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Derivational morphology in children with Grammatical-Specific Language Impairment

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Abstract
Although it is well-established that children with Specific Language Impairment characteristically optionally inflect forms that require tense and agreement marking, their abilities with regards to derivational suffixation are less well understood. In this paper we provide evidence from children with Grammatical-Specific Language Impairment (G-SLI) that derivational suffixes, unlike tense and agreement suffixes, are not omitted in elicitation tasks. We investigate two types of derivation – comparative/superlative formation and adjective-from-noun formation – and reveal that G-SLI children supply these suffixes at high rates, equivalent to their language matched peers. Moreover, increasing the phonological or morphological complexity of the stimulus does not trigger suffix omission, although it results in non-target forms that are not characteristic of typically developing children. We discuss what these results reveal about the nature of the deficit in G-SLI within the context of three hypotheses of SLI: the Extended Optional Infinitive, Implicit Rule and Computational Grammatical Complexity Hypotheses.

Keywords: Morphology, derivational morphology, specific language impairment, grammatical-specific language impairment

Introduction
Aims and structure of the paper
Children with Specific Language Impairment (SLI) have significantly impaired language acquisition in the absence of any obvious language-independent cause, such as hearing loss, low non-verbal IQ, motor difficulties or neurological damage (e.g., Leonard, 1998). Their language deficit is not uniform: it is well-established that English-speaking children with SLI have particular difficulties marking tense and agreement. This deficit manifests itself in the production of bare stems in contexts that require inflected forms (Loeb & Leonard, 1991; Rice, Wexler, & Cleave, 1995; Oetting & Horohov, 1997; Ullman & Gopnik, 1999).
There is some debate over whether the deficit extends to other types of inflection such as plurality and the progressive (Oetting & Rice, 1993; Rice & Wexler, 1996; Leonard, Eyer, Bedore, & Grela, 1997; Montgomery & Leonard, 1998). In comparison to inflection, SLI children’s abilities in the realm of derivational morphology have received scant attention, although difficulties are reported (Dalalakis, 1994; Gopnik, 1999; Piggott & Kessler Robb, 1999; Ravid, Levie & Ben-Zvi, 2003). The aims of this paper are two-fold. Firstly, we examine whether derivational-suffix omission characterizes the grammar of SLI children in the same way that tense and agreement omission does. Secondly, we investigate whether increasing the phonological and inflectional complexity of the stimulus affects the omission of derivational suffixes.

The paper is structured as follows. In the remainder of this section we discuss previous research into the morphological abilities of children with SLI and some of the theories that have been proposed to account for these difficulties. We also introduce the characteristics of the particular subgroup of SLI children taking part in our study, the Grammatical (G)-SLI subgroup. In Experiment 1 we elicit comparative and superlative adjectives, while manipulating the phonological complexity of the stem. In Experiment 2 we elicit adjectives derived from nouns using the suffix –y and manipulate the inflectional complexity of the stimuli. In the subsequent general discussion we discuss what the results of these two studies reveal about the nature of the deficit in G-SLI.

Morphology in SLI

Within the SLI population as a whole, deficits have been diagnosed in syntax, morphology, phonology and the lexicon (Leonard, 1998). However, inflectional morphology is the best-studied aspect of the language deficit. Deficits in tense and agreement marking, which result in omission of past tense –ed, third person singular –s, be and do, are considered to be clinical markers for SLI (Rice et al., 1995; Rice & Wexler, 1996). Importantly, omission of these morphemes in obligatory contexts is only optional, and where they are supplied, they are generally supplied correctly. These findings have been replicated in many studies (Loeb & Leonard, 1991; Oetting & Horohov, 1997; Ullman & Gopnik, 1999; van der Lely & Ullman, 2001).

More controversial is whether the same pattern of optional omission holds for other inflectional suffixes. The progressive suffix –ing appears to be unimpaired (Montgomery & Leonard, 1998; Leonard et al., 2003). The status of plurality, however, is unclear (Oetting & Rice, 1993; Leonard et al., 1997; Goad, 1998).

Far fewer studies have been carried out on derivation as compared to inflection in SLI, reflecting a strong bias towards studies of inflectional morphology in the language acquisition field as a whole. What we do know is that compared to inflectional morphology typically developing children start to acquire derivation at an older age (Clark, 1998), and that they are later to use it productively (Berko, 1958). Many factors influence the rate of acquisition of suffixes, including frequency, semantic complexity, allomorphy and the existence of irregularity (Clark, 1998). Because derivational suffixes are more irregular and constrained, and the form-to-meaning is not always predictable, they are applied less consistently than inflections. For derivational morphemes, exposure to written language plays a significant role in acquisition (Nagy, Anderson, & Herman, 1987). It is possible then that derivation, being richer, less obligatory and more complex than inflection, could be diagnostic of linguistic abilities in older SLI children who have already mastered obligatory inflections (Ravid, Levie, & Ben-Zvi, 2003).
A series of studies by Windsor have investigated derivational abilities in children with SLI. In a study designed to test the effect of suffix productivity on the use of derivational suffixes, Windsor and Hwang (1999a) found that SLI children were less accurate in determining the meanings of derivational suffixes when compared to chronological age-matched control children, but showed no difference when compared to younger children matched on general language age. In an auditory lexical decision task, Windsor and Hwang (1999b) asked children with SLI to make decisions about real and pseudo derived words. Some of these words were phonologically transparent, in that the stress pattern and vowel quality of the base was not changed by the addition of the suffix (e.g., coatless, harshful). Others were phonologically opaque, in that the phonology of the base was changed by suffixation (e.g., acidity, dividic). Children with SLI showed subtle deficits in making lexical decisions about phonologically transparent derivatives compared to their chronological age-matched controls. They showed generally similar performance to the younger control group matched on language age, but had longer reaction times for phonologically opaque pseudowords. Because phonologically opaque pseudowords make both phonological demands and grammatical demands on the child (the suffix is attached to a base of the wrong grammatical category), the authors concluded that SLI children are vulnerable to increased processing demands.  

