the impaired speakers. Prominent devoicing is characteristic of some varieties of Cockney (Sivertsen (1960), Wells (1982)). However, this will not account for the following facts. Firstly, the plural

reminiscent of a syllable break, between the stem and plural marker, (3b), as indicated by the period. Thirdly, the plural marker itself may appear with length, (3c), either half length as in 'clocks' or full length as in 'pits'. Finally, there may be lengthening of stem-final sonorants, as seen in (3d).[12]

(3)

	Pattern	Unimpaired Target	Impaired Output	Gloss
a.	Absence of voicing assimilation	[dɒgz]	[dɒgs]	'dogs'
		[hɛmz]	[hɛms]	'hems'
b.	Pause between stem and plural	[trɪiz]	[trɪi.s]	'trees'
		[wɪʊz]	[wɪʊ.s]	'wheels'
c.	Lengthening of plural marker	[klɒks]	[klɒks·]	'clocks'
		[pɪts]	[pɪts:]	'pits'
d.	Lengthening of stem-final sonorant	[sʌnz]	[sʌn·s]	'suns'
		[ʔɛmz]	[ʔʌm·s]	'hems'

All of the patterns in (3) suggest that, in the grammars of these SLI subjects, the plural forms an independent prosodic domain rather than being incorporated into the domain of the stem. (Exactly what this domain is will be discussed in Sections 5.3 and 5.4.) In this way, the data in (3) parallel those in (1) and (2) where we observed that, aside from truncation, the rightmost syllable defined an independent foot. Before we address the question of whether the data in (1,2) and (3) can be accounted for in a unified way, we must outline current views on prosodic structure. We begin with the prosodic hierarchy and licensing.

4. PROSODIC STRUCTURE

4.1. Prosodic Hierarchy and Licensing

Most current analyses of stress and syllable structure assume a theory where prosodic units are organized into a hierarchy along the lines of that in (4) (Selkirk (1980), McCarthy and Prince (1986; et seq.)).

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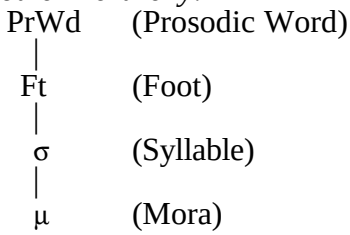
outputs produced by the unimpaired family members do not exhibit abrupt devoicing at the onset of the fricative, as observed in the impaired subjects' outputs; instead, we find standard (i.e., gradual) phrase-final devoicing, [z̬]. Secondly, not all of the plurals produced by the impaired speakers exhibit abrupt devoicing; sometimes standard phrase-final devoicing is observed (see Section 6.3 for discussion).

12. One might legitimately ask whether the years of therapy that the impaired individuals have received could be responsible for the [s]-final outputs discussed in (3). I contend that this is highly unlikely. While therapy may be responsible for the subjects producing more plural-marked forms than bare stems, I do not believe that the formal aspects of the system have been altered due to therapy. Firstly, while all of the impaired individuals exhibit each of the patterns documented in (3), as well as those discussed elsewhere in the paper, one of the subjects, the 78 year old, never received therapy for, when she was a child, no such system was in place. Secondly, while it is true that the impaired subjects were drilled on plural formation in therapy, they were similarly drilled on past tense formation. Discussions with the speech–language pathologists at Lionel Primary School which several members of this family had previously or were currently attending have indicated that impaired individuals are explicitly instructed to form plurals through adding 's' and to form past tense constructions through adding 'ed' (M. Gopnik, p.c.). If therapy were responsible for the final [s] which shows up on the plurals in (3), we would expect past tense verbs to show up with final [əd] or [ɛd]. Counter to expectation, past tense constructions are formed in [t] (see Ullman and Gopnik 1994), parallel to plurals which are formed in [s]; thus, they are exactly as expected under the formal account proposed here.

(4) *Prosodic Hierarchy:*



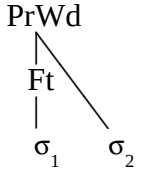
A given prosodic category must minimally contain one unit from the level of structure that it immediately dominates. Thus, a prosodic word must contain at least one foot; a foot, at least one syllable; and a syllable, at least one mora. Seen another way, every prosodic category must have a head and, by definition, the head must be one of the constituents that it immediately dominates or 'directly licenses'.

However, it need not be the case that every category is licensed directly, by the level of structure that immediate dominates it. On the contrary, the principle of prosodic licensing in (5) merely requires units at every level to belong to units at *some* higher level. (Material that is not licensed in some fashion is subject to deletion.)

(5) *Prosodic Licensing* (cf. Itô (1986, 2)):
All phonological units must be prosodically licensed, i.e. belong to higher prosodic structure.

Prosodic licensing, as defined in (5), thus opens up the possibility of indirect licensing. Conditions on headedness, however, place restrictions on when material can be indirectly licensed. This is best illustrated through an example. In the representation in (6), σ_1 is by definition the head of the foot, as it is the only syllable contained within the foot. σ_2 is outside the foot, and is thereby licensed indirectly, by the prosodic word. Since every prosodic word must contain a foot and every foot must contain a syllable, the indirect licensing relation that holds between σ_2 and PrWd is only possible in a configuration that contains a directly licensed syllable (σ_1—Ft). The theory of licensing, including its provision for indirect licensing, thereby captures the observation that prosodic elements are organized in such a way that the presence of one element (σ_2) is dependent upon the presence of another (σ_1).

(6) *Indirect Licensing:*



The notion of licensing will play a prominent role in our discussion of prosodic accounts of the SLI patterns provided earlier in Sections 3.1 to 3.3. To situate the discussion, we turn first to stress in nouns and derived adjectives.

4.2. Extraprosodicity and Stress in Nouns and Derived Adjectives

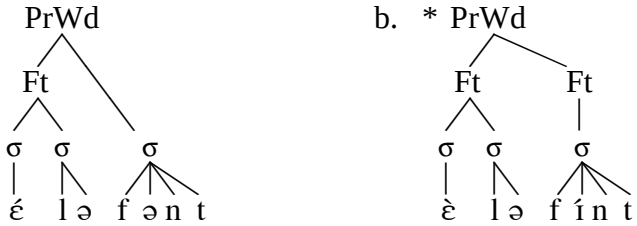
Returning to (4), we can observe that the mora is the lowest level of the prosodic hierarchy. Moras are weight units: CV syllables are monomoraic (light); CVV syllables are bimoraic (heavy); and CVC syllables are either monomoraic or bimoraic, depending on whether codas are weight-bearing in the language in question. In English, where CVC syllables behave as heavy, codas are moraic.

The stress foot in English is a moraic trochee, that is, a left-headed foot that organizes moras rather than syllables. Consistent with the view that feet are binary under syllabic or moraic analysis,

the stress foot can contain either a single heavy (H) syllable or two light (LL) syllables (see Hayes (1987)). Stress is assigned from the right edge of words in English. However, as is true of many languages, final syllables in most nouns and derived adjectives (e.g. those ending in *-al*) are 'extraprosodic' (Hayes (1982)): they are not visible to stress assignment and are therefore not incorporated into the final stress foot. Consequently, primary stress in a word like 'elephant' falls on the antepenultimate syllable, [élәfәnt], and the footing is [(ɛlә)fәnt].

In the theory of prosodic phonology, extraprosodicity is formally expressed through indirect licensing. This situation is displayed in (7a) for 'elephant'.

(7) a. b. *



If the final syllable in 'elephant' were not extraprosodic, it would incorrectly define its own foot and thereby bear (primary[13]) stress; see (7b). Recall that this stress contour is similar to what was observed in the impaired outputs in (2), e.g. [ríjən # nó·] 'regional', which Piggott and Kessler Robb (1994) had labelled as Compounding (what we are calling P-Compounding). In view of this, we turn now to the prosodic account offered by these authors for P-Compounding as well as for the other patterns they discuss, Truncation and Flattening.

4.3. Prosodic Accounts of Stress in SLI

Several researchers have remarked that individuals with SLI have difficulties producing or repeating multisyllabic words (Leonard (1982; 1989), Kamhi et al. (1988), Gathercole and Baddeley (1990)). These difficulties are manifested through truncation of segments and/or unstressed syllables as well as through outputs which sound monotonic rather than exhibiting alternating stress.[14] While the above mentioned works are not couched in terms of current prosodic theory, they may suggest that impaired individuals have difficulty constructing words of particular prosodic shapes. This hypothesis is explored in the research of Piggott and Kessler Robb (1994).

