

1 **Sources of Misinterpretation in the Input and their Implications for Language Intervention**
2 **with English-Speaking Children**

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12 Key words: developmental language disorder; specific language impairment; input; syntax,
13 morphology

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19 Declaration of Interest: The authors declare no potential conflicts of interest with respect to the
20 research, authorship, and publication of this article.

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Abstract

Purpose: In English and related languages, many preschool-age children with developmental language disorder (DLD) have difficulties using tense and agreement consistently. In this review, we discuss two potential input-related sources of this difficulty and offer several possible strategies aimed at circumventing input obstacles.

Method: We review a series of studies from English, supplemented by evidence from computational modeling and studies of other languages. Collectively, the studies show that instances of failures to express tense and agreement in DLD resemble portions of larger sentences in everyday input in which tense and agreement marking is appropriately absent. Furthermore, experimental studies show that children's use of tense and agreement can be swayed by manipulating details in fully grammatical input sentences.

Results: The available evidence points to two particular sources of input that may contribute to tense and agreement inconsistency. One source is the appearance of subject + nonfinite verb sequences that appear in auxiliary-fronted questions (e.g., *Is [the girl running]? Does [the boy like popcorn]?*) and as dependent clauses in more complex sentences (e.g., *Help [her wash the dishes]; We saw [the frog hopping]*). The other source is the frequent appearance of bare stems in the input, whether nonfinite (e.g., *go* in *Make him go fast*) or finite (e.g., *go* in *I go, you go*).

Conclusions: Although the likely sources of input are a natural part of the language that all children hear, procedures that alter the distribution of this input might be used in the early stages of intervention. Subsequent steps can incorporate more explicit comprehension and production techniques. A variety of suggestions are offered.

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47 **Introduction**

48 One of the hallmarks of developmental language disorder (DLD) in English during the
49 preschool years is inconsistency in the use of tense and agreement morphemes. Along with
50 correctly using morphemes such as present third person –s, past tense –ed, irregular past, and
51 both auxiliary and copula *be* forms, children with DLD can also be heard producing utterances
52 such as *The horse run fast, Mommy coming home soon, and Him draw this picture*. Often,
53 children with DLD at age five years continue producing errors of this type even though their
54 same-age peers with typical language development have reached mastery levels in the use of
55 these morphemes. During the preschool years, these differences between children with DLD
56 and their peers not only show statistical significance at the group level; tests that assess the
57 degree of use of these morphemes also show good diagnostic accuracy (e.g., Rice & Wexler,
58 2001). The magnitude of these verb morpheme difficulties can be further appreciated from
59 multiple studies showing that five-year-olds with DLD lag behind typically developing children
60 who are as young as three years of age, even when factors such as mean length of utterance
61 and verb inventories are taken into account (see review in Leonard, 2014).

62 Given these prominent weaknesses with tense and agreement morphemes, intervention
63 procedures designed to assist children with these forms have appeared in the literature. These
64 have included procedures making use of recasts (Camarata & Nelson, 1992), or a combination
65 of recasts and focused stimulation (e.g., Leonard et al., 2004). Although most intervention
66 approaches have relied on implicit learning on the part of the child, some recent approaches
67 incorporate explicit teaching of grammatical morphemes into their protocols (e.g., Finestack,
68 2018; Smith-Lock et al., 2013). Both implicit and explicit approaches usually operate under the
69 assumption that more frequent exposure to tense and agreement morphemes is a key factor in
70 promoting gains.

71 Although there is little doubt about the difficulties that tense and agreement morphemes
72 pose for children with DLD, there is no consensus on why these morphemes stand out as
73 especially problematic (see Leonard, 2014 for a review of alternative explanations). Accounts
74 have varied from assumed delays in the emergence of a biologically-based linguistic principle
75 (e.g., Rice & Wexler, 1996) to deep-rooted weaknesses in procedural memory that affect
76 nonlinguistic as well as linguistic learning (e.g., Ullman & Pierpoint, 2005). Like DLD itself, there
77 seems to be a genetic component to these particular weaknesses (Bishop et al., 2006), though
78 the source may prove to be multifactorial. In principle, if we knew the reasons for these special
79 difficulties, we might be able to shape our intervention procedures around the core problem,
80 thus improving the outcomes for these children.

81 **The Lure of Subject + Nonfinite Verb Sequences and Bare Stems in the Input**

82 In this paper, we explore implications for intervention if one assumes that the tense and
83 agreement morpheme weaknesses of children with DLD can be traced to the children's
84 misinterpretation of details in their language input. We begin with the assumption that children
85 with DLD have generally weak language skills, but the profile of extraordinary difficulty with
86 tense and agreement results from how this more general weakness interacts with the typology
87 of the language being learned. English is a prime case, though we will touch on how this profile
88 is altered when children are learning other types of languages.

89 We review two possible input sources of misinterpretation. The first concerns the
90 appearance in the input of sentence-final subject + nonfinite verb sequences such as *The girl*
91 *like puppies* and *The boy laughing*. The second involves the frequent appearance of "zero-
92 marked" bare stem verbs in the input (e.g., *I play, you play, we play, they play*). For each
93 source, we discuss evidence indicating that children with DLD make errors that can be
94 attributed to the input. We then offer some possible details that might be incorporated into
95 intervention that might reduce the degree to which these input factors contribute to the
96 children's tense and agreement morpheme difficulties.