Gopnik and her colleagues have studied derivational morphology in children and adults from the KE family, half of whom have a non-specific form of language impairment (see Gopnik & Crago, 1991, and Vargha Khadem, Watkins, Fletcher, & Passingham, 1995, for details of this family). Dalalakis (1994) investigated comparative adjective formation and found that language-impaired members of the family had problems forming comparatives with –er (82% correct, compared to 93% for the controls (unimpaired family members)) and more (21% correct, compared to 97% for the controls), but she provides no statistical analysis to show whether their performance on –er was significantly lower than that of the controls. There is no separate error analysis for adjectives taking –er and for those taking more, although Dalalakis reports a low proportion of bare stem errors overall, of just 15%. Additionally, the same individuals were able to use the suffix –al to derive adjectives from nouns, as in margin → marginal and parent → parental (Piggott & Kessler Robb, 1999). In a further test of derivational morphology, with stimuli designed to elicit a wider range of suffixes such as –y, –ish, –ful and –ness, language-impaired members of the family performed worse than their controls (Gopnik, 1999). However, their most frequent errors consisted not of bare stem forms but of lexical substitutions, for example kind for thoughtful. Therefore it is unclear whether the language-impaired members of the KE family have a deficit in derivation that results in suffix omission.

Derivational morphology has also been studied in Hebrew-speaking SLI children. Although these children show good comprehension of novelly-derived nouns, they perform worse than language-matched controls on the production of novel nouns from verbs or nouns, and the production of novel adjectives from verbs and nouns (Ravid, Levy, & Ben-Zvi, 2003). It should be noted that not all derived Hebrew nouns and adjectives are formed by suffixation. Instead, many are formed by nonlinear root-and-pattern affixation, whereby a consonantal root is combined with a vocalic pattern (e.g., taken “fixer” = root t-k-n “fix” and pattern CaCaC “agent”). However, denominal adjectives are formed through –i suffixation. For adjectives formed in this way, Ravid et al. interpret the problems children have as being not so much with the suffixation but rather with semantic complexity, as the semantics of these forms is not always predictable. In sum then, we don’t yet know for certain whether children with SLI have difficulties with derivational suffixation itself, and this is the question that motivates the present study.
Hypotheses of SLI and their predictions for derivational morphology

We now consider three hypotheses that have been put forward to account for deficits in SLI: the Extended Optional Infinitive Hypothesis, the Implicit Rule Hypothesis and the Computational Grammatical Complexity Hypothesis (a development of the Representational Deficit in Dependent Relations Hypothesis). We also discuss the predictions that these hypotheses make regarding SLI children’s ability to use derivational morphology.

The Extended Optional Infinitive (EOI) Hypothesis claims that the syntactic features which mark tense and agreement inflection are maturationally delayed (Rice et al., 1995). Consequently SLI children experience a prolonged period in which both inflected and uninflected stems are acceptable forms in their grammar: “extended” because an optional infinitive stage is also characteristic of younger, typically developing, children. However, because derivational morphology is not part of the tense and agreement system, the EOI Hypothesis predicts that derivational suffixation will be unimpaired.

The Implicit Rule (IR) Hypothesis locates the deficit in the use of grammatical rules and morphological paradigms (Gopnik, 1999; Ullman & Gopnik, 1999). It claims that SLI children do not build normal representations in their grammar, and that they therefore cannot construct the rules that rely on those representations. Instead they have to rely on other strategies, such as memory and the learning of explicit rules, in order to create suffixed forms. In other words, suffixation is not the implicit and automatic process that it is for typically developing children. Importantly for our purposes, and in contrast to the EOI Hypothesis, the IR Hypothesis claims that the deficit affects derivational morphology (Gopnik, 1999).

A subgroup of older (aged 9 years and over) children with SLI, termed Grammatical (G)-SLI, have language difficulties that encompass the core aspects of grammar—syntax, morphology and phonology (van der Lely, Rosen, & Adlard, 2004; van der Lely, 2005). Like other children with SLI, those with G-SLI have difficulty marking tense (van der Lely & Ullman, 2001). Specifically, the G-SLI group lacks the advantage for regular over irregular forms shown by language-matched control groups, and unlike the controls, shows frequency effects for regular forms. Van der Lely and Ullman concluded that G-SLI children have an impaired inflectional suffixation rule, meaning that whereas typically developing children compose regular forms de novo from the verb stem and past tense morpheme, G-SLI children preferentially retrieve stored regular forms from the lexicon. Further evidence for the storage of inflected forms comes from an elicitation task whereby G-SLI children (but not their language-matched controls) produced regular plural forms inside compounds, e.g., *rats-eater (van der Lely & Christian, 2000). Because irregular nouns can legitimately be included in compounds, such as mice-eater, this evidence was interpreted as indicating that in the G-SLI grammar, regulars are stored just as irregulars are.

The deficit in G-SLI is not limited to inflection but extends to syntax and phonology. G-SLI children inconsistently manipulate core aspects of syntax such as the assignment of thematic roles to noun phrases, and coreference to pronouns and anaphors when only syntactic cues are available, and the production of questions requiring Wh-movement (van der Lely, 2005). Van der Lely claims that G-SLI children have a core deficit in the computational syntactic system (Representational Deficit in Dependent Relations Hypothesis). Specifically, the deficit is in structural syntactic dependencies which can be characterized by “Movement” (Chomsky, 1995), where Movement is defined as attraction by a feature for the purposes of feature checking. Whereas the basic operation “Move” is
obligatory in normal grammar, in G-SLI syntax it is optional. In other words, G-SLI syntax is characterized by “optional Movement” (van der Lely, 1998). The phonological deficit in G-SLI manifests as a difficulty with prosodic complexity (Gallon, van der Lely, & Harris, submitted; Marshall, Harris, & van der Lely, 2003). G-SLI children simplify consonant clusters, and are hypothesized to have impaired syllabic representations. They also have difficulties at the metrical level: the presence of unfooted syllables causes syllabic and segmental changes elsewhere in the word. \(^2\)

The Computational Grammatical Complexity (CGC) Hypothesis (Marshall, 2004; van der Lely, 2005) seeks to parsimoniously explain the wide-ranging deficits found in G-SLI. It locates the deficit in the representation of structural linguistic complexity at the syntactic, morphological and phonological levels. In its current form the CGC Hypothesis is agnostic as to whether the deficits in each of these three components of grammar are independent and highly likely to co-occur, or whether the deficit is in an aspect of complexity that is common to all three components. Deficits in the three components interact in the realization of tense, as regular tensed forms are syntactically, morphologically and (typically) phonologically complex (Marshall, 2004; van der Lely, 2005; Marshall & van der Lely, in press), which could be why deficits in tense marking are such a reliable marker for SLI.