Recall from Sections 4.1 and 4.2 that, in accordance with the principles governing the well-formedness of prosodic structure, a prosodic word must minimally contain one binary foot (σσ or μμ), a constituent commonly referred to as the 'minimal word' (McCarthy and Prince (1986)). In the literature on first language acquisition, it has been argued that this constituent functions to place an upper bound on children's early outputs (see Fee (1992), Fikkert (1993), Demuth (1994), Pater (in press), amongst others). Piggott and Kessler Robb (1994) suggest that the SLI stress contours observed in (2) are due to the same restriction on the shapes of words; see (8).[15]

(8) *Prosodic Impairment* (Piggott and Kessler Robb (1994, 20)):
PrWd = Wd_{min}: The maximal size of a derived prosodic word is equivalent to the size of the minimal word

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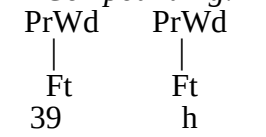
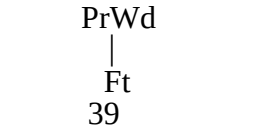
13. In English, the head foot is rightmost in the word; consequently, in the illicit representation in (6b), primary stress occurs on the final syllable.
14. It should be pointed out that Hurst et al. (1990, 354) remark that, for individuals from the same family as under present investigation, "...polysyllabic words became monosyllabic or bisyllabic".
15. Although not directly addressed by Piggott and Kessler Robb, given the similarities observed between the SLI and early child language, it may be the case that SLI represents a grammar arrested at some non-final (perhaps unmarked) stage in development. This point will be returned to in Sections 5.4 and 7.3.

In light of (8), we begin with P-Compounding, one of the strategies observed earlier in (2b). Recall that, according to Piggott and Kessler Robb, in P-Compounding, the stem and *-al* suffix constitute independent prosodic words, e.g. [ríj̃ən # nó·] ‘regional’. The resulting structure is provided in (9a). In the second strategy, Truncation, the *-al* suffix ([-ʊ·]) is incorporated into the foot of the root (e.g. ‘person’); consequently, the root must be shortened to monosyllabic, yielding [pésʊ·] for ‘personal’, as illustrated in (9b). In the third strategy, Flattening, each syllable, if heavy, forms its own minimal word, e.g. ség # mént # ʔál ‘segmental’, as in (9c).

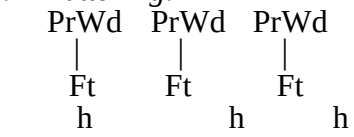
(9) a. *P-Compounding:*



b. *Truncation:*

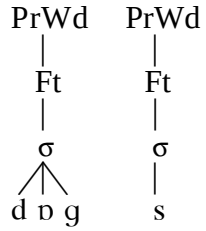


c. *Flattening:*



Beyond the data examined by Piggott and Kessler Robb, PrWd = Wd_{min} can account for some of the data in (2a) — plurals of three-syllable stems such as [(ɛlə)(fɪts)] ‘elephants’ — and for the data in (1), plurals of monosyllabic sibilant-final stems, e.g. [(pɪi)(tʃɪs:)] ‘peaches’. However, it cannot be extended to the data in (3), plurals of non-sibilant-final stems, e.g. [dɒgs] ‘dogs’. Recall that in cases such as these, the plural is not incorporated into the prosodic domain of the stem. If the plural were to constitute its own foot and prosodic word, along the lines of the last syllable in (9a,c), the result would be ill-formed; see (10). Feet must be binary, a requirement which the final foot in (10) clearly does not meet. While foot binarity can be violated to meet the demands of other constraints (cf. Prince and Smolensky (1993)), in a purely prosodic account of the facts such as that discussed thus far, it is not at all clear what constraint would demand a violation of foot binarity. The footing in (10) could, however, result from meeting the demands of some higher-ranked constraint on *morphological* structure, a point to which we return in Section 8.1.

(10)



As the PrWd = Wd_{min} account cannot be straightforwardly extended to data such as those in (3), it would appear that we need a generalized prosodic impairment on licensing, one which will apply both at the level of foot structure and at the level of syllable structure.

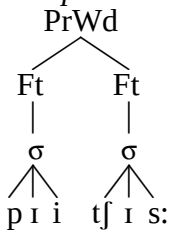
Before we turn to such an account, recall from our earlier discussion of stress that final syllables in nouns and derived adjectives are extraprosodic: they are not visible to stress assignment. They are therefore not incorporated into the final stress foot and are instead licensed indirectly, by the prosodic word. Extraprosodicity is not merely a property of stress systems. In fact, extraprosodic status can be assigned to any element which is not visible at the level of structure that would normally organize it. As we will see shortly, in the unimpaired grammar, inflectional morphology in English is extraprosodic; it is not incorporated into the stem-final syllable and is licensed by the prosodic word. In view of this, a purely prosodic account of the facts discussed thus far is in (11), that the grammars of some impaired individuals do not tolerate this type of extraprosodicity.[16]

16. Here, we are crucially concerned with the right edge of the prosodic word. In the unimpaired grammar, the initial syllable in a word like ‘potato’ is also licensed indirectly, by the prosodic word:

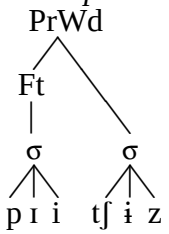
(11) *Prosodic Impairment (Generalized):*
The grammars of (some) SLI subjects do not tolerate extraprosodicity: indirect licensing by the prosodic word

One consequence of (11) is that the structure provided in (7a) for 'elephant' would not be possible in the grammars of these SLI individuals. We would expect instead the representation in (7b). This is consistent with the presence of final stress observed in the forms in (2a), e.g. [éləfɪ́ts] 'elephants'. To illustrate further, (11) requires the final syllable in the SLI output for 'peaches' to be footed, (12a). Unlike in the unimpaired grammar, (12b), it cannot be licensed by the word.

(12) a. *Impaired Representation:*

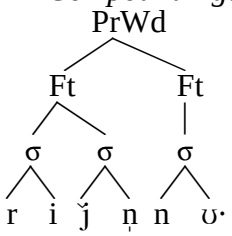


b. *Unimpaired Representation:*

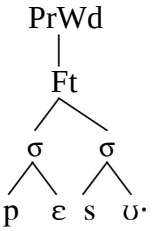


Finally, under (11), P-compounding, Truncation and Flattening would have the structures in (13). In contrast to the representations provided in (9a,c), a single prosodic word would dominate all feet.

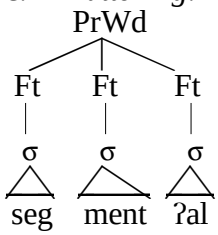
(13) a. *P-Compounding:*



b. *Truncation:*



c. *Flattening:*

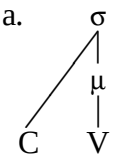


Before we turn to how the proposal in (11) can be extended to the plurals of the non-sibilant-final stems in (3), we must review current assumptions about syllable structure in English.

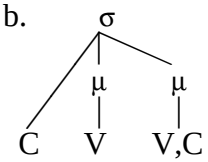
5. SYLLABLE STRUCTURE

Recall from Section 4.1 that in the theory of prosodic phonology, the only syllable-internal constituent is the mora. CV syllables are monomoraic and CVV syllables are bimoraic, as are CVC syllables in English. As is clear from a comparison of (14) and (15), material that is dominated by the mora corresponds to the rhyme constituent in traditional Onset–Rhyme theory.

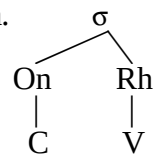
(14) a.



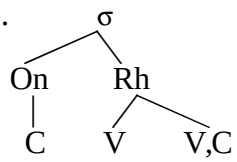
b.



(15) a.



b.



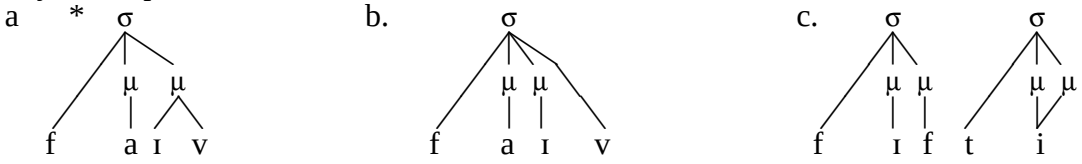
[pə(tʌ́ɪ)təʊ]. However, this is by virtue of its position in the string; importantly, it is not marked as extraprosodic in the lexical entry.

5.1. Rhyme Shape and Extraprosodicity

As inflectional morphology is realized at the right edge in English, the discussion will focus on the prosodic status of clusters at the right edge. We begin with rhyme shape. Kaye and Lowenstamm (1981) have argued that, universally, rhymes are maximally bipositional (see also Kaye, Lowenstamm and Vergnaud (1990)). Borowsky (1986; 1989) has further demonstrated the relevance of this constraint to English.[17] In moraic theory, this constraint translates into the statement that the final mora of a bimoraic syllable cannot branch. Consequently, in English, where VXC]$_\sigma$ strings are tolerated, the final consonant cannot be syllabified as part of the 'rhyme'[18] but must instead be licensed by the syllable, as an 'extra-rhymal position' (ERP). The representation in (16a) is thus illicit while that in (16b) is well-formed.

Positions which are designated as extraprosodic (including ERPs) can only appear at domain edges (see Hayes (1981)). Evidence in favour of (16b) over (16a) can thus be found by observing the behaviour of CVXC syllables when they appear word-internally. Consider in this regard (16c). If [aɪv] in 'five' were syllabified as a tripositional rhyme, as in the illicit structure in (16a), there would be no explanation for why [aɪ] shortens to [ɪ] when this sequence occurs word-medially in 'fifty'.