97 **Subject + Nonfinite Verb Sequences**

98 Consider the following examples:

99 *The horse run fast*

100 *She buy a new car*

101 *Mommy coming home soon*

102 *A dog barking*

103 *The boy fix his bike*

104 *Her stop that*

105 *Her playing outside*

106 *Him draw this picture*

107 These utterances are clearly missing a tense and agreement morpheme, and three of
 108 them also reveal a pronoun error in subject position. However, these utterances, if taken as
 109 word sequences, represent propositions that children can, in fact, hear, as the following
 110 grammatical utterances reveal:

111 *Can [the horse run fast]?*

112 *Did [she buy a new car]?*

113 *Is [Mommy coming home soon]?*

114 *I hear [a dog barking]*

115 *Help [the boy fix his bike]*

116 *Make [her stop that]*

117 *We saw [her playing outside]*

118 *Watch [him draw this picture]*

119 In each of these grammatical utterances, a lexical verb (*run, buy, coming, barking, fix,*
 120 *stop, playing, draw,*) is nonfinite because an element earlier in the sentence requires it. In the
 121 first three examples, a fronted modal auxiliary (*can*), auxiliary *do* form (*did*), or auxiliary *be* form

122 (*is*) provides the agreement and/or tense information. In the remaining examples, a preceding
 123 lexical verb (*hear, help, make, saw, watch*) takes a nonfinite verb as its sentence complement.

124 To conclude that child utterances such as *The horse run fast* and *Mommy coming home*
 125 *soon* can be traced back to the input, it must be assumed that the children hear these
 126 sequences and fail to recognize that they are structurally tied to information (e.g., *can, is, help,*
 127 *saw*) that appears earlier in the input utterance. Without understanding these constraints, the
 128 children treat these sequences as appropriate for use as stand-alone utterances (see
 129 Tomasello, 2003). That is, these stand-alone utterances have the same status in the children's
 130 grammar as utterances such as *That frog hops* and *Daddy's working outside* that could have
 131 their basis in simple sentences heard in the input. And, just as simple grammatical sentences in
 132 the input can then serve as a basis for children's own creations using the same constructions
 133 (e.g., from *That frog hops* to *This guy falls*), so too can inappropriately extracted nonfinite
 134 sequences serve as the basis for new (ungrammatical) creations by the child (e.g., from *The*
 135 *horse run fast* to *That cat purr*). There are several types of evidence that are consistent with this
 136 assumption.

137 First, consider sentence constructions in which there is a separation between a sentence
 138 element and its "interpreted" position, sometimes called "long-distance dependencies," as in the
 139 following examples. We use the notation of underlining the element of interest and indicate its
 140 interpreted position with _____.

141 Claudette was pushed _____ by Antonella

142 Who was Lars pushing _____?

143 The car that the taxi hit _____ was blue.

144 There is strong evidence that children with DLD have significant difficulties
 145 comprehending these types of long-distance dependencies. Examples of studies on passives
 146 include Hestvik et al. (2010), Montgomery and Evans (2009), and van der Lely (1996). For wh-
 147 object questions, examples include Deevy and Leonard (2004), Epstein et al. (2013), and van

148 der Lely and Battell (2003). Evidence for DLD weaknesses in comprehending object relative
149 clauses can be seen in the studies of Dick et al. (2004), Hestvik et al. (2022), and Montgomery
150 et al. (2017).

151 Of course, the long-distance “dependencies” in *Did she buy a new car?* and *Help the*
152 *boy fix his bike* are quite different from those seen in passives, wh-object questions, and object
153 relative clauses. Yet, they share the property of requiring the learner to make use of earlier
154 information when dealing with the later parts of the sentence. In cases such as passives, proper
155 semantic interpretation is at stake. In cases such as *Did she buy a new car?* and *Help the boy*
156 *fix his bike*, proper use of tense and agreement is in the balance. Although semantic
157 interpretation may not be challenging in the *Did she buy...* or *Help the boy fix...* examples, the
158 fact that these sentences contain nonfinite verbs that immediately follow their subjects could
159 lure children into treating these subject + nonfinite verb sequences as acceptable. In fact,
160 because these sequences represent meaningful propositions (*she buy a new car; the boy fix his*
161 *bike*), the lure may be even greater.

162 There are several more direct sources of evidence for the appeal of subject + nonfinite
163 verbs in the input. In studies of young children with typical language development (TLD) ages
164 2;6 to 3;0, when children are still inconsistent in using tense and agreement morphemes, they
165 tend to produce novel verbs in the same form in which they are consistently heard, even when
166 the context changes to render the heard form ungrammatical. For example, Theakston et al.
167 (2003) found that when the children heard the novel verb *mib* consistently in sentences such as
168 *Will it mib?*, the children continued to produce *mib* rather than *mibs* when tested in the context
169 of “What does this one do? It ____.” Yet when a novel verb was consistently heard with the third
170 person singular -s inflection (e.g., *This one tams*), the children were much more likely to
171 produce the inflection in the context “What does this one do? It ____.” Similar findings were
172 reported by Finneran and Leonard (2010).

173 This suggests that the development of tense and agreement use is built up in part by the
174 interaction between the children's input and their developing ability to interpret this input.
175 Computational models have attempted to simulate this effect. They begin by building into the
176 model an utterance-final bias and initially restricting the learning span to mimic young children's
177 limited processing ability (Crocker et al., 2001; Freudenthal et al., 2006; Freudenthal et al., 2007;
178 Freudenthal et al., 2009, 2010). When presented with transcripts of actual adult-to-child input,
179 the output of the model shows the kinds of utterances illustrated above, including those with
180 pronoun errors, as in *Her playing outside*). When the learning span of the model is gradually
181 increased to reflect development, the proportion of subject + nonfinite verb sequences in the
182 output decreases.

183 ***Input Effects in DLD***

184 Thus far, we have discussed the plausibility of subject + nonfinite verb errors reflecting
185 misinterpretations of the input and have referred to studies of young children with TLD.
186 However, these children cease making such errors well before children with DLD. It needs to be
187 shown that input effects are also implicated in the slower acquisition of tense and agreement
188 morphology in children with DLD.