Given that there is no evidence of a core lexical impairment in G-SLI, and derivation is a word-forming process, the CGC Hypothesis does not predict that derivational suffixation will be impaired in G-SLI children. So in this respect its predictions are similar to the EOI Hypothesis but different to the IR Hypothesis. However, the CGC Hypothesis goes further in the following way: it predicts that the deficits that G-SLI children have with inflectionally and phonologically complex forms will affect derivation—either by causing suffix to be omitted, or by causing suffixed, but otherwise untar Get-like forms, to arise. The aim of this paper is therefore to investigate three issues:

- Do G-SLI children omit derivational suffixes?
- Does phonological complexity affect derivational morphology?
- Does inflectional complexity affect derivational morphology?

Introduction to the experiments

In this paper we report two experiments designed to investigate derivational morphology. Each experiment had two aims:

1. To investigate whether derivational suffix omission characterizes G-SLI.
2. To investigate whether increasing the phonological or morphological complexity of the stem affects suffix omission.

Experiment 1 was designed to elicit comparative and superlative adjectives. We manipulated the phonological complexity of the stem, using stems consisting of either one (e.g., *short*) or two syllables (e.g., *heavy*). In Experiment 2 we elicited adjectives from nouns by the addition of *–y*, and manipulated the inflectional complexity of the stimulus by using stimuli that are either uninflected or inflected for plurality (e.g., *sand, stars*).

The morphemes *–er, –est* and *–y* were chosen because their acquisition is predicted to be relatively straightforward compared to other derivational morphemes. They are all transparent in the sense that the stem and suffix in forms such as *hotter, heaviest* and *sunny* are easily identifiable. When the suffix is added no phonological changes occur in the
stem, in contrast to the vowel change in deep-depth, the vowel and consonant changes in receive-reception, and the stress change in origin-original. In addition, the semantics of –er, –est and –y are predictable.

Importantly for the purposes of our study, these suffixes are also acquired early. Clark reports a child (D) who at the age of 2;02 added –y to all the adjectives in his vocabulary, producing forms such as darky and coldy, before adding it to nouns a few weeks later to produce forms such as crumby and cracky (Clark, 2003). Gathercole (1985) and Graziano-King (1999) show that –er is used before the age of 3;00, and that its use precedes that of the periphrastic (i.e., more+adjective) construction. Graziano-King and Cairns (under revision) have proposed a three stage process in the acquisition of comparatives. Until the age of about 6;00, children show no preference for producing either suffixed or periphrastic forms (stage 1). Because most of their input will consist of gradable monosyllabic adjectives, which are therefore suffixed, children between the ages of about 6;00–8;00 start to posit a suffixation rule, which they use productively and over-generalize to forms that are unlikely to be suffixed by adults (stage 2). However, the presence of forms in the input which do not take the suffix, for example multi-syllabic forms, causes children to become more conservative and to list the forms for which they have positive evidence of suffixation, thereby attaining a more adult-like grammar (stage 3). For our purposes, Graziano-King and Cairns’ data show that the typically developing children we investigate here (aged 4;06–10;02) can be expected to use –er with the stimuli we have chosen.

Experiment 1. Comparative and superlative adjective formation

Introduction

Experiment 1 is designed to investigate two issues:

1. Do G-SLI children omit the comparative and superlative suffixes at the high levels that they omit the past tense suffix?

2. Does increasing the number of syllables in the stem increase the rate of suffix omission for G-SLI children?

The theoretical reason for investigating the first of these issues should be clear—we want to clarify whether derivational suffix omission is characteristic of G-SLI grammar in the same way that tense and agreement omission is. The second issue requires more motivation, however.

Comparative and superlative suffixation, while very productive, is phonologically conditioned: on the whole –er and –est attach to one-syllable gradable adjectives and to two-syllable gradable adjectives that have strong-weak stress (e.g., happier but *contenter). There are only a few, high frequency, irregulars (e.g., good → better, bad → worse). For non-gradable adjectives, two-syllable adjectives with weak-strong stress and those longer than two syllables, the phrasal route (e.g., more real, more content, most adorable) is used.

The output of derivation of a two-syllable stem (e.g., happy) is a three-syllable word with strong-weak-weak stress (e.g., happier). Not only is such an output longer than that derived from a one-syllable stem (e.g., sadder), but its metrical structure is more complex in that the final weak syllable is unfooted, attached directly at the word level. In the two-syllable sadder, in contrast, the suffix can be incorporated into the trochaic foot with the stem. There is evidence from two previous studies to suggest that individuals with language impairments have difficulty producing three-syllable forms. Piggott and Kessler Robb
(1999) asked members of the KE family to inflect two-syllable nouns with the derivational suffix -al, as in margin → marginal; parent → parental. Although impaired family members managed to do this as easily as their unimpaired controls, examination of the prosody of the derived forms showed differences between the two groups. Whereas, in the vast majority of cases, the controls kept stress on first syllable of the derived word, impaired subjects produced a range of prosodic anomalies, including compound stress on the suffix (e.g., /riˌdʒən#nu/ for regional), the insertion of an extra syllable before the suffix (e.g., /φe.νιn.ʔu.ro/ for fragmental) and stem truncation (e.g., /pe.ʔi/ for personal). The authors suggest that a maximal word constraint limits the maximal size of the stress domain to the foot.

In a second study relevant to our own, Wauquier-Gravelines, Jakubowicz, Sauzet, Durand, and Franc (1997) investigated agentive derivation in French, as when /f[tɛl (chante “sing”) becomes /f[tɛsw] (chanteur “singer”). Eight SLI children aged 5;07–13;00 participated in the study. The authors were interested in whether the children could supply the correct consonant between stem and suffix in those verbs where the stem-final consonant is latent. Latent consonants are only heard when a vowel-initial suffix, in this case /eʃ/ is added, e.g. /dɔʁ/ (dort “sleep”) → /dɔʁmæʃ/ (dormeur “sleeper”). Additionally, the syllable number of the target, whether two or three, was found have an effect on production. On occasion, a three-syllable target was reduced to two syllables, whereas two-syllable targets were produced with the correct number of syllables. Unfortunately no examples of outputs are given, and nor are error types clearly defined. It is therefore unclear whether the reduction of what should be a three-syllable output comes from the suffix being omitted or the stem being truncated.