(16) *Rhyme Shape:*



5.2. Extra-rhymal Positions in SLI Outputs

When we abstract away from the confounds of morphological complexity and multisyllabicity and observe the shapes of outputs produced by the impaired subjects, it becomes clear that the addition of an extra-rhymal consonant to a syllable poses no particular difficulty for them. Representative examples which demonstrate this are provided in (17b). Importantly, these forms are not being shortened to yield CVX syllables of the shape in (17a).

(17) *Monomorphemic Monosyllabic Outputs in SLI:*

a.

CVV		CVC	
[trɪi]	'tree'	[brʷɪdʒ]	'bridge'
[bʌʊ]	'bow'	[krʷæb]	'crab'

b.

CVVC			CVCC		
[tjʉ:b];	*[tjʉb]	'tube'	[lʌntʃ];	*[lɪ̃tʃ]	'lunch'
[kəɪk];	*[kɛk]	'cake'	[tʃaɬd], [tʃaʊd];	*[tʃɔd]	'child'

In contrast to forms such as those in (17b), we observed earlier in (3) that the addition of a consonant which marks plural morphology does lead to outputs which are prosodically and segmentally anomalous. The data in (18), an expanded set of those provided in (3), demonstrate that the anomalies are present, regardless of whether the stem is simply bimoraic (stem = CVX) or whether it also contains an extra-rhymal consonant (stem = CVXC).

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17. Borowsky argues that this constraint on rhyme shape holds only of Level 1 in the lexical phonology of English. If we adopt more recent views on licensing in prosodic theory, this constraint does not need to be so restricted. See Section 5.3 for related discussion.

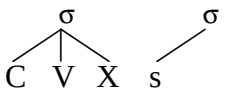
18. While I will assume moraic theory throughout this paper, I will continue to use the terms 'onset', 'rhyme' and 'coda' as descriptive labels.

(18)

		Stem = CVX			Stem = CVXC		
	Pattern	Unimpaired Target	Impaired Output	Gloss	Unimpaired Target	Impaired Output	Gloss
	Pause between stem	[trɪiz]	[trɪi.s]	'trees'	[kɑ:dz]	[kɔ:d.s]	'cards'
a.	and plural	[wɪʊz]	[wɪʊ.s]	'wheels'	[dʒʌmps]	[dʒʌmp.s]	'jumps'
	Lengthening of stem-	[sʌnz]	[sʌn·s]	'suns'	[kʌʊmz]	[kʌʊm·z]	'combs'
b.	final sonorant	[ʔɛmz]	[ʔʌm·s]	'hems'			
	Absence of voicing	[dɒgz]	[dɒgs]	'dogs'	[tju:bz]	[tju:bs]	'tubes'
c.	assimilation	[hɛmz]	[hɛms]	'hems'	[kəʊmz]	[kəʊms]	'combs'
	Lengthening of plural	[pɪts]	[pɪts:]	'pits'	[kɑ:ts]	[kɑ:ts:]	'carts'
d.	marker	[klɒks]	[klɒks·]	'clocks'	[sku:ps]	[sku:ps:]	'scoops'

From the data in (18), we can conclude that the plural defines its own prosodic domain in the grammars of these impaired individuals. I suggest that this domain is the syllable, as depicted in (19) (see further Section 5.4). Thus, the pause observed between stem and plural in (18a) is present precisely because it corresponds to a syllable boundary. Secondly, it is not at all surprising that sonorant-final stems would show stem-final lengthening, (18b), if they are at the right edge of a syllable. Thirdly, if there is a syllable boundary between stem and plural, then these two consonants need not agree in voicing, even if they are obstruents, (18c); compare, for example, SLI *do[g.s]* with unimpaired *o[b.t]use, a[b.s]tract.* Finally, if the plural forms its own empty-headed syllable, it is not surprising that it should undergo lengthening, (18d).[19]

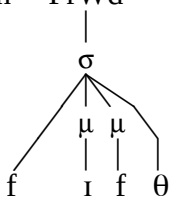
(19)



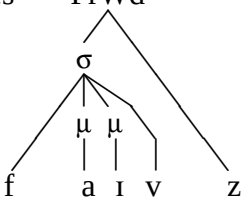
5.3. Indirect Licensing by the Prosodic Word

Before we elaborate on the observations drawn from (18), we must discuss how the plural is prosodically licensed in the unimpaired grammar. A comparison of 'fifth' and 'fives' in (20) reveals that plural *-s* is not an extra-rhymal consonant. It does not trigger shortening, which demonstrates that it is less tightly bound to the base to which it attaches than is the derivational suffix *-th.* (20b) shows that the plural is licensed directly by the prosodic word. I will henceforth refer to this position as an appendix (Halle and Vergnaud (1980)). (For ease of exposition, foot structure has been excluded from (20).)

(20) a. 'fifth'



b. 'fives'



19. Lengthening occurs variably. I suggest that it is a phonetic consequence of [s] being syllabified as an onset; as such, lengthening is related to the fact that onsets want to be followed by a release. Seen another way, it may be the case that, representationally, onsets of empty-headed syllables are followed by empty nuclei and that [s] optionally spreads from the onset into this empty position, yielding a lengthened [s].

Any consonant (barring [h]) may be syllabified as an ERP in English. Appendices, on the other hand, are restricted to unmarked coronal obstruents ([t/d] and [s/z]). Monomorphemic words with super heavy rhymes are consistent with the latter restriction: only unmarked coronals can surface after an extra-rhymal consonant, e.g. [paɪn**t**] 'pint', but *[paɪŋ**k**] (cf. [pɪŋ**k**] 'pink'). It is thus no accident that inflectional morphemes which are expressed by a single consonant in English have the following shapes: [t/d] – past, perfective; [s/z] – plural, 3sg, genitive case (cf. Booij (1983, 259)).

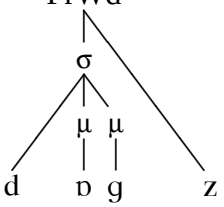
5.4. Appendices in the SLI Outputs

We turn now to consider the consequences of the constraint in (11) for monosyllabic forms such as [dɒgs]. We have seen that, in the unimpaired grammar, the plural is loosely bound to the stem to which it attaches. Formally, this is expressed through indirect licensing by the prosodic word; see (21a). If this option is not available to the grammars of these impaired individuals, as per (11), the plural must be licensed in some other fashion. The only remaining option is as the onset of an empty-headed syllable (cf. Giegerich (1985), Kaye (1990), McCarthy and Prince (1990), Piggott (1991), Rice (1992)). Under this analysis, the structures for 'dogs' and 'cards' for the impaired subjects would be as in (21b). As discussed in Section 5.2, the analysis in (21b) is supported by the phonetic facts observed in (18).

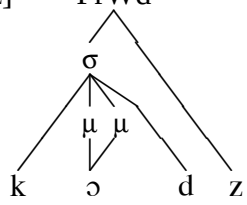
(21) *Prosodic Account: Syllable Structure:*

a. *Unimpaired Representations:*

CVX [dɒgz] PrWd

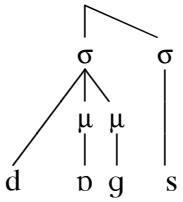


CVXC [kɔ:dz] PrWd

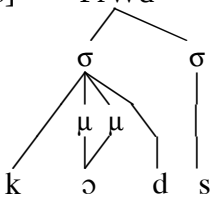


b. *Impaired Representations:*

CVX [dɒgs] PrWd



CVXC [kɔ:d.s] PrWd



This type of representation, where final consonants are syllabified as onsets of empty-headed syllables, has for independent reasons been argued to represent the unmarked case for final consonants across languages (Piggott (1991)). Empirical support for this position from first language acquisition is provided in Goad (1996a; 1997). The syllabification in (21b) would thus appear to be consistent with the view that SLI grammars have been arrested at some non-final stage in development.

Before concluding this section, one related issue must be addressed. How would a constraint such as that in (11) arise in the first place in the grammars of impaired individuals? If indirect licensing by the prosodic word reflects the marked state of affairs, (11) is the default option. It is undoubtedly true that unimpaired English is marked in allowing, for example, plural [s/z] to be appended directly to nouns. The burden for acquisition thus lies on the unimpaired child. He or she must arrive at the correct analysis on the basis of evidence available in the input: the (non)effect that plural suffixation has on rhyme shape; the sonority profile observed between plural

[s/z] and the preceding consonant; and the restrictions on the melodic content of material that expresses inflectional properties in English.

5.5. Summary

To summarize thus far, we have seen that final syllables in English nouns (and derived adjectives) and inflectional (plural) morphology both share the property of being extraprosodic in the unimpaired grammar and, as such, they are licensed by the prosodic word. See (22).

(22) *Licensing by the Prosodic Word: Unimpaired English:*

Final σ in nouns:	[(ɛ́lə)fənt]$_{PrWd}$	'elephant'	[s/z] plural:	[(dɒg)z]$_{PrWd}$	'dogs'
Final σ in nouns:	[(hɔ́:)sɨz]$_{PrWd}$	'horses'	[ɨz] plural:	[(hɔ́:)sɨz]$_{PrWd}$	'horses'

In the impaired grammars of the SLI subjects, polysyllabic nouns like 'elephant' and 'horses' bear final stress, suggesting that the final syllable is not extraprosodic but is, instead, visible at the level of structure which would normally organize it, the foot. For forms such as 'dogs', the prosodic and segmental shapes of these plurals suggest that the plural constitutes the onset of an independent syllable. I have suggested that both of these sets of facts can be captured with the constraint in (11), that the SLI grammar prohibits indirect licensing of material by the prosodic word.