189 Several experimental studies point in this direction. Leonard and Deevy (2011)
190 conducted a novel verb learning study with four- and five-year-olds with DLD and a group of
191 same-age peers with TLD. The children with DLD were inconsistent in their use of tense and
192 agreement morphemes whereas the TLD group were at mastery levels. Half the novel verbs
193 were presented in nonfinite contexts only, as in *We saw the dog pagging*. The other half were
194 heard only with auxiliary *was*, as in *Just now the horse was channing*. After the exposure period,
195 the children's use of the novel verbs was tested in contexts requiring auxiliary *is* (e.g., "Tell me
196 what's happening here."). The children with TLD used *is* with all novel verbs. In contrast, the
197 children with DLD were more likely to use auxiliary *is* if the novel verbs had been heard in the
198 auxiliary *was* context than in the nonfinite context. During testing, items were included that used

199 different characters serving as the subjects of the sentences (e.g., a mouse rather than a dog
200 *pagging*). Yet these items yielded the same pattern of responses seen for items that used the
201 same subjects as those used during the exposure period. This last point is important because it
202 suggests that once a new verb is heard strictly in nonfinite form, it can be transferred to other
203 utterances involving different subjects.

204 Leonard et al. (2015) conducted a novel verb learning study with four-year-old children
205 with DLD and a group of younger children with TLD matched for mean length of utterance. As is
206 the case in such comparisons, the TLD group showed greater use of tense and agreement
207 morphemes than the DLD group, yet the TLD group had not reached the level of mastery.
208 Depending on the novel verb, nonfinite contexts used during the exposure period were of the
209 type *Let's watch the dog fimm* and *Does the cat brack?* Finite contexts were of the type *All day*
210 *long the dog kreffs* and *Do you think the cat swopes?* Testing after the exposure period included
211 items requiring third person singular -s ("Every day the cat ____") and those requiring a nonfinite
212 form ("We wanna watch the cat ____"). The children with TLD were influenced by the input context
213 but not to the degree seen in the DLD group. An especially interesting finding was how the
214 children with DLD showed more inappropriate productions of -s on nonfinite test items when the
215 novel verbs had been presented in third person singular form during the exposure phase. Such
216 errors were of the type "We wanna watch the horse.... *swopes*."

217 A basic assumption behind input effects is that children showing inconsistent use of
218 tense and agreement morphemes have not accurately sorted out contexts in which attested
219 subject + nonfinite verb sequences are and are not appropriate to use. If this is true, then there
220 should be evidence of some of this difficulty on comprehension measures. A second experiment
221 by Leonard and Deevy (2011) examined this issue. Children with DLD age four and five years
222 participated as well as a group of three-year-olds with TLD matched according to scores on a
223 general comprehension test. The children's use of auxiliary *is* was first tested, which revealed
224 greater proficiency on the part of the TLD group. A comprehension task was then administered

225 requiring the children to point to the correct picture in response to sentences such as *The cow*
226 *sees the horse eating*. Foil pictures depicted events such as a horse watching a cow eating and
227 a horse eating while a cow is looking away. To ensure that the children understood the
228 individual elements within these sentences, simple control sentences were also tested such as
229 *The cow sees the horse* and *The horse is eating*. All children were near ceiling on the control
230 sentences. However, on sentences of the type *The cow sees the horse eating*, the children with
231 DLD were less accurate than their younger typically developing peers. Souto et al. (2016)
232 replicated this finding with the same target structure but a slightly different set of foils.

233 One of the most likely sources of subject + nonfinite verb sequences is the appearance
234 in the input of questions with fronted auxiliaries. Testing children's comprehension of these
235 questions is not as straightforward because it is assumed that children hear the fronted
236 auxiliaries and interpret the utterance as a question. What is at issue is whether the children
237 understand the dependency connection between the fronted auxiliary and the information later
238 in the question. Deevy and Leonard (2018) approached this issue through use of a looking-
239 while-listening task. Children saw pairs of pictures on a screen such as a picture of a boy
240 running and a picture of several dogs running. They then heard sentences such as *Are the nice*
241 *little dogs running?* or *See the nice little dogs running?* For the first type of sentence, children
242 could anticipate the picture of the dogs given the appearance of plural *are* at the beginning of
243 the sentence. This could lead children to focus on the picture of the dogs before they actually
244 hear the word *dogs*. On the other hand, *See the nice little dogs running?* provides no such
245 opportunity for anticipatory looking. Deevy and Leonard found that younger TLD children (*M* age
246 = 3;6) began to focus their gaze on the proper picture before hearing the noun, whereas the
247 DLD group (*M* age = 5;11) did not show a clear pattern of gaze until they actually heard the
248 noun. This finding suggests that the TLD group were doing more than treating the fronted
249 auxiliary as a pragmatic indicator of a question; they were actually treating the auxiliary as
250 structurally related to other information to come in the sentence. The DLD group did not show

251 evidence of this kind of understanding. Importantly, the TLD group were already producing
252 auxiliary *is* and *are* with over 90% accuracy whereas the DLD group used *is* and *are* with 70%
253 and 62% accuracy, respectively.

254 Recall that in the Leonard et al. (2015) study, children with DLD often produced third
255 person singular -s with verbs that had been heard strictly in this form even on subsequent test
256 items requiring nonfinite verbs (as we saw with the example “We wanna watch the horse....
257 *swopes*”). This finding is in line with the assumption that the children did not understand the
258 dependencies between earlier-appearing elements in the sentence and the type of verb form to
259 use. In an investigation making use of electrophysiological evidence, Purdy et al. (2014)
260 examined this issue with a group of school-aged children with a history of DLD and a group of
261 same-age children with TLD. The children heard fully grammatical sentences, as well as simple
262 sentences with agreement commission errors (e.g., *Every day, the girls drives home*) and
263 complex sentences with commission errors requiring the processing of long-distance
264 relationships (e.g., *The dad watches the boy eats cookies*). The DLD group responded much
265 like the TLD group when listening to simple sentences with agreement errors by showing a clear
266 “P600” neural response. However, unlike the TLD group, the children with DLD showed less
267 sensitivity to agreement commission errors in complex sentences. It seemed like the children
268 with DLD were influenced by the local agreement (e.g., *the boy eats cookies*) reflected in the
269 dependent clause.