Other studies suggest that weak syllables are commonly omitted by SLI children in non-derivational contexts, as they are by younger typically developing children (Allen & Hawkins, 1978; Demuth, 1996). Sahlen, Reuterskiold-Wagner, Nettelbladt, and Radeborg (1999) found that when Swedish-speaking children with SLI repeat words and non-words, they omit more unstressed syllables in weak-strong positions than in strong-weak positions. Similarly, Bortolini and Leonard (2000) studied a group of English-speaking SLI children who omitted word-initial weak syllables from real words on approximately 90% of occasions.

The picture is slightly different for children with G-SLI. Work by Marshall, Ebbels, Harris, and van der Lely (2002), Marshall (2004) and Gallon et al. (submitted) reveals that in a non-word repetition task where non-words are systematically varied according to metrical complexity, G-SLI children repeat non-words with unfooted syllables less accurately than when all syllables are footed. However, Marshall (2004) has also shown that the group of G-SLI children participating in the present study rarely delete final unfooted syllables.

At first glance, then, it seems unlikely that G-SLI children should omit the suffix in a strong-weak-weak output for phonological reasons, as they are able to produce final unfooted syllables. However, there is one fundamental difference between non-word repetition and the derivational processes being tested here—in the former the output is required to have the same metrical structure as the input, whereas in the latter the output has a different metrical structure. In other words, the derived word has to be generated using the speaker’s knowledge of phonological structure. Under the circumstances of derivation we might expect maximal word effects to emerge. Assuming in line with the standard acquisition literature that the maximal word in English is the trochaic foot (Allen & Hawkins, 1978; Gerken, 1994; Demuth & Fee, 1995), we predict pressure to produce a strong-weak output. While this maximal word constraint would be inactive under
circumstances such as non-word repetition when the input already contains an unfooted syllable, the constraint could become active in certain circumstances, for example during morphology.

If we predict maximal word effects on the output, then what should that output be? Pater and Paradis (1996) and Pater (1997) report that for spontaneously produced three-syllable words, typically developing children retain the first and third syllables, as in broccoli → /bakɪ/, buffalo → /baʃo/, sesame → /sɛmi/, cinnamon → /ˈsɪmən/ and tricycle → /ˈtwɑɪkl/. Although the final rhyme and word-final consonant seem to always be preserved, the second onset appears to be chosen on the basis of sonority—the one with the lowest sonority is the one that is generally retained. Kehoe (1999) likewise reports this pattern of first and third syllable preservation.

If maximal word effects act on derived forms, and if the shape of the output is determined solely by phonological pressures, then we expect the suffix to be retained, in line with the morphemically simplex words above. However, if there is an interaction with morphology, we expect the suffix to be dropped, and the output to consist solely of the stem. In order to check that the suffix omission in this case is due to maximal word effects rather than to a deficit in morphology, we need to compare performance on one- and two-syllable stimuli. If maximal word effects are in operation, suffix omission will be higher for the two-syllable stimuli. None of the words in Pater (1997), Pater and Paradis (1996) or Kehoe (1999) are suffixed, so we cannot be sure whether to expect stem truncation or suffix omission in typically developing children. However, if G-SLI children manifest a deficit in derivational suffixation, just as they do in tense suffixation, then we expect maximal word effects to be expressed through suffix omission.

**Method**

**Stimuli and procedure.** The stimuli consist of 10 monosyllabic and 10 disyllabic strong-weak adjectives. Five of the disyllabic adjectives are morphologically decomposable in that their truncated stem is a semantically-related word in its own right (hairy, funny, curly, muddy, dirty) and five are non-decomposable (happy, silly, tidy, narrow, heavy). This enables us to investigate whether children of any group are more likely to truncate a stem when that first syllable could stand on its own as a semantically-related word. We might predict that *mudder* would be produced more often than *heaver* because mud is a word in its own right whereas *heav* is not.

The child is shown three pictures on a page (see Figure 1). The examiner points to each picture in turn and elicits the adjectives as follows: e.g., “This snake is short, this snake is even

Figure 1. Example of stimulus pictures for Experiment 1.
This is standard methodology for eliciting suffixed forms from young children, and it has also been successfully used in studies of SLI (Berko, 1958; Dalalakis, 1994; Leonard et al., 1997; Rice & Wexler, 2001). There were two practice items, for which corrections were provided if needed. See Appendix B for the list of stimuli. The stimuli were randomized and one list created for all the participants. Note that the one-syllable stimuli have higher frequencies of occurrence than the two-syllable stimuli, and that stem frequencies are higher than comparative frequencies, which are in turn higher than superlative frequencies.

Participants. Twelve children with G-SLI, aged 9;10–16;08 (mean age 12;01), participated in this experiment. The G-SLI children were selected on the basis of a persistent deficit in grammatical production and comprehension, as revealed by both standardized language tests and tests designed specifically to target the difficulty with complex syntactic structures that characterizes this group. The precise selection criteria for the G-SLI subgroup are well-documented and so will not be repeated here (see van der Lely, 1996; 1997a; 1997b; 1998; 2005; van der Lely & Stollwerck, 1997; van der Lely, Rosen, & McClelland, 1998). Note, however, that all these children have a diagnosis of SLI from a qualified speech and language therapist and are receiving speech and language therapy, either in special language schools or in language units in mainstream schools. They are aged 9;00 years and over, and have non-verbal IQs of 85 and above as measured by the Ravens Progressive Matrices (Raven, 1998) or the British Ability Scales (Elliott, 1996). Lexical impairments do occur in the G-SLI sub-group, but are considered to be a secondary consequence of difficulties in using syntactic cues to learn new lexical items (van der Lely, 1994). These children do not have articulatory deficits, but many have phonological impairments that affect prosodic structure (Marshall et al., 2003; Gallon et al., submitted). See Appendix A for details of individual participants. The extent to which G-SLI is a qualitatively different sub-group of SLI is an empirical issue to which this paper contributes.

Because of the wide range in language abilities demonstrated by the G-SLI group, and the discrepancy within individuals between grammatical and vocabulary abilities, each G-SLI child was individually matched to two typically developing children. 12 typically developing children were individually matched to G-SLI children on raw score (±1) obtained on a test of grammar comprehension (Test of Reception of Grammar, TROG (Bishop, 1983)). A further 12 typically developing children individually matched to G-SLI children on raw score (±3) obtained on a test of vocabulary comprehension (British Picture Vocabulary Scales, BPVS (Dunn, Dunn, Whetton, & Burley, 1997)). In order to get a picture of typical development, these control children were divided into two groups according to age. The Language Ability 1 (LA1) control group are aged 4;06–6;11, with a mean age of 5;09, and the Language Ability 2 (LA2) control group are aged 7;00–10;02, with a mean age of 8;09. Group participant details are shown in Table I.