6. PROBLEMS FOR THE PROSODIC ACCOUNT

Thus far, the account proposed for the data we have examined has been expressed solely in prosodic terms, that the impairment lies in the licensing options (un)available to the grammars of the SLI individuals under discussion. When we delve further into the data, and examine both the patterns that occur and those which are noticeably absent, it becomes clear that a prosodic account alone will not capture the full range of facts. Instead, reference to the morphological make-up of inflectionally complex words will prove to be necessary. As we will see, there are certain insights from the prosodic account that we will want to maintain, and these fall out directly from the morphological account.

We consider first plurals of sibilant-final stems, and then turn to plurals of non-sibilant-final stems. Finally, we compare the prosodic contours of inflectionally-complex plurals with trisyllabic forms such as 'elephant' and 'regional'; we will find that the numbers of prosodically anomalous versus natural-sounding outputs for these two types of words differ greatly, suggesting that different impairments are responsible for each.

6.1. Problem 1: Plurals of Sibilant-final CVC$_{Sib}$ Stems

Recall from the data in (1) that when sibilant-final stems are pluralized by individuals with SLI, the *-es* allomorph of the plural bears stress and thereby defines its own foot. The examples from (1) are repeated in (23a). Notice that, in all of these data, the stem contains an extra-rhymal consonant. As a result, when this consonant becomes the onset of the final syllable in the plural, the initial foot is always binary.

What is missing from (1) are plurals for sibilant-final stems where the stem does not contain an extra-rhymal consonant. Data such as these are provided in (23b). From the fourth column, it can be seen that the same two-foot pattern is found. What is particularly interesting about these cases is that when the stem-final consonant becomes the onset of the syllable containing *-es*, what remains of the stem defines a subminimal foot, e.g. (bʌ) in 'buses'. Compare the forms in the second column of (23b) where it can be seen that, in the unimpaired grammar, the epenthetic vowel is incorporated into the stem foot, (bʌ́sɨ), because the initial syllable is light.

(23) a. *Stem Shape:* $CVXC_{Sib}$

Unimpaired		Impaired		
Target	Footing	Output	Footing	Gloss
[píitʃɨz]	(píi)tʃɨz	[píitʃís:]	(píi)(tʃís:)	‘peaches’
[rʌ́ʊzɨz]	(rʌ́ʊ)zɨz	[rɜ́ozɪ̀s·]	(rɜ́o)(zɪ̀s·)	‘roses’
[tɔ́:tʃɨz]	(tɔ́:)tʃɨz	[tɔ́:tʃɪs]	(tɔ́:)(tʃɪs)	‘torches’

b. *Stem Shape:* CVC_{Sib}

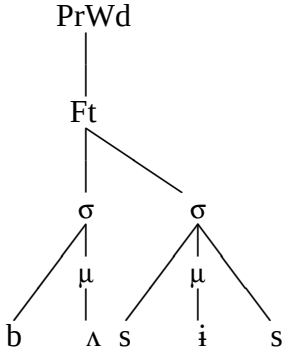
Unimpaired		Impaired		
Target	Footing	Output	Footing	Gloss
[bʌ́sɨz]	(bʌ́sɨ)z	[bʌ́sɪ̀s]	(bʌ́)(sɪ̀s)	‘buses’
[dʲíʃɨz]	(dʲíʃɨ)z	[dʲíʃɪs]	(dʲí)(ʃɪs)	‘dishes’
[wɛ́dʒɨz]	(wɛ́dʒɨ)z	[wɛ́dʒɪ̀s]	(wɛ́)(dʒɪs)	‘wedges’

If the final *s* in CVC_{Sib} stems is licensed by the prosodic word in the unimpaired grammar, $[(bʌ́sɨ)z]_{PrWd}$, then this structure would be unavailable to the impaired subjects under (11). We might, however, still expect a one-foot output for stems of this shape as the final *s* could be licensed directly by the syllable as an extra-rhymal consonant; see (24a). Recall from Section 5.2 that the impaired individuals have no problem with representations of this sort. One-foot outputs, however, are not what we find with plurals.

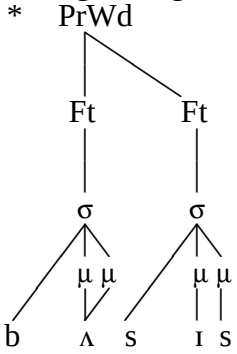
If we could construe the prosodic impairment in such a way so as to force the last syllable to be footed, as it clearly is in (23b), then we would expect the initial foot in such forms to be augmented, either through lengthening of the vowel, e.g. [bʌ́:sɪ̀s] in (24b), or through gemination of the stem-final consonant, e.g. [bʌ́ssɪ̀s] in (24c). Augmentation would yield outputs where both feet satisfy foot binarity, a better structure in prosodic terms than what is actually observed in (23b).[20] Augmentation, however, is not attested in the impaired outputs.[21]

(24) *Options for the Impaired Subjects for CVC_{Sib} stems:*

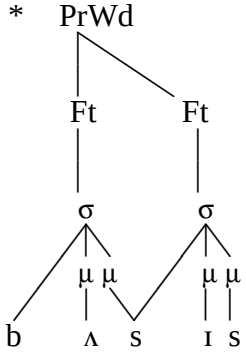
a. *s* as ERP:



b. No Lengthening: *



c. No Gemination: *



Another point related to this which casts doubt on the prosodic account is as follows. In the impaired outputs in (23), we see that each syllable constitutes its own foot. These forms thus appear

---

20. In (24b,c), I have considered the word-final consonant to be weight-bearing because the rightmost syllable forms its own foot. This is in contrast to *s* in (24a). The final syllable in (24a) is in the dependent position in the foot and must therefore, by definition, be light.

21. I have come across one exception to the statement there there is no augmentation in the SLI outputs. As part of the wug test which probed for plurals, one impaired adult provided [bʌ́ssís] as the plural for ‘bus’. This was the only example across the fifty CVC_{Sib} stems elicited (ten CVC_{Sib} stimuli for each of five subjects).

to be identical to those discussed by Piggott and Kessler Robb (1994) under the name of Flattening; see (2b) above. Importantly, Piggott and Kessler Robb point out that Flattening only occurred in their data when each foot was prosodically well-formed (bimoraic), e.g. $(\text{ség})_H(\text{mént})_H(\text{ʔál})_H$. In contrast to this, however, plurals for CVC_{Sib} forms do not conform to this well-formedness requirement, e.g. $(\text{bʌ́})_L(\text{sɪ̀s})_H$. If the impairment were expressed solely in prosodic terms, we would again expect outputs of the type given in (24b,c).

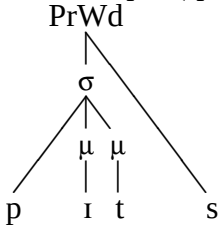
One crucial difference between forms such as $(\text{ség})_H(\text{mént})_H(\text{ʔál})_H$ and forms such as $(\text{bʌ́})_L(\text{sɪ̀s})_H$ is that the latter are inflectionally complex. It would appear, then, that a morphological explanation underlies the footing in $(\text{bʌ́})_L(\text{sɪ̀s})_H$: the morphology forces the footing that we observe, at the expense of prosodic well-formedness. We will return to this point shortly.

6.2. Problem 2: Plurals of Non-sibilant-final CVX Stems

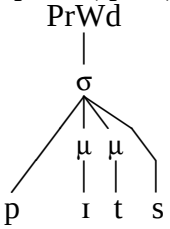
We consider now the second problem for an impairment expressed solely in prosodic terms. Recall from Section 5.4 that, for the non-sibilant-final stems produced by the impaired subjects, the plural was argued to be syllabified as the onset of an empty-headed syllable. In the unimpaired grammar, the plural is licensed directly by the prosodic word, but this option, according to (11), is unavailable to the grammars of the impaired individuals under investigation. Extra-rhymal positions, however, are freely tolerated by the SLI subjects. Thus, if the impairment were truly prosodic, we would expect subjects to compensate for their impairment as follows: (i) syllabify the plural as an ERP when the stem is of the right shape, CVX; and (ii) shorten CVXC stems to CVX so that the plural can be syllabified as an ERP. See the structures in (25) and (26) respectively.