270 The experimental evidence seems consistent with the idea that children with DLD have
271 difficulty relating subject + nonfinite verb propositions to information appearing earlier in the
272 input sentence (or, in the case of the above looking-while-listening study, vice-versa).
273 Freudenthal et al. (2021) conducted a computer simulation of this difficulty by building into the
274 model a learning factor that controls the model’s ability to associate elements in the sentence
275 that occur in different time steps. This was operationalized by having the model predict the verb
276 inflection in input utterances. Each word in the utterance was treated as occurring in a different

277 time step. Sentence-level cues tied to words occurring earlier in the utterance had less
278 predictive weight than cues occurring nearer to the inflection. For example, the pronoun *he* in
279 *He runs* can serve as a cue to the third person singular -s inflection. However, in the input
280 utterance *Does he run?*, the pronoun *he* occurs closer in time to “run, which attenuates the
281 weight of the earlier occurring cue, “does.” As a result, *he run* (from *Does he run?*) competes
282 with *he runs*. When Freudenthal et al. tested their model, the model’s output showed slow but
283 gradual learning of the third person singular inflection. This pattern of learning was capturing the
284 fact that, in English, nonfinite (bare stem) verb forms appear later in utterances. Freudenthal et
285 al. then simulated learning by children with DLD by increasing the attenuation levels which
286 lowered the model’s sequential learning abilities. The resulting output reflected the more
287 protracted period of learning third person singular -s seen in actual DLD data.

288 Can weaknesses in appreciating dependencies between tense and agreement
289 morphemes and earlier-appearing material be improved through intervention? Fey et al. (2017)
290 pursued this question in an intervention study aimed at facilitating use of auxiliary *is* and third
291 person singular –s in a group of children with DLD age 3;3 to 4;7. The children were randomly
292 assigned to either an experimental treatment, or a more traditional treatment. For the
293 experimental treatment, the children heard stories and received recasts that included the target
294 morphemes but in strictly declarative contexts. They also participated in a comprehension
295 component involving yes-no questions in which the correct answer depended on the tense of
296 the fronted auxiliary. An example for auxiliary *is* treatment was *Is/was the boy diving into the*
297 *pool?* For third person singular -s, an example was *Does/did the boy see the dog?* Responding
298 correctly depended on the child recognizing that the question referred to a past and not present
299 event or vice-versa. This component was designed to emphasize the relevance of the fronted
300 auxiliary to the sentence as a whole – an insight that was hypothesized to be lacking in the
301 children. The traditional approach also used focused stimulation and recasts but half were in
302 declarative form and half in interrogative form. The comprehension component included the

303 same questions used in the experimental treatment condition except that the children could
 304 respond correctly simply by understanding the agents and actions in the question (e.g., *Was the*
 305 *girl/boy diving into the pool?*). Clear effects of treatment were seen for the auxiliary *is* target.
 306 Specifically, the experimental condition was associated with greater gains in the children's
 307 production of auxiliary *is* in declarative position. However, the two types of treatment did not
 308 differ for the third person singular target. Fey et al. noted that the children in the experimental
 309 condition made gains in comprehending the difference between *does* questions and *did*
 310 questions. They speculated that the minimal transfer to third singular –s production was
 311 because the children did not clearly relate the fronted auxiliary *does* to the present singular
 312 inflection –s (compare *Does the boy see the dog?* and *The boy sees the dog*). In contrast, this
 313 connection is more transparent for auxiliary *is* given the identical phonetic form in interrogative
 314 and declarative positions (as in *Is the girl climbing the ladder?* *The girl is climbing the ladder*).

315 Although subject + nonfinite verb utterances are frequently produced by English-
 316 speaking children with DLD during the preschool years, English is not the only language in
 317 which children with DLD show more extensive use of these kinds of utterances than their peers
 318 with TLD. In some of these languages nonfinite productions come in the form of overt infinitive
 319 inflections in place of overt tense and agreement inflections. Swedish and Dutch are two such
 320 languages. Consider the following examples (we use “drink coffee” throughout our examples to
 321 facilitate translation):

322 Swedish: Lars dricka kaffe
 323 “Lars drink coffee”
 324 (Correct: Lars dricker kaffe)
 325 “Lars drinks coffee”
 326 Dutch: Anna koffie drinken
 327 “Anna coffee drink”
 328 (Correct: Anna drinkt koffie)

329 “Anna drinks coffee”

330 In the Swedish example, *-a* in *dricka* “drink” is an infinitive inflection instead of the
 331 correct present tense *-er*. In the Dutch example *-en* as in *drinken* “drink” is an infinitive inflection
 332 instead of the correct present tense *-t*. Also, in the Dutch example we see the infinitive in
 333 sentence-final position.

334 Let’s look now at how questions with fronted modal auxiliaries are formed in these two
 335 languages:

336 Swedish: Kan [Lars dricka kaffe]?

337 “Can [Lars drink coffee]?”

338 Dutch: Kan [Anna koffie drinken]?

339 Can [Anna coffee drink]?

340 From the Swedish example, it can be seen that Swedish resembles English in that a
 341 nonfinite verb is used when the modal auxiliary appears earlier in the sentence. In Swedish, of
 342 course, infinitives carry overt inflections rather than being bare stems as in English. However, in
 343 Dutch, when a fronted modal auxiliary is used, the infinitive (with its overt infinitive inflection)
 344 appears in sentence-final position. Therefore, the problem with *Anna koffie drinken* is not the
 345 location of the infinitive in the sentence, but rather the use of an infinitive instead of the present
 346 tense form when there is no accompanying auxiliary to express tense or agreement. If we
 347 assume the origins of the production came from misinterpreting the input, the utterance is not
 348 surprising. German shares with Dutch this same feature.

349 Subject + nonfinite verb productions occur in DLD in Swedish (e.g., Hansson et al.,
 350 2000), Dutch (e.g., de Jong, 2004), and German (e.g., Rice et al., 1997). However, they are not
 351 as frequent as in English. One possible reason is that whereas many questions are formed with
 352 an auxiliary *do* in English, as in *Does Carol drink coffee?*, these other languages simply use the
 353 finite lexical verb in sentence-initial position, as in the Swedish *Dricker Lars kaffe?* (“Drinks Lars
 354 coffee?”).