Coding of the responses. Responses were coded as follows:

1. Correct e.g., silly → sillier, silly → silliest
2. Bare stem e.g., silly → silly
3. Stem truncation e.g., tidy → tider, muddy → muddest
4. More/most+bare stem e.g., funny → more funny
5. Others e.g., curly → fluffiest, silly → silliness, heavy → more heaviest
Semantic substitutions, selection of the wrong suffix and double marking through the use of more/most with a suffixed form, are all classified as “other” errors. As the aim of this analysis is to focus on maximal word errors, we consider three types of errors that are plausibly caused by possible maximal word constraints—bare stem, stem truncation, and more/most + bare stem. Note that the use of more/most with a bare stem is not strictly speaking an error, given that the comparative or superlative is marked, but it is the inappropriate choice of construction for an adjective of this particular phonological shape.

Results

All participants understood the task, and completed it quickly and fluently. The scores for the number of correct items are given in Table II.

Correct performance was investigated with a 3 (Group: G-SLI, LA1, LA2) × 2 (Suffix: -er, -est) × 2 (Syllable number: 1, 2) ANOVA, carried out by subjects. The analysis revealed significant main effects of group, F(2, 33) = 3.462, p = .043 and syllable number, F(2, 33) = 8.593, p = .006, reflecting worse performance on two-syllable stimuli. The main effect of suffix was not significant, and nor were any of the interactions. Post-hoc comparisons (Bonferroni-corrected) revealed that the G-SLI group performed significantly worse than the LA2 group, t (23) = -2.2917, p = .040, but no differently to the LA1 group, t (23) = - .8958, p = .364. There was no significant difference in performance between the two control groups, t (23) = -1.3958, p = .364.

Because the analysis revealed no main effect of suffix and no interactions involving × suffix, -er and -est are conflated in the analysis that follows. The finding that there are significantly fewer correct responses for two-syllable stimuli suggests that maximal word effects are present. In order to test this hypothesis, we carried out an error analysis.
Error scores are shown in Table III. Because one of the error types, stem truncation, is not possible with one-syllable stimuli, it is not possible to carry out a group $\times$ error type $\times$ syllable number ANOVA. A 3 (Group: G-SLI, LA1, LA2) $\times$ 3 (Error type: bare stem, stem truncation, more/most+ bare stem) ANOVA within just the two-syllable stimuli reveals a significant group $\times$ error type interaction, $F(2, 33)=3.822, p=.007$, and we now investigate each of these error types in turn.

For the bare stem errors on two-syllable stimuli, a one way ANOVA by group reveals that the main effect of group does not reach the significance level, $F(2, 33)=2.987, p=.064$, indicating no real group differences in bare stem error production within two syllable stimuli. For stem truncation errors, a one way ANOVA reveals a significant group effect, $F(2, 33)=4.579, p=.018$. Post-hoc comparisons (Bonferroni-corrected) reveal that the G-SLI group make marginally more of these errors than the LA1 control group, $t (23)=3.917, p=.059$, and significantly more than the LA2 group, $t (23)=4.417, p=.028$. This indicates that only the G-SLI group respond to maximal word effects by producing stem truncation errors. For more/most+ bare stem errors, a one way ANOVA within the two-syllable stimuli showed no main effect of group.

The question remains as to whether any of the groups are producing more bare stem forms with two-syllable stimuli. A 3 (Group: G-SLI, LA1, LA2) $\times$ 2 (Syllable number: 1, 2) ANOVA revealed no significant main effects of group or syllable number, but a significant group $\times$ syllable number interaction, $F(2, 33)=3.413, p=.045$, indicating that the groups produce different numbers of bare stem errors as a function of syllable number. To investigate this interaction further, t-tests within each subject group revealed that only the LA1 controls produced significantly more bare stem errors for two-syllable compared to one-syllable stimuli, $t (12)=-1.827, p=.050$ (1-tailed). This indicates that the LA1 controls, but no other groups, make bare stem errors in response to maximal word effects.

To check whether any of the groups produce more more/most+ bare stem errors with two-syllable stimuli, a 3 (Group: G-SLI, LA1, LA2) $\times$ 2 (Syllable number: 1, 2) ANOVA was carried out. This revealed no significant main effects of group or syllable number, and no significant group $\times$ syllable number interaction. However, the G-SLI group does produce more of this type of error than the controls on both one- and two-syllable stimuli. Although the results are not significant, this is potentially an important phenomenon, suggesting that the syntactic route of comparative and superlative formation would be worth investigating in further work.

One obvious question at this point is whether children of any group are more likely to truncate a stem when that first syllable could stand on its own as a semantically-related word. For example, is a form like *mudder, where mud is a word in its own right, produced more often than *heaver? Table IV shows the number of stem-truncation errors.

<table>
<thead>
<tr>
<th>Error type</th>
<th>G-SLI</th>
<th>LA1 controls</th>
<th>LA2 controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare stem</td>
<td>Mean 2.08</td>
<td>.83</td>
<td>.83</td>
</tr>
<tr>
<td></td>
<td>(SD) (.582)</td>
<td>(1.95)</td>
<td>(1.95)</td>
</tr>
<tr>
<td>Stem truncation</td>
<td>Mean 22.08</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>(SD) (33.74)</td>
<td>(.0)</td>
<td>(.0)</td>
</tr>
<tr>
<td>More/ most+ bare stem</td>
<td>Mean 5.00</td>
<td>3.33</td>
<td>.00</td>
</tr>
<tr>
<td></td>
<td>(SD) (9.29)</td>
<td>(6.15)</td>
<td>(.0)</td>
</tr>
</tbody>
</table>

Table III. Experiment 1: Error types displaying maximal word effects, expressed as a percentage of total responses, comparatives and superlatives together.
apportioned to the decomposable and non-decomposable group. Thus G-SLI children truncate stems whether or not what remains of the stem is a word, but a t-test indicates that decomposable stems are more likely to be truncated than non-decomposable ones, \( t(11) = 2.708, p = .020 \). The LA children do not make enough stem truncations for statistical analysis to be reliable, but they too show a preference for truncating the stem when a real word results from that truncation. While the finding that G-SLI children are more likely to truncate on decomposable stems suggests, at least in part, a lexical effect on errors, the finding of such large numbers of truncations on non-decomposable stems indicates that stem truncations also have a phonological cause.