(25) *CVX Stems:*

a. Unimpaired Output (‘pits’):

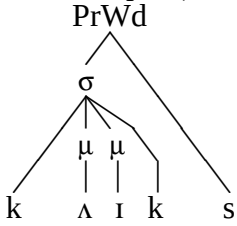


b. Impaired Option (‘pits’):

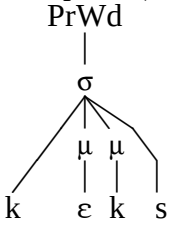


(26) *CVXC Stems:*

a. Unimpaired Output (‘cakes’):



b. Impaired Option (‘cakes’):



Shortening of the stem, as exemplified in (26b), is unattested in the impaired outputs.[22] To determine whether the syllabification in (25b) is possible, we cannot simply look at surface strings, as is clear from the fact that the strings of segments in (25a) and (25b) are identical. However, if the impaired subjects resorted to the ERP option to compensate for the impossibility of indirect

[22]. I have found one exception to this claim. As part of the wug test, one impaired adult provided [k=ʌm·z] as the plural for ‘comb’, where the vowel has been shortened to [ʌ]. Note, however, that there is still lengthening of the stem-final sonorant which casts doubt on the analysis where the plural has been syllabified as an extra-rhymal position. This was the only example from the thirty-five CVXC stems elicited (seven CVXC stimuli for each of five subjects).

licensing of the plural, we would expect a significantly higher percentage of correct-sounding outputs (i.e., outputs which do not conform to the patterns illustrated in (18)) for CVX stems than for CVXC stems where the ERP option for the plural is not available.

To investigate this, we will look at the results of the wug test of Goad and Rebellati (1994; 1995). In (27), two lists are provided. The first, (27a), contains CVX stems which end in vowels and those which end in coda consonants where the sonority profile between the coda and plural would be possible morpheme-internally in word-final position, for example, [ps] in 'caps' as compared with 'lapse'; in monomorphemic 'lapse', the [s] is an ERP, not an Appendix. Any sequence that could not be found morpheme-internally (e.g. [bz]) has been eliminated from the list. The second list, (27b), contains all the CVXC stems from the wug test. Naturally, the ERP option for the plural is not available in this case, regardless of the quality of the final consonant, so no forms have been eliminated from this list.

(27)

a. *CVX + ERP [s]*				b. *CVXC + App [s]*			
'tree'	[trɪi]	'chin'	[tʃɪn]	'comb'	[kʌʊm]	'cart'	[kɑ:t]
'bow'	[bʌʊ]	'pit'	[pɪt]	'scoop'	[sku:p]	'card'	[kɑ:d]
'wheel'	[wɪʊ]	'lid'	[lɪd]	'tube'	[tju:b]	'cake'	[kʌɪk]
'skull'	[skʌʊ]	'cap'	[kæp]	'sleeve'	[slɪiv]		
'sun'	[sʌn]	'clock'	[klɒk]				

In Table 1, scores (in per cent correct) are provided for the two types of stems, CVX and CVXC respectively. The numbers reveals that performance on the two types is not dramatically different for the five impaired subjects. Although one subject, 4, shows strikingly better results for the CVX stems, two other subjects, 3 and 5, show the opposite pattern. If the plural were being syllabified as an extra-rhymal consonant in the case of the CVX stems, performance on this category should approach 100% correct for all subjects.

TABLE 1
Wug Test: Prosodically Natural Plurals for Non-sibilant-final Stems (in per cent correct)

Subject	CVX + ERP [s]	CVXC + App [s]
1	50.0	42.9
2	20.0	33.3
3	30.0	71.4
4	80.0	57.1
5	62.5	83.3
Mean	48.5	57.6

We have seen that the impaired subjects do not take advantage of the ERP option for syllabifying the plural. Since ERPs pose no particular difficulty for the impaired subjects, this option would be expected under an approach such as that in (11) where the impairment is expressed solely in prosodic terms. We can infer from this that something else must be preventing the ERP option, something that forces the plural to be syllabified as the onset of a new syllable. Notice, of course, that the syllable boundary corresponds to the boundary between stem and plural. If it is the morphological structure that forces plural [s] to be syllabified as an onset, then the impairment must lie in the morphological representation. We will return to this point shortly.

6.3. Problem 3: Numbers

We turn finally to the last problem for an impairment expressed solely in prosodic terms: numbers. Recall from the data in (23) that, in the outputs from the impaired subjects, plurals for sibilant-final stems have the following properties: the *-es* allomorph of the plural bears stress and, related to this,

the vowel is 'upgraded' to the nearest stressable vowel in English. Exemplary data are repeated in (28a). Plurals for non-sibilant-final stems have a variety of shapes, all of which suggest that the plural is syllabified as the onset of an empty-headed syllable. Representative examples are repeated in (28b).

(28) *Prosodically Anomalous Plurals:*

a. *Sibilant-final Stems:*

[píitʃĭs:]	'peaches'
[rɜ̀oz̀ɪs·]	'roses'
[tɔ́:tʃĭs]	'torches'
[bʌ́sɪ̀s]	'buses'
[díʃɪs]	'dishes'
[wɛ́dʒɪ̀s]	'wedges'

b. *Non-sibilant-final Stems:*

[trɪi.s]	'trees'
[kɔ:d.s]	'cards'
[sʌn·s]	'suns'
[kʌʊm·s]	'combs'
[dɒgs]	'dogs'
[tju:bs]	'tubes'
[pɪts:]	'pits'
[sku:ps:]	'scoops'

While the impaired subjects often produce plurals which display the patterns observed in (28), at the same time, they produce outputs that are, in relevant respects, identical to unimpaired outputs. Data which illustrate this are provided in (29a,b). [z]-final forms typically exhibit standard phrase-final devoicing (although it is not transcribed).

(29) *Prosodically Natural Plurals:*

a. *Sibilant-final Stems:*

[píitʃɨz]	'peaches'
[pʲjdʒɪz]	'pages'
[tɔ́:tʃəz]	'torches'
[vázəz]	'vases'
[lʌ́ntʃɨz]	'lunches'
[wɛ́dʒɨz]	'wedges'

b. *Non-sibilant-final Stems:*

[bowz]	'bows'
[kɑ:dz]	'cards'
[tʃɪnz]	'chins'
[kəʊmz]	'combs'
[lɛgz]	'legs'
[tju:bz]	'tubes'
[pɪts]	'pits'
[kɛjks]	'cakes'

Table 2 summarizes the number of correct versus prosodically anomalous plurals for each subject.[23] Results are provided in per cent correct, followed by the raw score in parentheses. Two individuals, Subjects 2 and 3, produce somewhat fewer anomalous outputs, while the remaining three produce fewer correct outputs. Abstracting away from individual differences, the important generalization to draw is that there is a balance of correct and prosodically anomalous outputs, especially for non-sibilant-final stems. This is unexpected under an account which sees the impairment in prosodic terms alone. I will elaborate on this below.

23. Two subjects provided uninflected forms on a number of occasions. For sibilant-final stems, Subject 2 provided bare stems 40.9% (9/22) of the time, and Subject 5, 4.5% (1/22) of the time. Subject 2 also provided bare stems 4.8% (1/21) of the time for non-sibilant-final stems. These forms have been excluded from the counts as the focus is on correct-sounding versus prosodically anomalous outputs.

TABLE 2
Wug Test: Correct vs. Prosodically Anomalous Plurals

	Non-sibilant-final Stems				Sibilant-final Stems			
	Correct		Anomalous		Correct		Anomalous	
Subject	%	N	%	N	%	N	%	N
1	47.6	(10)	52.4	(11)	31.8	(7)	68.2	(15)
2	65.0	(13)	35.0	(7)	53.8	(7)	46.2	(6)
3	50.0	(11)	50.0	(11)	54.5	(12)	45.5	(10)
4	22.7	(5)	77.3	(17)	13.6	(3)	86.4	(19)
5	19.0	(4)	81.0	(17)	0.0	(0)	100.0	(21)
Mean	40.6		59.4		29.0		71.0	

In standard views on syllabification, prosodic constituency (above the level of the mora) is absent from underlying representations. This is because languages do not contrast forms solely in terms of their syllabification, for example, *a.pla* versus *ap.la.* On the contrary, if a language permits branching onsets, the string *apla* will always be syllabified as *a.pla.*

It follows that an impairment expressed in prosodic terms cannot discriminate between prosodically correct outputs such as [dɒgz] and prosodically anomalous outputs like [dɒg.s]. The input form /dɒg + z/ will be prosodified in one way only, in accord with universal and language-specific constraints on syllabification. The constraint in (11), that the grammars of the SLI subjects do not tolerate extraprosodicity, is equivalent to a language-specific constraint; it yields outputs like [dɒg.s]. A grammar without (11), the unimpaired English grammar, will instead yield [dɒgz]. In view of this, it is highly unlikely that the prosodically correct [dɒgz] and the prosodically anomalous [dɒg.s], both of which can be produced by the same speaker, differ only in terms of their syllabification.

While prosodically anomalous plurals exist alongside natural sounding plurals, this is not the case with multisyllabic outputs of the type observed in (2), e.g. [ríjən # nó·] 'regional'. The prosodic contours discussed in this context — Flattening, Truncation, and P-Compounding — are observed virtually without exception, well over 90% of the time. This is exactly what is expected under a prosodic account of the impairment. We may thus conclude that the prosodic contours observed on trisyllabic words are indeed due to a prosodic impairment, one which is expressed as in (11), as a constraint on licensing, (or alternatively, one which is expressed as in (8), as a constraint on word size). The patterns observed in plurals, on the other hand, must be due to a different sort of impairment.