355 In Romance languages such as Italian and Spanish, subject + nonfinite verb errors by
356 children with DLD are even less frequent than in the languages just discussed, and are
357 described as quite uncharacteristic of these languages (e.g., Bedore & Leonard, 2001; Bortolini
358 et al., 1997). It is probably no coincidence that sequences of this type in the input are not as
359 common. There is no equivalent of the English auxiliary *do* in questions. Instead, questions are
360 often phrased with declarative word order, as in Italian *Gina beve il caffè?* and Spanish *Sofía*
361 *bebe café?* (“Gina/Sofía drinks coffee?”). Questions in English with the modal auxiliary *will* (e.g.,
362 *Will Gina drink coffee?*) can be produced with future tense forms (Italian *Gina berrà il caffè?*;
363 Spanish *Sofía beberá café?*). Questions with the equivalent of the modal auxiliary *can* will often
364 be constructed with the modal adjacent to the main verb, rather than separated by being placed
365 in sentence-initial position. This is especially true in Italian (e.g., *Gina può bere il caffè?* “Gina
366 can drink coffee?”). In short, these languages offer fewer opportunities for children to hear
367 subject + nonfinite sequences.

368 The idea that these cross-linguistic differences in subject + nonfinite verb use are related
369 to input effects finds support in computational modeling studies. For example, Freudenthal et al.
370 (2007) found that the degree of nonfinite use in the model’s output was greatest when the input
371 was English, intermediate for Dutch and German input, and much more limited when the input
372 was Spanish. (See Jourdain & Lahousse [2021] for compatible evidence from young French-
373 speaking children.) Further support can be found in the Freudenthal et al. (2021) computational
374 model study that simulated DLD. Recall that when the model was run with English input, the
375 output showed a prolonged period of learning the third person singular form. However, when
376 Spanish input was used, the effects were less dramatic. This was expected given that the tense
377 and agreement differences between DLD and TLD groups are smaller in Spanish than in
378 English (see review in Leonard, 2014).

379

Defaulting to Bare Verb Stems

380 The appearance of subject + nonfinite verbs in the input may not be the only factor
381 influencing children's failure to use tense and agreement inflections. In English, children may be
382 influenced by the sheer frequency of bare verb stems in the input. Many of these are "zero-
383 marked" finite forms (e.g., *I run, you run, we run, they run*). In a corpus study of British English,
384 Räsänen et al. (2014) found that verbs most likely to be used by adults as bare stems (in
385 appropriate contexts) were those most likely to lack third person singular –s in obligatory
386 contexts in the speech of young TLD children. This suggested to Räsänen et al. that bare stems
387 might serve as a type of default form. The children were hearing correctly used bare stems, but
388 by hearing them so frequently, the children adopted these stems as appropriate to use even in
389 unattested third person singular contexts.

390 Kueser et al. (2018) asked whether the same could be true for children with DLD.
391 Instead of looking at bare stems, these investigators examined the degree to which children with
392 DLD and younger children with TLD produced verbs marked for third person singular –s in
393 obligatory contexts. Kueser et al. then examined whether this use was related to the degree to
394 which the same verbs appeared in third singular –s form in a large American English corpus of
395 adult speech to children. As expected, the children with DLD were less likely than younger
396 peers with TLD to produce third singular –s in obligatory contexts. However, the two groups
397 were quite similar in producing third singular –s in accordance with the relative proportion of this
398 inflection in the corpus. Or, put in defaulting terms, both groups were less likely to produce this
399 inflection with verbs that were the most likely to appear as bare stems in the corpus.

400 In the computational modeling study of Freudenthal et al. (2021) described earlier, the
401 feasibility of a defaulting factor was also examined. Specifically, Freudenthal et al. removed
402 from the input those adult-to-child utterances that were most likely to contain subject + nonfinite
403 verb sequences (e.g., auxiliary-fronted questions). For English, this manipulation showed an
404 output that still revealed a slow rate of learning the third person singular form. These results
405 were attributed to the overall frequency of bare stems in the English input.

406 Subsequently, Freudenthal et al. (in press) created a dual-factor model in which the
407 defaulting factor was formalized by converting each verb in a child's transcript to a single form
408 (e.g., *drink* or *drinks* in English, *drinkt* or *drinken* in Dutch) if the verb showed a strongly
409 dominant form in the input corpus. The defaulting factor was given greater weight in the case of
410 DLD. Other details of the model (e.g., the right-to-left processing bias) functioned as in earlier
411 models. The output of this dual-factor model showed even greater correspondence to actual
412 data than previous models. Again, simulations for TLD and DLD showed the expected group
413 differences. Cross-linguistic differences in the predicted direction were also seen. In this case,
414 however, the degree of difference between English and the other languages provided an even
415 closer match to actual child data. Yet, defaulting did not prove to be a sufficient explanation for
416 the observed differences. Freudenthal et al. noted that the utterance-final learning bias built into
417 the model was necessary along with the defaulting bias to produce the high levels of
418 correspondence with the available child language evidence.

419 Although Spanish makes only limited use of subject + nonfinite verbs, in principle,
420 children learning this language might resort to defaulting. For Spanish, the most likely default
421 form would be the present tense third person singular form as it is the most frequent in the
422 language and represents the most frequent (though not the only) substitute used by children
423 (see Aguado-Orea & Pine, 2015). In fact, Grinstead et al. (2013) and Grinstead et al. (2018)
424 have interpreted the children's frequent use of present third person singular as constituting a
425 type of nonfinite form. When Freudenthal et al. (in press) applied the defaulting factor to
426 Spanish input in their model, defaulting appeared in the output to a more restricted degree than
427 in the other languages, though third person singular was, in fact, the most likely substitute.

428 The frequency difference between candidates for default use and unlikely candidates is
429 much smaller in Spanish than in English. In English, bare stems appear throughout the
430 paradigm, whereas third person singular in Spanish competes with many other inflections.
431 However, in the early stages of learning particular verbs, "competes" may be a misleading term.