### Discussion

The G-SLI group makes very few suffix omissions overall, indicating that derivational suffixation is relatively intact compared to past tense suffixation. Both the G-SLI and LA1 groups will on occasion reduce a three-syllable output to a two-syllable output. In other words, there is pressure to limit the output to the size and shape of a trochaic foot. This maximal word effect is present in both groups, but they respond differently. For the G-SLI group, the favoured strategy is to truncate the stem and retain the suffix, whereas for typically developing children the favoured strategy is to omit the suffix and retain the stem-final weak syllable. This indicates that the derivational suffix is more vulnerable to omission in typically developing children aged 4;06–6;11 than it is in G-SLI children.

A possible explanation is that G-SLI children are more sensitive to the semantic content of the suffix than their younger controls, and therefore retain it for semantic reasons. It would be informative to compare these results to those of strong-weak verbs taking the syllabic past tense suffix, e.g., *merit (ed)*, *ballot (ed)*. Although these outputs are also strong-weak-weak, we predict that in these cases the suffix will be omitted, in line with the results for other past tense regular verbs (van der Lely & Ullman, 2001; Marshall, 2004). However, it is very difficult to find stimuli for this sort of task. Verbs such as *merited* and *balloted* have very low frequencies in child-directed speech and are not acquired early in life, and so the study is not feasible.

### Experiment 2. Adjective-from-noun formation

#### Introduction

This second experiment is designed to elicit adjectives derived from nouns by the addition of \(-y\) (whose semantics mean “having the characteristics that the noun refers to”) with the aim of investigating two issues:

1. Does the derivation of adjectives from nouns provide additional evidence for the relative intactness of derivational suffixation in G-SLI? In other words, is the \(-y\) suffix used in this context, as \(-er\) and \(-est\) are, or is it omitted, as the past tense suffix is?
2. What is the impact on derivation of increasing the morphological complexity of the stimulus?

Given the very low rates of suffix omission in Experiment 1, we predict that G-SLI children’s omission rate of –y will likewise be very low. We manipulate the inflectional complexity of the noun stimulus: the noun is either uninflected (e.g., rain → rainy) or inflected for the plural (e.g., spots → spotty). Note that the adjective derived from spots loses the plural suffix when –y is added. This is an instance of the general rule that inflectional morphology generally does not occur within derivational morphology.

Relevant here is the observation that inflectional morphology cannot occur within compounds either (Kiparsky, 1982; Pinker, 1999). Irregular plurals can appear inside compounds but that regular plurals cannot, causing, for example, mice-eater to be more felicitous than *rats-eater. Pinker (1999) has proposed that irregular forms are stored in the mental lexicon whereas regular inflected forms are generated by rule. The rule governing the formation of inflected words applies after the rule governing compound formation. Given these assumptions, it follows that irregular plurals, but not regulars, can enter into compounding. Gordon (1985) found that even children as young as 3 to 5 years old are sensitive to the distinction between regulars and irregulars inside compounds.

Based on lexical frequency effects found for regular past tense forms (van der Lely & Ullman, 2001), van der Lely and Christian (2000) hypothesized that G-SLI children store regularly inflected words in the lexicon. If this is the case, then Pinker’s model predicts that G-SLI children should use regular plurals as well as irregulars inside compounds, given that both will be in the lexicon and available for compounding. Van der Lely and Christian found that this was indeed the case for the majority of the G-SLI children that they tested. These children frequently produced forms such as *rats-eater whereas their language matched controls very rarely did, suggesting that G-SLI children store inflected forms in the lexicon.

Derivational morphology, like compounding, is proposed to take place in lexicon. The derivation of adjectives from nouns by addition of –y can only apply to uninflected stems. A dress covered with lots of spots may be described as spotty but not *spotsy, even though something that is spotty must have more than one spot. Similarly a sea with lots of waves is wavy rather than *wavesy even though one wave does not make a wavy sea. However, if G-SLI children store plural forms such as spots and waves in their lexicon, then presumably they will have these plurals available for suffixation, and will produce forms such as *spotsy and *wavesy. On the other hand, typically developing children very rarely, if ever, will.

There is a second explanation for forms such as *spotsy and *wavesy. An alternative to level ordering is the theory that affixes have selectional requirements (Fabb, 1988; Plag, 1999, 2001). According to Fabb (1988), adjective-forming –y never attaches to an already-suffixed word. Although Fabb discusses only derivational suffixes, this restriction presumably holds for inflectional suffixes too, and therefore –y will not attach to a word ending in –s. Hay (2002) has developed a psycholinguistic model of selectional requirements, whereby constraints on the processing of morphological structure determine which suffixes will attach to which. For example, less parsable affixes cannot attach to more parsable affixes. Our interpretation of Hay’s proposal is that –y is less parsable than –s because –s is less likely to be analysed as being part of the stem, e.g., the final clusters of curls, spots and clouds are not found in monomorphemic words. Therefore –s (more parsable) cannot appear within –y (less parsable). Any child who is unable to parse the plural suffix will treat it as part of the stem, and produce plurals inside –y.
Method

Stimuli and procedure. The experiment was a simple elicitation task. The child was shown pictures, one on each page of a booklet (see Figure 2). The lead in sentence, spoken by the examiner, was of the format This fish has lots of scales. The next sentence, also spoken by the examiner, was designed to elicit the adjective, for example This fish is very _______. Two practice stimuli were presented and corrections given if necessary. There were 20 test stimuli, 10 with uninflected nouns and 10 with plural nouns. See Appendix C for the list of stimuli. The stimuli were randomized and one list order was created for all participants. Note that adjectives derived from uninflected stimuli have higher frequencies than those derived from plural stimuli.

Participants. The same participants participated in this study as in the comparative/superlative study. See Table I for details.

Coding of the responses. Responses were coded as follows:

1. Correct e.g. sun → sunny, spots → spotty
2. s inside -y e.g. rocks → rocky
3. (applies only to plural stimuli) e.g. hair → hair, frills → frill, spots → spots
4. Bare stem e.g. wool → fluffy, fur → furdy, rocks → rockily, holes → no response
5. Others

Results

All subjects understood the task and completed it quickly and fluently. The results are shown in Table V.