6.4. Towards a Solution

The numbers in Table 2 reveal that, for (most) plurals, there are two possible outputs for the impaired speakers. To formally capture this, two sets of lexical entries are required for these nouns, one which will yield prosodically natural outputs like [dɒgz] and the other, prosodically anomalous outputs like [dɒg.s]. A priori, it would appear that the former are derived in the same manner as in the unimpaired grammar, through the concatenation of stem and inflectional suffix. However, if the unimpaired route were available, one might wonder why the SLI speakers would produce prosodically anomalous outputs at all (see further Section 8.2). I will argue, on the contrary, that neither [dɒgz] nor [dɒg.s] is built in the same fashion as in the unimpaired grammar. This is because the grammars of these impaired individuals lack (some) sub-lexical features which express inflectional information in languages; in particular, these grammars lack [±plural].

As a consequence of this morphological deficit, the SLI subjects have two options. One, they can store plurals as inflectionally unanalysed chunks in their lexicons; or two, they can build plurals through compensatory means. Following Goad and Rebellati (1994; 1995), I will suggest that the latter yields forms which resemble compounds, both morphologically and prosodically. I

will thus refer to this process as M(orphological)-Compounding. Before we can proceed any further, however, we must outline some assumptions about word structure.

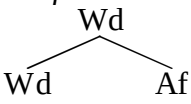
7. MORPHOLOGICAL STRUCTURE

In this section, I begin by providing some discussion of word structure in the unimpaired grammar. This is followed in Section 7.2 by my assumptions about how such representations are learned during the course of acquisition. I then turn in Section 7.3 to the representations that I propose hold for the SLI subjects under investigation.

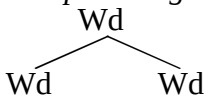
7.1. Unimpaired Morphological Representations

It is standardly accepted that morphologically-complex words are hierarchically organized into constituents, as can be seen from the structures provided in (30). In the strong lexicalist model which I adopt, all morphology takes place in the lexicon (e.g. Selkirk (1982)). Selkirk (1982) proposes that morphological categories are formally restricted to three types: affixes, roots, and words. Here, we are concerned with affixes and words only, as the focus is on inflection and compounding. Inflectional affixes attach to words (what we have been calling stems); see (30a). Compounding involves the concatenation of words, (30b).

(30) a. *Inflection:*



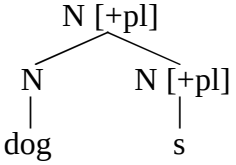
b. *Compounding:*



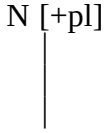
Inflectionally complex words and compounds are both right-headed: the rightmost morpheme determines the lexical category of the whole. This is formally expressed through feature percolation, where the features of the head percolate up to the dominating node (Williams (1981)). Both lexical features, such as N and A, and sub-lexical features, such as [+plural], have this property; see (31a) and (32).

(31) *Inflection:*

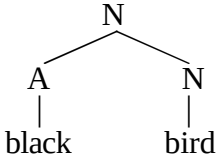
a.



b.



(32) *Compounding:*



Inflectional affixes are (with few exceptions) the only morphemes which bear both lexical and sub-lexical features.[24] The presence of sub-lexical features thus determines, in the usual case, a morpheme's status as an inflectional affix. (The situation is complicated somewhat by the presence of irregulars such as 'women' in (31b), as these forms are not morphologically decomposable.)

Following Lieber (1980; 1992), I assume that the lexical entries of inflectional affixes contain, in addition to lexical and sub-lexical features, subcategorization frames which express the structural relations that particular affixes enter into with the stems to which they attach. The entry for plural, for example, contains the features [N, +plural] and a subcategorization frame which indicates that it is suffixed to noun stems; see (33).

(33) *-s* [[N] ___]; [N, +plural]

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[24] The proposal that inflectional affixes bear lexical (as well as sublexical) features is standardly assumed both in the theoretical and in the psycholinguistic literature; on the latter, see for example, Caramazza, Laudanna and Romani (1988).

Finally, morphological category — affix versus word — affects the mapping between the morphological representation and the prosodic representation. Inflectional suffixes (in most languages) are incorporated into the prosodic word of the stem to which they attach. Compounds constitute two prosodic words and, thus, two domains for stress. Compare (34a) and (34b).

(34) *Prosodic Structure:*

a. *Inflection:*
[dógs]$_{PrWd}$ [wíshes]$_{PrWd}$

b. *Compounding:*
[[blácк]$_{PrWd}$ [bìrd]$_{PrWd}$]$_{PrWd}$

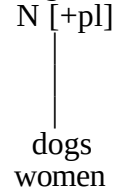
7.2. Hypothesized Stages in the Acquisition of Inflectional Morphology

Before turning to the representation of inflection in the impaired subjects' grammars studied here, I will discuss the stages that the unimpaired child is hypothesized to go through in the acquisition of inflectional morphology. The discussion draws heavily on the work of Dalalakis (1996). At the onset of acquisition, I hypothesize that the normally-developing child represents plurals, both regular and irregular, as in (35a) (cf. as well Pinker and Prince (1992)). At this stage, there is no word-internal structure. As the lexical features N, V and A are arguably present in all languages, the feature N is represented on 'dogs' and 'women' from the onset of acquisition. However, sub-lexical features are not universally present. In fact, there are some languages, for instance Chinese and Vietnamese, which (arguably) lack them altogether. [±plural] is therefore absent from the Stage 1 morphological representation, and plurality is instead expressed at the level of conceptual structure.

(35) *Stages in Unimpaired Acquisition:*

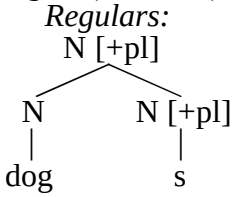
a. *Stage 1:*

b. *Stage 2:*

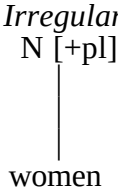


c. *Stage 3 (end state):*

Regulars:



Irregulars:



As languages vary in the sub-lexical features they choose to represent, sub-lexical features must be learned one at a time, on the basis of positive evidence from the input. Thus, once a certain threshold in the child's vocabulary is reached, Stage 2, he or she will acquire features such as [±plural]. At this point, the representation for both regulars and irregulars looks like that of an irregular plural in the adult grammar (cf. (31b)). Consistent with this view, Pinker (1984) notes that, in early acquisition, children learn irregular forms as easily as regularly inflected forms. Overregularisations do not appear until later in development (Kuczaj (1977), Pinker (1984), Marcus et al. (1992), inter alia).

Learning which sublexical features the target language marks is only part of the child's task. He or she must also learn to segment the word into its morphological constituents. In a language like English where the boundary between stem and plural is transparent and plural allomorphy is relatively straightforward, the transition from Stage 2 to the adult representation at Stage 3 may be rather abrupt. As the plural affix is segmented from the stem at this stage, plural formation should begin to show some degree of productivity, evidenced in part by the presence of overregularisations.

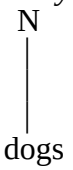
7.3. Inflection in the Impaired Subjects' Grammars

If, as hypothesized, the grammars of the SLI subjects under investigation lack (certain) sub-lexical features, then impaired individuals cannot get beyond the Stage 1 representation in the acquisition

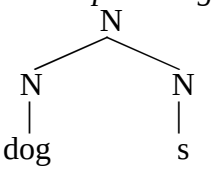
sequence outlined in (35). As a result, seemingly-inflected words should be stored as morphologically unanalysed chunks, as I have represented in (36a), with the notion of plural expressed at the level of conceptual structure. In this way, the grammars of these SLI subjects look like a grammar arrested at the earliest stage in acquisition (cf. Dalalakis 1996). However, a second option exists as well, one which suggests that SLI speakers can compensate for their impairment. As mentioned above, the boundary between stem and plural in English is transparent. If the impaired speakers are able to break apart the structure, they could store *-s* as a bound stem. Plurals which are built through the concatenation of noun stem and plural stem would then structurally resemble compounds. This is depicted in (36b), under the heading M-Compounding.

(36) *Impaired Representations:*

a. *Morphologically Unanalysed:*



b. *M-Compounding:*



The proposal that the grammars of the SLI subjects under investigation resort to M-Compounding is consistent with the privileged (i.e., unmarked) status that compounding has cross-linguistically. In some languages, again Chinese and Vietnamese, it is the only productive morphological process.[25]

From (36b), it can be seen that I assume that *-s* bears the lexical feature N. There are three arguments in favour of this view, two of which are theory-internal and one of which is empirical. We begin with the theory-internal arguments. Firstly, if plural-formation for the impaired subjects under investigation involves M-Compounding, which is consistent with the prosodic and segmental facts discussed, then the presence of N on *-s* is required, as compounding involves the concatenation of stems. Secondly, in the earlier discussion of unimpaired representations, it was mentioned that the lexical features N, V and A do not have to be learned; they are present from the onset of acquisition (see Stage 1 in (35a)) as they are arguably part of the grammars of all languages. It is possible, however, that this is where the impairment lies. In view of this, we turn to the empirical support for the presence of N on *-s*. Evidence that lexical features such as N are intact for the SLI subjects comes from the observation that they do not make cross-category errors; they do not, for instance, put past tense morphology on nouns or vice versa. This observation has been made for Greek subjects with SLI (see Dalalakis 1996), as well as for the English subjects under present investigation (Ullman and Gopnik 1994). Consequently, I suggest that the plural for the impaired subjects has the subcategorization frame in (37). Unlike the subcategorization frame for the unimpaired grammar provided earlier in (33), this frame lacks the sublexical feature [+plural].