432 In a study of fast mapping, Bedore and Leonard (2000) found that Spanish-speaking three-year-
433 olds were more likely to recognize a novel Spanish-like verb that was consistently heard with
434 the same inflection than a novel verb that varied in its inflections. In that study, the verb stems of
435 the verbs occurred with the same frequency in both conditions; it was only the stem-inflection
436 combinations that varied in frequency. Rather than “competing” with other inflected forms of the
437 same verb, then, the more frequently occurring form of the verb may be recognized in the input
438 more readily, possibly as even distinct from the same verb when it is used with other inflections.

439 **Language Learning Weakness Meets Language Typology**

440 We have noted some examples of utterances from children with DLD that, on first
441 appearance, seem quite peculiar, such as the English *Him draw this picture*. However, rather
442 than reflecting an unnatural language learning mechanism, these examples could represent
443 what happens when children with a broader based language deficit are dealing with a target
444 language with particular typological characteristics.

445 Yet, counterintuitively, the diversity of errors across languages might actually be helpful
446 in allowing us to better understand the nature of the broader deficit. The surface forms of *Him*
447 *draw this picture* and *Anna koffie drinken* may be different from each other but together they
448 implicate a problem connecting later appearing elements to early sentence elements. This
449 problem, in turn, may suggest one source of the broader weakness in language. Take, for
450 example, the proposal of McMurray et al. (2022) that children with DLD may have a weakness
451 in inhibiting competing forms. When children with DLD are faced with sentences requiring an
452 element to be related back to an earlier element in the sentence, they may have difficulty
453 resisting the *semantically complete* nature of the subject + nonfinite sequence (e.g., *she buy a*
454 *new car; Mommy coming home soon; him draw this picture*. That is, the semantically
455 interpretable nature of this sequence may suppress the search for the separated element (e.g.,
456 *did, is, help*) that is responsible for the nonfinite form of the sequence in the first place. This
457 underlying weakness might be universal in DLD but more likely to be manifested when a

458 particular language makes significant use of sequences that, when separated from earlier
459 elements in the sentence, are meaningful propositions that have the potential to be
460 communicated as stand-alone utterances.

461 Also compatible with the notion of weaknesses with inhibition is the finding that children
462 with DLD differ in their degree of defaulting as a function of the language being learned. Such a
463 deficit would lead to the expectation that bare stems would dominate as the error forms in
464 English, because the high frequency of such forms in the input would make it a strong
465 competitor in almost any sentence context. The present third person singular form in Spanish
466 would also be expected to be the most difficult for children with DLD to inhibit, though its lower
467 relative frequency compared to bare stems in English would result in a less dramatic case of
468 defaulting. The potential for defaulting might be universal, but its conspicuous use by children
469 with DLD could be dictated by the presence and strength of competing forms in the language.

470 The McMurray et al. (2022) proposal is surely not the only one that might be pursued to
471 gain a better understanding of DLD. Our point is to show that alternative explanations for DLD
472 might be refined or even discarded based on whether they offer a reasonable account of how
473 input effects can shape the grammatical profiles of the children.

474 **Implications for Intervention**

475 Although much work remains to determine how input interacts with the broader language
476 deficits seen in DLD, the evidence accumulated thus far provides some potential directions for
477 intervention. Several examples follow. All are based on the assumption that children's difficulties
478 are not likely due to faulty input from parents or others but rather to limitations in the children's
479 intake and interpretation of the input. By altering the distribution of particular types of forms in
480 the input, clinicians (ideally in collaboration with parents) might be able to help children develop
481 the insights needed to gain greater consistency in tense and agreement use.

482 Our examples serve as suggestions intended to augment rather than replace current
483 evidence-based practices. Many useful findings have emerged from the literature on ways to

484 facilitate tense and agreement use in children with DLD. Recent examples include using
485 imitation primarily to allow children to obtain early production success in intervention rather than
486 as a long-term procedure (see Eisenberg et al., 2020), and, for past tense treatment, focusing
487 on verbs that are (counterintuitively) atelic, relatively low in frequency, and more phonologically
488 complex (Owen Van Horne et al., 2018). Our concern is that, even when children's ability to
489 produce tense and agreement forms becomes stronger with the help of such procedures, the
490 children may still lack the awareness of when these forms *must* be produced. We believe that
491 this awareness might be fostered through input manipulations and activities that promote
492 children's awareness of differences in input structures.

493 **Reducing the Impact of Subject + Nonfinite Verb Sequences**

494 The use of auxiliary-fronted questions is a central part of English. Unfortunately, before
495 children have recognized the structural links between the auxiliary and the later portions of the
496 utterance, there is the risk that the later-appearing subject + nonfinite verb sequence takes hold
497 as a basis for generating new utterances. This presents a dilemma for practitioners because
498 whereas questions are important to teach, they are also a potential source of continued use of
499 nonfinite verbs on the part of the child.

500 Paradoxically, just the opposite might be assumed – that auxiliary-fronted questions
501 would be an excellent way to introduce and teach auxiliary forms given their seemingly salient
502 sentence-initial position. Yet a study by Fey and Loeb (2002) illustrates the potential pitfalls in
503 taking this view. Fey and Loeb asked whether the use of recasts with auxiliary-fronted auxiliary
504 *is* questions (e.g., *Is that man eating a cookie?*) and auxiliary *will* questions (e.g., *Will that boy*
505 *fall?*) would assist young children with DLD in acquiring these particular auxiliaries or, more
506 broadly, auxiliaries in general. At the outset of the study, the children were not yet using
507 auxiliaries in their own utterances. Unfortunately, treatment was unsuccessful: The children's
508 gains in using both the target morphemes and the broader class of auxiliary *be* and modal
509 auxiliaries were no greater than the gains seen by a comparison play group that was not

510 provided recasts. In fact, for auxiliary *is* there was a trend for the (modest) gains to be higher in
511 the play group than the group receiving the auxiliary-fronted recasts. It appears that the fronting
512 of the auxiliaries had no particular impact on the children's language and, worse, might have
513 given the children more opportunities to conclude that nonfinite verbs can directly follow
514 subjects (*that man eating a cookie; that boy fall*).