We first analysed correct responses for the three groups on both types of stimuli using a 3 (Group: G-SLI, LA1, LA2) × 2 (Plurality: uninflected, plural) ANOVA by subjects. This revealed main effects of group, F(2, 33)=4.529, p=.018, and plurality, F(1, 33)=4.233, p=.048, and a significant group × plurality interaction, F(2, 33)=5.903, p=.006.

Further one-way ANOVAs were used to unpack the group × plurality interaction. A one-way ANOVA within the uninflected stimuli revealed no significant effect of group, F(2, 33)=1.715, p=.196. However, a one-way ANOVA within the plural stimuli did reveal a
significant effect of group, $F(2, 33) = 6.098, p = .006$. Post-hoc comparisons (Bonferroni-corrected) showed that the G-SLI group perform worse than both the LA1 controls, $t(23) = -2.333, p = .022$, and the LA2 controls, $t(23) = -2.583, p = .010$. t-tests comparing performance on uninflected and plural stimuli revealed that only the G-SLI group showed a significant difference in performance on the two sets of stimuli, with fewer correct responses for the plural than the uninflected, $t(11) = 2.916, p = .014$.

The mean percentage errors shown in Table V indicate that bare stem errors are very rarely produced by any of the groups, and therefore a statistical analysis of these errors is not possible. A second error type, the $-s$ inside $-y$ response, is only relevant for plural stimuli. This error type occurs at very low levels in the LA1 group and not at all in the LA2 group, again making statistical analysis inappropriate. However, the G-SLI group produce the $-s$ inside $-y$ error more frequently than their language-matched controls.

**Discussion**

As was the case for the comparative and superlative suffixes investigated in Experiment 1, the results of this experiment reveal that G-SLI children only very rarely omit the derivational suffix $-y$. Furthermore, our results show that some G-SLI children include the inflectional suffix $-s$ inside $-y$ when presented with a plural stimulus, whereas typically developing children very rarely do so. Not every G-SLI child makes this error; only four do so, including the youngest in the group (Child BD, 9;09) and the oldest (Child CM, 16;08). Their errors are:

1. Child GD  holesy, frillsy, scalesy, starry
2. Child CM  holesy, frillsy
3. Child SM  frillsy, scalesy
4. Child BD  rocksy, stripesy

Note that the majority of the targets for which this occurs (holey, frilly, scaly, starry, stripy) have very low frequencies, of 0 or 1 (see Appendix C). Higher frequency adjectives, such as curly and cloudy, are presumably more likely to be lexicalized, and therefore to be produced correctly.

The $-s$ inside $-y$ error plausibly arises from the child not analysing the plural input as being morphologically complex. Note that on some occasions where $-s$ is included, it could be because the phonotactics mean that the inflection could be interpreted as part of the
stem, e.g., stars, rocks. The higher incidence of –s inside –y errors in the G-SLI group could indicate that some have difficulty with morphological parsing.

Rates of – inclusion are lower than in van der Lely and Christian’s compounding experiment, where G-SLI children produced forms such as *rats-eater (8.33% in our experiment versus 35% in theirs). Not only are the rates lower, but a smaller number of children make this error (4/12 versus 14/16). These differences could arise because the outputs of adjectival derivation are likely to be lexicalized, whereas it is extremely unlikely that compounds such as rat-eater and mice-eater are lexicalized. In our derivation experiment there are two ways of producing the correct item—productive derivation and retrieval of the lexical item from the lexicon. In the compounding experiment the only available option is presumably productive word formation.

Discussion

The first finding to come out of this study is that G-SLI children very rarely omit derivational suffixes. Overall, their omission rate for –er and –est is 1.46%. Their omission rate for –y is likewise low, at 2.08%. These figures are a fraction of the rate seen for past tense suffix omission (21.88%) in the same group of G-SLI children (plus two additional G-SLI children, Marshall and van der Lely (in press)). The second finding is that phonological and inflectional complexity in the stimulus causes non-target outputs to be produced. In comparative and superlative formation, three-syllable outputs are on occasion reduced to two-syllable outputs. In adjective derivation from nouns, some G-SLI children include the inflectional suffix –s inside –y when presented with a plural stimulus.

Given that the control groups show high levels of performance in both Experiments 1 and 2, it would be informative to carry out the same tasks children younger than those tested here. Of particular interest is whether they would make the same errors shown by the G-SLI children, i.e., stem truncation errors for comparatives and superlatives, and –s inside –y errors. This would give insight into whether G-SLI children display delayed but otherwise normal language development, or whether their linguistic representations are qualitatively different from those of typically developing children.

We argue that our results cannot be accounted for by the Extended Optional Infinitive Hypothesis, which makes no predictions about either derivational morphology or the interaction of components of grammar that lie outside the tense and agreement system. It is possible that our results could be accounted for by the Implicit Rule Hypothesis, which would explain successful suffixation as the result of an explicitly applied rule and/or the retrieval of derived forms from the lexicon. However, it is not clear that the Implicit Rule Hypothesis would predict the large discrepancy between tense omission rates (high) and derivational suffix omission rates (almost zero) that we find in our G-SLI participants.

Instead, our results are consistent with a model whereby children with G-SLI have deficits in different components of grammar—syntax, phonology, inflectional morphology. This model, the Computational Grammatical Complexity (CGC) hypothesis, proposes that the deficits lie in the formation of complex hierarchical structures within each of these components (Marshall, 2004; van der Lely, 2005). These deficits can impact individually on responses to linguistic tasks (such as wh-question formation, van der Lely and Battell, 2003, and non-word repetition, Marshall et al., 2003; Gallon et al., submitted) or can impact in interaction with one another (regular past tense formation, van der Lely, 2005). Even when an aspect of language is not impaired, as is the case with derivational suffixation, linguistic complexity in components that are impaired can impact on the output.
to create non-target forms that may not be characteristic of younger, typically developing children.