(37) *-s* [[N] ___]; [N]

If the lexical entry for plural includes the information that *-s* is a bound stem which attaches at the right edge of N, we will not incorrectly predict that it will show the same distribution as true noun stems.[26]

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25. The morphological analysis proposed predicts that the impaired subjects should produce virtually no correct-sounding outputs for novel items on the wug test of Goad and Rebellati (1994; 1995) discussed here. Instead, they should resort to M-Compounding (among other strategies such as substituting phonetically-similar sibilant-final real words for plurals of novel stimuli). This prediction holds true; the mean percentage of correct-sounding outputs for the five subjects is 9.8%. I attribute these forms to analogy.

26. Before concluding this section, one final issue must be addressed. As an anonymous reviewer has pointed out, the phonological properties of inflectional affixes play an essential role in the child's ability to project sublexical features. In particular, the child has to notice a relationship

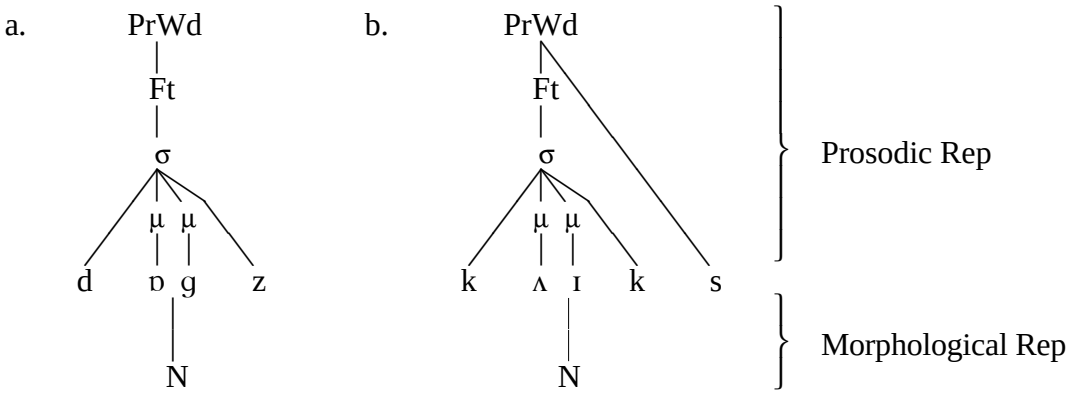
8. TWO ROUTES

In the preceding section, I proposed that the impaired individuals have two possible representations for plurals. They may be stored as morphologically unanalysed chunks, (36a), or they may be built through compensatory means and thereby structurally resemble compounds, (36b).[27] In Section 8.1, I will demonstrate how the prosodically natural and anomalous outputs discussed in Section 6.3 map onto the respective structures in (36). Evidence against the view that prosodically natural outputs are morphologically unimpaired and thereby map onto the unimpaired structure in (31a) is provided in Section 8.2.

8.1. Mapping between Morphological and Prosodic Structure

We begin with prosodically natural plurals, for example [dɒgz] 'dogs' and [kʌɪks] 'cakes', presented earlier in (29). I suggest that prosodically natural plurals are morphologically unanalysed; consequently, they map onto the structure in (36a). This is illustrated in (38).

(38) *Prosodically Natural Plurals:*



As can be seen from the prosodic representation in (38a), I have assumed that the 'plural' for CVX 'stems' is licensed as an extra-rhymal position, and not as an appendix. Recall from Section 6.2 that this would be the case in the unimpaired grammar if [dɒgz] were monomorphemic, as it is in

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between interpretation (e.g. plurality) and affix shape (e.g. [s/z/ɨz]). If the impairment lies at the level of segment structure, as opposed to prosodic or morphological structure, the two possibilities entertained here, then this might be what is responsible for the patterns observed in the data.

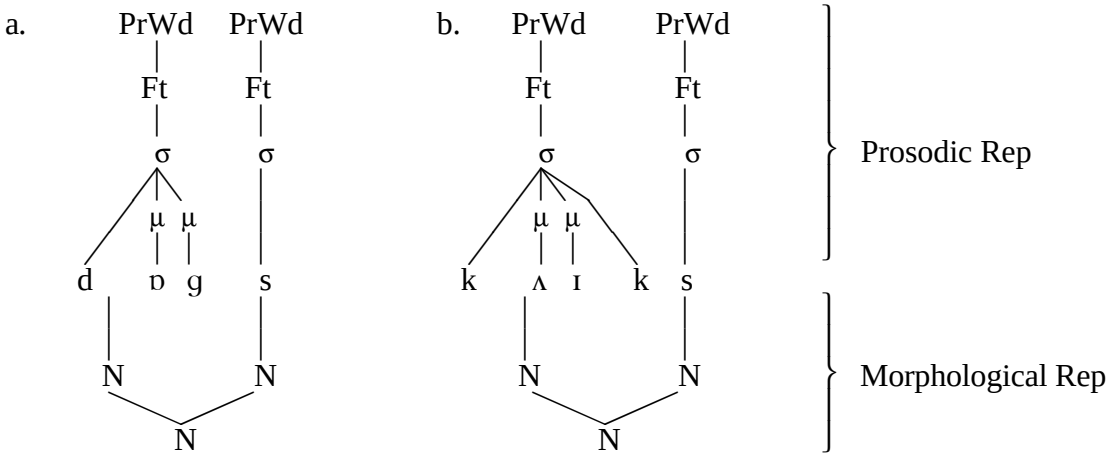
As I see it, an impairment in segment structure would prohibit the mapping between the segmental content of a morpheme and its interpretation, thereby resulting in the inability of impaired subjects to segment words into their various morphological constituents. In other words, plurals would be structurally monomorphemic (one option that I have suggested, but for different reasons). In contrast, I have proposed that segmentation is possible (although not necessary); the result is compound-like structures where unimpaired subjects instead have inflectionally-complex representations. If the problem were with segmentation, we would not expect the impaired subjects to be able to produce compound-like plurals for novel words, as such forms require the productive concatenation of novel stem and plural. Subjects should resort to omission and substitution of phonetically-similar real plurals significantly more often than compounding. The numbers, however, suggest otherwise. Averaged across the five subjects, we find the following profile for the novel stimuli on the wug test of Goad and Rebellati (1994; 1995): real word substitution: 10.2%; omission: 10.2%; prosodically anomalous outputs (i.e., M-compounding): 65.6%.

[27] Note that this two-route situation is not restricted to impaired individuals. Research in processing is consistent with the view that high frequency inflected forms can be both stored as chunks as well as built through the concatenation of stem and suffix.

the grammars of these impaired individuals. In the case of CVXC 'stems', however, 'plural' can only be licensed as an appendix. In this way, the representation in (38b) is identical to that for monomorphemic words such as [paɪnt] 'pint' which have super heavy rhymes (see earlier Section 5.3).

The prosodically anomalous plurals from (28), for example [dɒg.s] 'dogs' and [kʌɪk.s:] 'cakes', are morphologically compounds. Therefore, they map onto the structure in (36b). This can be seen in (39).

(39) *Prosodically Anomalous Plurals:*



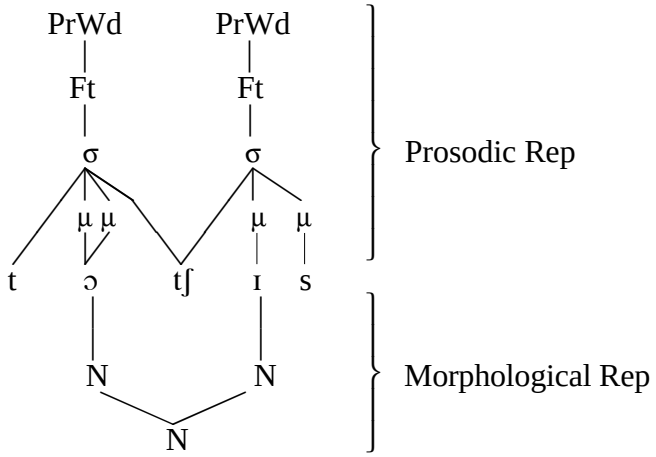
The prosodic structures in (39) are identical in relevant respects to that provided earlier in (10) for 'dogs' (Section 4.3). At that point, I suggested that a representation along these lines, where plural *s* defines a foot unto itself, would not arise solely because of a constraint on word shape akin to that proposed by Piggott and Kessler Robb (1994): the maximum size of a prosodic word is equivalent to the minimal word (one foot). The problem is that the foot which contains plural *s* is ill-formed. I suggested further that the footing in (39) could only arise to meet the demands of a higher-ranked constraint on morphological structure. This is precisely the situation that we have in the grammars of these SLI subjects. The absence of sublexical features means that an independent plural morpheme can only be represented as a bound stem. The concatenation of plural with a noun would thus yield a compound.