515 One possible alternative would be to postpone targeting auxiliary-fronted questions until
516 the children have acquired some skill with the declarative counterparts of the questions. For
517 questions with auxiliary *be* and modal auxiliaries, this seems relatively straightforward (e.g.,
518 *Mommy is going outside; That horse can run really fast*). As a next step, activities might pair
519 declaratives with auxiliaries and auxiliary-fronted interrogative versions of the same sentences
520 (e.g., *The bus is going fast – Is the bus going fast?*). When presented together in contexts that
521 are compatible with how declaratives versus interrogatives are used, the nonfinite sequence
522 (*the bus going fast*) might become more closely associated with fronted auxiliaries and no
523 longer regarded as an acceptable alternative in declarative contexts. The temporally close
524 pairing of the declarative and interrogative equivalents is likely to be important. If the declarative
525 and interrogative versions are separated in time, the input might approximate children's usual
526 input. Recall that a basic assumption is that one reason for children's inconsistency is that they
527 hear in the input both declarative sentences with the auxiliary adjacent to the main verb (e.g.,
528 *Angie is going home now*) and similar questions with the auxiliary separated from the main verb
529 (e.g., *Is Angie playing outside?*) which can provide the basis for nonfinite use (e.g., *Angie going*
530 *outside*). As a result, both the with-auxiliary and without-auxiliary versions have the same
531 communicative status in the children's grammar. The close temporal pairing of the declarative
532 and interrogative versions might help the child recognize that declaratives always have the
533 auxiliary.

534 Unfortunately, the structural relationship between questions with auxiliary *do* and the
535 corresponding declaratives is opaque (*does the girl like ice cream – the girl likes ice cream; did*

536 *the boy wash the car – the boy washed the car*). As we saw in the Fey et al. (2017) treatment
537 study, children do not seem to recognize this relationship as readily as the relationship between
538 declaratives and questions with auxiliary *be* forms, as in *The bus is going fast – Is the bus going*
539 *fast?* Employing declaratives with auxiliary *do* could be appropriate if the pragmatic context is
540 altered to involve agreeing with a previous assertion (as in *Does the girl like ice cream? Yes, the*
541 *girl does like ice cream*). However, it is not clear if such an activity would have any effect on
542 children's use of tense and agreement in more typical declarative sentences (such as *The girl*
543 *likes ice cream*).

544 The Fey et al. (2017) study was much more successful in finding a way to emphasize
545 the relationship between fronted auxiliary *be* forms and the later appearing subject + nonfinite
546 verb sequences. Recall that these investigators required the children to respond to questions in
547 which the correct answer depended on the tense of the fronted auxiliary (e.g., *Is/was the girl*
548 *climbing the ladder?*). Treatment activities that included this component were associated with
549 significant gains in the children's use of auxiliary *be* in declaratives. A similar strategy might be
550 used for contrasts such as *Is/are the fish jumping?* By having a singular/plural as well as a
551 present/past contrast, the relevance of the sentence-initial auxiliary might become clearer.
552 However, children's awareness of the invariant number in words such as *fish, deer, and moose*
553 would be required to ensure that responses to the *is/are* items relied on attention to the auxiliary
554 and not to the cues provided by overt singular/plural differences in the noun (as would be the
555 case in *Is the girl jumping?* versus *Are the girls jumping?*).

556 Questions are often used to engage children in conversation and there are likely many
557 contexts in which alternative ways to elicit responses could be just as effective without using
558 subject + nonfinite sequences. For example, instead of *Does this kind of dinosaur eat grass?*,
559 the alternative *I wonder if this kind of dinosaur eats grass* might be used. Note that the child
560 might not know that *wonder if* requires a finite verb in the sentence complement; the point is that
561 the sentence complement (*this kind of dinosaur eats grass*) will not lead the child astray.

562 Constructions with nonfinite dependent clauses (e.g., *Make that horse jump; We*
563 *watched Sarah run the race*) are another possible source of children's subject + nonfinite verb
564 utterances. Early in treatment, such constructions might well be avoided altogether, especially if
565 the children's comprehension of complex syntax is in doubt. Constructions with nonfinite
566 dependent clauses are not as frequent in the input as questions, and therefore may play a
567 smaller role in children's nonfinite verb use. However, they may play an outsize role in
568 contributing to children's use of utterances with pronoun errors such as *Me open this* (from *Help*
569 *me open this*) and *Her take my car* (from *I saw her take my car*). One potential way to reduce
570 children's use of nonfinite dependent clauses as separate utterances might be to present pairs
571 such as *We saw her playing outside. She was playing outside*. Pairs of this type might more
572 closely associate the nonfinite clause (and pronoun forms such as *me* and *her*) with preceding
573 material in the same sentence.

574 When teaching sentences with dependent clauses of this type, it might prove helpful to
575 begin with nouns rather than pronouns immediately preceding the nonfinite verb (e.g., *We saw*
576 *the girl playing outside* rather than *We saw her playing outside*). Imagine a modeling procedure
577 in which the child observes the clinician and a model (a person or puppet) in a pre-arranged
578 dialogue. An utterance by the clinician could be followed by an utterance by the model, and then
579 the reverse for the next pair of utterances. In this way the child could hear a simple finite
580 sentence and a similar sentence with an embedded subject + nonfinite verb. Examples could
581 include:

582 Clinician: *Let's watch the horse eat hay.*

583 Model: *Every day the horse eats hay.*

584 Model: *Let's watch the bird eat worms*

585 Clinician: *Every day the bird eats worms*

586 Following several pairs of utterances presented in this way, the child could replace the model in
587 attempting both types of utterances. Once the types of sentences requiring a finite versus

588 nonfinite verb form become clearer to the child, similar sentences involving pronouns might be
589 introduced.