An important finding is that even when G-SLI children have to add a derivational suffix to a stem that is phonologically or inflectionally complex, they very rarely omit that suffix. Our results strongly suggest that the difficulties that G-SLI children have with tense omission are not present in derivation. Note, however, that we are not claiming that derivation is unimpaired in G-SLI. The greater number of more/most+bare stem errors in the comparative/superlative experiment and the greater number of “other” errors in the adjective-from-noun experiment, most of which were semantic substitutions (e.g., wool → fluffy) suggests that the group does have difficulties with derivation in comparison to their language-matched peers, affecting, for example, the retrieval of derived forms that are stored in the lexicon. What is clear, however, is that G-SLI children do not have difficulty with actual derivational suffixation. It remains an open question as to whether SLI children with different language profiles to the G-SLI group, and those who are younger, are able to use derivational suffixes consistently.

We conclude that G-SLI children, despite a persistent deficit in past tense suffixation, are not impaired in derivational suffixation of the types explored here. However, phonological and inflectional complexity impact on the products of derivation, resulting in outputs that are not typical of normally developing children. The findings from this study provide further support for the Computational Grammatical Complexity model of G-SLI.

Acknowledgements

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Notes

1. Note that this form of language impairment is non-specific in that it is accompanied by verbal dyspraxia, and so it is not clear how far the research findings and the hypotheses proposed to account for them generalize to SLI.
2. Unfooted syllables lie outside the trochaic foot, as in the non-word bœ±{dœ±pa}ri, where unfooted syllables lie to the left and right of the trochee {dœ±pa}.

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Current Biology, 8, 1253–1258. 
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Science, USA, Psychology, 92, 930–933. 

Appendix A

G-SLI group: Individual participant details

<table>
<thead>
<tr>
<th>Code</th>
<th>Age</th>
<th>TROG score Raw (z-score)</th>
<th>BPVS score Raw (z-score)</th>
<th>Non-verbal IQ * Standard (z-score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM</td>
<td>13;09</td>
<td>16 (−1.3)</td>
<td>92 (−1.6)</td>
<td>107 (.47)</td>
</tr>
<tr>
<td>GD¹</td>
<td>14;03</td>
<td>17 (−.7)</td>
<td>92 (−2.2)</td>
<td>88 (−.8)</td>
</tr>
<tr>
<td>LJ</td>
<td>12;10</td>
<td>16 (−1.2)</td>
<td>92 (−1.2)</td>
<td>106 (−.4)</td>
</tr>
<tr>
<td>CM¹</td>
<td>16;08</td>
<td>17 (−.7)</td>
<td>104 (−.2)</td>
<td>87 (−.87)</td>
</tr>
<tr>
<td>QC</td>
<td>10;02</td>
<td>12 (−1.73)</td>
<td>61 (−1.93)</td>
<td>86 (−.93)</td>
</tr>
<tr>
<td>CT</td>
<td>11;05</td>
<td>12 (−2.07)</td>
<td>55 (−2.6)</td>
<td>94 (−.4)</td>
</tr>
<tr>
<td>SA</td>
<td>9;10</td>
<td>12 (−1.73)</td>
<td>67 (−1.53)</td>
<td>92 (−.53)</td>
</tr>
<tr>
<td>HD</td>
<td>10;05</td>
<td>9 (−2.4)</td>
<td>69 (−1.53)</td>
<td>86 (−.93)</td>
</tr>
<tr>
<td>BD</td>
<td>9;09</td>
<td>6 (−2.27)</td>
<td>47 (−2.1)</td>
<td>108 (.53)</td>
</tr>
<tr>
<td>GS</td>
<td>11;08</td>
<td>11 (−2.27)</td>
<td>92 (−0.8)</td>
<td>87 (−.87)</td>
</tr>
<tr>
<td>SL</td>
<td>11;10</td>
<td>9 (−2.47)</td>
<td>74 (−1.9)</td>
<td>91 (−.6)</td>
</tr>
<tr>
<td>OD</td>
<td>12;02</td>
<td>12 (−2.07)</td>
<td>63 (−2.5)</td>
<td>106 (−.4)</td>
</tr>
</tbody>
</table>


* As measured by Ravens Progressive Matrices (Raven, 1998): SM, GD, LJ, CM, QC, CT, SA and BD, and by a composite of the block design and matrices sub-tests of the British Ability Scales (Elliott, 1996): HD, GS, SL, OD. ¹ These children were included in the group despite z-scores on the TROG which are in the normal range. The TROG is only standardized up to the age of 12;11, and so the z-scores for children in the group over the age of 12 actually over-estimate the abilities of these children. A raw score of 17 on the TROG is appropriate for a child aged 9;00–9;11.

Appendix B

Stimuli for experiment 1 – comparative and superlative formation

<table>
<thead>
<tr>
<th>Stimuli: 1 syllable</th>
<th>Raw frequency*</th>
<th>Stimuli: 2 syllables</th>
<th>Raw frequency*</th>
</tr>
</thead>
<tbody>
<tr>
<td>stem</td>
<td>-er</td>
<td>-est</td>
<td>stem</td>
</tr>
<tr>
<td>Big</td>
<td>359</td>
<td>34</td>
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<tr>
<td>Fat</td>
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<tr>
<td>Hard</td>
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<td>14</td>
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<td>Tall</td>
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<td>Sad</td>
<td>35</td>
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<tr>
<td>Short</td>
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<tr>
<td>Dark</td>
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<tr>
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<td>Red</td>
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</tr>
<tr>
<td>Thin</td>
<td>90</td>
<td>6</td>
<td>0</td>
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<tr>
<td>Mean</td>
<td>135.7</td>
<td>10.5</td>
<td>4.1</td>
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</table>

### Appendix C

Stimuli for experiment 2 – adjective derivation from nouns

<table>
<thead>
<tr>
<th>Stimuli: uninflected</th>
<th>Raw frequency* of derived adjective</th>
<th>Stimuli: plural</th>
<th>Raw frequency* of derived adjective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>12</td>
<td>Spots</td>
<td>1</td>
</tr>
<tr>
<td>Mud</td>
<td>10</td>
<td>Holes</td>
<td>0</td>
</tr>
<tr>
<td>Wool</td>
<td>3</td>
<td>Waves</td>
<td>2</td>
</tr>
<tr>
<td>Sand</td>
<td>6</td>
<td>Curls</td>
<td>5</td>
</tr>
<tr>
<td>Soap</td>
<td>1</td>
<td>Frills</td>
<td>1</td>
</tr>
<tr>
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<td>36</td>
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<td>5</td>
<td>Stars</td>
<td>0</td>
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<td>Rain</td>
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