The prosodic facts discussed earlier in (18) for non-sibilant-final stems are entirely consistent with this analysis. At that point, I suggested that the plural defined its own prosodic domain in the grammar of the impaired individuals: the syllable. Recall from (18a) that, in the prosodically anomalous outputs, there was often a pause between stem and plural, e.g. [wɪʊ.s] 'wheels'; I suggested that the pause was present precisely because it corresponded to a syllable boundary. Secondly, in (18b), we observed that sonorant-final stems often show stem-final lengthening, e.g. [sʌn·s] 'suns'; again, this was expected if these consonants were at the right edge of a syllable. Thirdly, in (18c), we found that there was often no voicing assimilation between the stem-final consonant and plural, even in the case of stem-final obstruents, e.g. [dɒgs] 'dogs'; as obstruents do not need to agree in voicing over a syllable boundary in English, these plurals were not problematic under the heterosyllabic analysis. Finally, in (18d), we noticed that the plural often undergoes lengthening, e.g. [pɪts:] 'pits'; again, this was not seen to be surprising if the plural were to form its own syllable. Under the morphological compounding analysis, the plural, by definition, defines its own syllable, as is clear from (39).

We turn finally to consider prosodically anomalous plurals for sibilant-final stems. In Section 3.1, we observed that in these cases, the *-es* allomorph of the plural receives stress, e.g. [tɔ:tʃɪs] 'torches'. Recall that in order for the final syllable to bear stress, it must define its own foot. The M-Compounding analysis predicts this as well. Since compounds are composed of two

prosodic words and each prosodic word must minimally contain one foot, the correct stress pattern is obtained. See (40).

(40) *Prosodically Anomalous Plurals: Sibilant-final Stems:*



There is one feature of (40) that distinguishes it from the structures seen earlier in (39): the morphological boundary does not exactly coincide with the prosodic boundary. Instead, I have assumed that the medial consonant in [tɔ́:tʃɪs] is ambisyllabic. The absence of [ʔ]-epenthesis (*[tɔ́:tʃʔɪs]) reveals that [tʃ] does not belong (solely) to the leftmost constituent. When we compare similar forms in the unimpaired grammar — compounds where the second constituent begins with a vowel — it becomes clear that the ambisyllabic representation in (40) is not unmotivated. In a form like 'apple eater', for instance, the medial lateral is dark, [ʔǽpəɬ ìjtəˠ], indicating that it is syllabified as a coda (alternatively, it is in the nucleus). However, given that there is no epenthetic [ʔ] at the beginning of 'eater', as there would be if this word were said in isolation, we can conclude that [ɬ] is also syllabified as an onset, in spite of the fact that the ambisyllabic consonant straddles the prosodic word boundary.

8.2. Residual Issues: Morphologically Unanalysed Chunks

Thus far, I have suggested that plurals have two possible representations in the grammars of the impaired subjects under investigation, one which resembles compounding, and the other which is morphologically unanalysed. I suggested that the latter representation corresponded to those plurals which are prosodically natural. The following questions arise in this regard. What evidence do we have that there is no morphological structure internal to the prosodically natural outputs? How do we know that these forms are not instead represented as in the unimpaired grammar? In this final section, I will provide three types of evidence in favour of the position that prosodically natural plurals are morphologically unanalysed: frequency effects; evidence from on-line lexical decision tasks; and substitution of sibilant-final real words for plurals of novel stems (see Gopnik and Goad 1997 for further discussi1on of these issues).

8.2.1. Frequency Effects: Regulars vs. Irregulars

In the work of Pinker and his colleagues (e.g. Pinker and Prince (1988)), it has been observed that frequency affects the retrieval of words that are stored in the lexicon. There is an interesting dissociation between regulars and irregulars in this regard: frequency effects are not observed with regularly inflected words (but cf. note 27), only with irregulars. This dissociation lends support to the standard view that regularly-inflected forms are built — they are not stored in their inflected form — whereas irregulars are stored as such. In a sentence completion task conducted on the same subjects as discussed in the present paper, frequency effects were observed

with *regularly*- as well as irregularly-inflected past tense forms (Ullman and Gopnik (1994)). Specifically, the probability that impaired individuals would provide a correctly-inflected form was dependent on the frequency of the existing past tense form. This observation strongly suggests that regulars and irregulars are represented in the same fashion in the lexicons of impaired subjects; both are stored without internal morphological structure, along the lines of (36a).

8.2.2. Lexical Decision Tasks: Inflected vs. Uninflected

Further support for the hypothesis that regularly inflected forms do not contain internal morphological structure comes from the on-line processing experiments conducted by Kehayia (1997) on the same subjects as discussed in the present paper, as well as on other English-, French- and Greek-speaking impaired individuals. Kehayia has observed that, in lexical decision tasks, impaired subjects process inflected forms in a manner different from unimpaired controls. For unimpaired speakers, reaction times are significantly longer for inflectionally complex forms than for uninflected stems. The standard interpretation of this observation is that the morphology must be stripped, and this adds to processing time. In the impaired population, however, reaction times for inflected forms are not significantly different from reaction times for uninflected forms. This finding strongly suggests that inflectionally complex outputs are accessed as if they are monomorphemic; in other words, there appears to be no processing or decomposition of the inflectional suffix as observed in unimpaired controls. These results are compatible with the hypothesis put forward here, that regularly inflected forms, like bare stems, contain no internal morphological structure.

8.2.3. Real Word Substitution

We consider finally some evidence from the wug test of Goad and Rebellati (1994; 1995) in favour of the view that regularly inflected forms are stored as unanalysed. As discussed earlier, in this test, subjects were presented with a number of real and novel singular stems for which they were asked to provide plurals. For the novels, subjects often produced compound-like structures. However, another pattern that was observed was the substitution of a sibilant-final real word in place of the plural for the novel form. (The unimpaired controls resorted to substitution of real words extremely rarely.) Real word substitution is entirely consistent with the hypothesis that regularly inflected forms are stored as such in the lexicons of impaired individuals (Goad 1996b). Due to the inability of subjects to build plurals for novel stimuli in the unimpaired fashion, they instead search in their lexicons for sibilant-final words which are phonetically close to the target novel word. Most of the substitutes are existing plurals. However, we also find sibilant-final non-plural substitutes — verbs and uninflected stems — and even some substitutes which are not sibilant-final. The latter is not surprising as a 'last resort'. Typical examples of real word substitution are provided in Table 3.

TABLE 3
Real Word Substitution in the Wug Test of Goad and Rebellati (1994; 1995)

Type of Substitute	Novel Stimulus	Outputs
Plural Substitutes	[lʌnt]	'lunches'
	[kræd]	'crabs'
3sg Verb Substitutes	[spʌl]	'spells'
	[tʃætʃ]	'chats'
Other Sibilant-final Substitutes	[brɒm]	'bronze'
	[blʌɪʒ]	'blaze'
Non-sibilant-final Substitutes	[grɪi]	'green'
	[sʌʊdʒ]	'soldier'

8.2.4. Summary

In sum, frequency effects suggest that regularly-inflected forms and irregulars are stored in the same fashion in the lexicons of impaired individuals: like irregulars, regularly-inflected forms have no internal morphological structure. On-line lexical decision tasks reveal that regularly-inflected forms are accessed by impaired speakers in the same manner as uninflected forms; regularly-inflected forms look like bare stems in that they do not undergo morphological decomposition. Finally, real word substitution suggests that impaired speakers search their lexicons for regularly-inflected or other phonetically close substitutes; this is consistent with the hypothesis that regularly-inflected forms are stored without internal morphological structure.

9. CONCLUSION

In this paper, I have compared two accounts for the segmental and prosodic anomalies observed in SLI plurals, one prosodic and one mophological. The prosodic account proposed was that the grammars of the subjects under investigation do not tolerate indirect licensing by the prosodic word. While this account could capture a range of facts, it was rejected nonetheless. The greatest problem it faced was that it could not discriminate between anomalous outputs such as [dɒg.s] and natural-sounding outputs such as [dɒgz]. In view of this, a morphological account was proposed as follows: the grammars of these SLI subjects lack certain sub-lexical features, in particular [±plural]. Consequently, plurals must be built through compensatory means; they involve the concatenation of stems and thereby structurally resemble compounds, both morphologically and prosodically. The morphological account provided the SLI subjects with two options for plurals. One, as just mentioned, they can involve compounding; or two, plurals can be stored as morphologically unanalysed chunks. These two options were argued to be responsible for the prosodically-anomalous and natural-sounding outputs respectively.

As discussed in the introductory section, there is disagreement in the earlier research as to whether plural marking is impaired in SLI; while there is clearly a delay in acquisition, at the same time, the performance on plurals is often found to be higher than that on most other grammatical morphemes. This paper has taken a different approach to the question. The conclusion arrived at, that plural marking is indeed impaired, has come from an investigation of the segmental and prosodic shapes of plural outputs, rather than from the percentage of times that a plural-like element is produced in obligatory contexts. Whether the findings discussed here are characteristic of the SLI population in general or are instead limited to a subset of individuals remains to be investigated.

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