590 There is renewed interest in treatment approaches that involve explicit instruction to
591 assist children’s grammatical abilities (e.g., Balthazar et al., 2020; Finestack, 2018). Because
592 there is only a limited number of matrix verbs that call for nonfinite verbs in dependent clauses,
593 explicit teaching approaches might be most appropriate. Much like teaching which verbs are
594 irregular in past tense, practitioners might have to teach specific matrix verb – nonfinite clause
595 constructions on a one-by-one basis. In some instances, should children’s metalinguistic
596 abilities allow for it, distinctions might be made such as the fact that some “perception” verbs
597 take nonfinite dependent clauses (e.g., *We heard her playing the piano; I saw him break the*
598 *window*) while “cognition” verbs do not have that option (e.g., *We think she was playing the*
599 *piano; I know he broke the window*).

600 **Reducing the Effects of Defaulting**

601 Subject + nonfinite verb sequences in larger structures may not be the only source of
602 children’s use of nonfinite verb forms in contexts requiring tense and agreement marking.
603 Especially in English, bare stems abound in the input. Many of these are “zero-marked” finite
604 forms (e.g., *I play, they go, we sleep*). Although zero-marked finite forms do not appear with
605 third person singular subjects, their omnipresence makes them easy substitutes when children
606 are still inconsistent with tense and agreement forms.

607 Defaulting to bare stems can occur at two levels. At a more general level, the overall
608 frequency of bare stems in the input can lead children to adopt bare stems as the form of choice
609 across the verbs they use. At a more specific level, some verbs may appear in the input in bare-
610 stem form more frequently than other verbs. Those with high bare stem frequency might be
611 more likely to be used as bare stems in contexts requiring overt tense and agreement forms.
612 We will consider the general- and specific-level cases in turn.

613 Procedures to counteract children’s use of bare stems across verbs in general are not
614 likely to differ from prevailing approaches in the clinical literature. Those approaches identified
615 at the outset of this article are likely to be appropriate. These include conversational recasting,
616 focused stimulation, auditory bombardment, and others that provide an increase in the
617 frequency of verbs overtly marked for tense and agreement. Some of these approaches target
618 specific morphemes, whereas others have as their aim greater exposure across a wider variety
619 of tense and agreement forms. These approaches do not necessarily assume that input factors
620 are the cause of the grammatical difficulty, though they do share the view that enhancing
621 exposure to tense and agreement forms can be beneficial to the children.

622 An example of the latter is “toy talk” – an approach first designed to assist parents in
623 their interactions with their children (e.g., Hadley et al., 2011; Hadley & Walsh, 2014). In this
624 approach, tense and agreement morphemes are viewed as a constellation of related forms (see
625 Rispoli et al., 2009, 2012). In toy talk, the adult interacts with the child and focuses on
626 comments about the actions of toy characters and other objects during play. This emphasis
627 results in a naturally occurring increase in the degree to which overt tense and agreement forms
628 are used.

629 Also, at a more general level, explicit tactics might be incorporated, even within
630 approaches that are ordinarily viewed as implicit (see Baron & Arbel, 2022). For example,
631 Leonard et al. (2004) used a focused stimulation procedure to help children with DLD acquire
632 tense and agreement morphemes. They reasoned that although the stories they created
633 provided multiple examples of appropriate tense and agreement use, these stories provided
634 children with no indication that the alternative subject + nonfinite verb utterances were *not*
635 appropriate. Accordingly, in each story, these researchers built in an exchange in which one of
636 the characters produced a subject + nonfinite verb utterance and then explicitly self-corrected,
637 as in: “Do you know where Bobby’s grandmother lives? She live on a farm. Whoops, I meant to
638 say she *lives* on a farm!” The contribution of this cue could not be separated from the other

639 elements of the treatment package, though, overall, children with DLD made reliable gains on
640 tense and agreement morphemes relative to gains on control forms.

641 At a more specific level, experimental studies of input effects have shown that children
642 are prone to use a novel verb in the form in which it was most frequently heard. For example,
643 the form *kreffs* might be used if it was consistently heard in a third person context but *kreff* might
644 be the form adopted if the verb was consistently heard in a nonfinite context. Even if the child is
645 later presented with a third person singular context such as “Every day the girl ___”, the child
646 will be more likely to use *kreff* instead of *kreffs* if only *kreff* had been heard in the input. This
647 suggests strongly that it is not only the proportion of subject + third person singular verb or
648 subject + nonfinite verb sequences that are influential, but the specific verb used in these
649 sequences. This specific-verb effect means that it may not be enough to help children use a
650 tense and agreement morpheme with only select verbs. The morpheme may become too
651 closely associated with these particular verbs and thus the children may continue to show spotty
652 use of the morpheme when other verbs are required.

653 Thanks to studies conducted by Plante and her colleagues (e.g., Plante et al., 2014),
654 there is a remedy for this potential problem. Plante et al. used conversational recasting to assist
655 four- and five-year-old children with DLD in their acquisition of grammatical morphemes. For
656 most children these were tense and agreement morphemes. These investigators found that
657 strong treatment effects occurred when the target morpheme was used with 24 unique verbs
658 during recasting in each session. These gains included the children using the target morphemes
659 with verbs that were not presented during treatment. A similar approach using fewer unique
660 verbs with the target morphemes was not successful in leading to generalization.

661 Following Plante et al. (2014), a good first step toward promoting generalization might be
662 to employ a wide range of different verbs in treatment for tense and agreement morphemes.
663 This could increase the number of verbs that could be re-balanced if the children’s input history
664 with some of these verbs almost exclusively involved bare stems.

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Learning Outcomes

856 As a result of reading this article, learners will be able to describe:

857 (1) Two potential sources in the input that might lead children to be inconsistent in the use

858 of tense and agreement morphology.

859 (2) The reasons why tense and agreement inconsistency might also be seen in languages

860 beyond English.

861 (3) The difference between an intervention approach designed to help children use tense

862 and agreement morphology and an intervention approach designed to help children

863 learn when they *must* use tense and agreement morphology.