

Against the Deficit in Computational Grammatical Complexity Hypothesis: A Corpus-based Study^{*}

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Based on the Leonard corpus in the Child Language Data Exchange System (CHILDES), this paper tries to determine the nature of grammatical errors made by English-speaking children with specific language impairment (SLI) and to evaluate a recent account of SLI, namely van der Lely's (2005) Deficit in Computational Grammatical Complexity (CGC) hypothesis, which asserts that SLI can be characterized by a primary deficit in syntax. However, it is found that the SLI children in the Leonard corpus correctly perform syntactic operations such as Case assignment, A-movement and *Wh*-movement even though they frequently commit errors on tense marking, agreement marking and auxiliary inversion. Within the framework of Chomsky's Minimalist Program (1998, 1999, 2001, 2005), this paper argues that SLI may involve a PF deficit rather than a syntactic deficit. Therefore, it is shown that the CGC hypothesis is not compatible with this finding.

Key words: computational grammatical complexity (CGC) hypothesis, specific language impairment (SLI), minimalist program (MP)

1. Introduction

“Specific Language Impairment” (SLI), also known as “developmental dysphasia”, refers to a delayed or deviant language development of children in the absence of neurological trauma, cognitive impairment, psycho-emotional disturbance, or motor-articulatory disorders (Eisenbeiss, Bartke and Clahsen 2006). Although SLI is a heterogeneous disorder, tense marking has been argued to be a good clinical marker of SLI in English-speaking children (Rice and Wexler 1996). However, different models have been proposed to explain whether tense-marking errors are syntactical in nature. This paper is also concerned with the nature of grammatical errors made by SLI children, which involves core syntactic operations such as movement, agreement and Case assignment. A recently proposed account of SLI, the Computational Grammatical Complexity (CGC) hypothesis (van der Lely 2005), will be evaluated on the basis of the Leonard corpus in the Child Language Data Exchange System (CHILDES). This corpus consists of spontaneous speech production data from eleven monolingual English-speaking children with SLI. In the following section, the key claims and predictions made by the CGC hypothesis are presented.

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2. Literature review on the computational grammatical complexity hypothesis

The Deficit in Computational Grammatical Complexity (CGC) hypothesis is a development of the Representational Deficit for Dependent Relations (RDDR) account proposed by van der Lely (1994). It aims to characterize the underlying deficits of SLI at the core of the syntactic system. This account of SLI suggests that SLI involves a deficit in the computational system, which leads to the inconsistent use of certain grammatical operations (van der Lely 1994, 1998 and van der Lely and Stollwerck 1997).

What van der Lely and Stollwerck (1997) propose is that SLI children have a deficit with “structure-dependent” relationships that can be observed on subject-verb agreement, tense marking, Case marking and movement. They argue that both subject-verb agreement and tense marking are dependent on a syntactic relationship between two constituents. In more detail, the agreeing form of the verb (e.g. the third-person, singular, present-tense morpheme *-s*) requires a syntactic relationship between a nominal expression and the verb (e.g. they are in a subject-verb or Spec-Head relationship) and the specification of the grammatical [PERSON] and [NUMBER] features. As for tense marking, it relies on a syntactic relationship between the verb and the functional head Tense (T). Therefore, the proposal that SLI children have a deficit with structure-dependent relationships can account for SLI children’s deficit with agreement and tense marking.

Since the CGC hypothesis embraces Chomskyan theories, long-distance dependencies which necessitate movement in terms of Chomsky’s Minimalist Program (1998, 1999) become a strong test of the CGC hypothesis. Given the assumption that SLI children have a deficit with structure-dependent relationships, van der Lely (1998) proposes that SLI children’s syntax is characterized by optional movement operations. That is, while the basic grammatical operation “Move” is obligatory for typical developing children, it is optional for SLI children. In more detail, van der Lely takes SLI children’s difficulties with Argument-movement (A-movement) as the source of their problems in the assignment of thematic roles (θ -roles) to NPs, especially in passive sentences. However, in van der Lely’s (1998) study, what the single subject AZ has problems with is the comprehension task of passive sentences. Whether this is due to the difficulty with A-movement is still questionable. In later research, van der Lely and Battell (2003) claim that *Wh*-movement and auxiliary inversion are problematic in SLI grammar, resulting in particular problems in forming object questions. Moreover, van der Lely and Battell propose that SLI children “merge” the *wh*-word as an interrogative marker in the Specifier position of the Complementiser Phrase (CP) instead of moving the *wh*-word.

In summary, the CGC hypothesis argues that SLI within syntax includes impairment in marking tense and agreement and in assigning Case. In addition, the movement operation, such as *Wh*-movement, is predicted to be problematic for SLI children. These key claims and predictions made by the CGC hypothesis are empirically evaluated in the following sections.

3. Results

3.1. Tense marking and agreement marking

As predicted by the CGC hypothesis, it is found in the present study that all eleven children in the Leonard corpus do commit errors concerning tense marking and agreement marking. Five of them mark the past tense at chance level, and nine of them mark agreement at chance level. The children's overall mean correctness score for past tense marking on main lexical verbs is 53.87% ($SD=17.24$), whereas their mean correctness score for the third-person, singular, present tense (3SgPres) suffix *-s* is 34.78% ($SD=20.74$). These children tend to drop the morphemes that mark tense and/or agreement.

3.2. Case marking

In contrast to their performances on tense marking and agreement marking, the SLI children in the Leonard corpus are found to use nominative (Nom) subjects perfectly in their spontaneous speech. Their mean percentage usage of the correct Nom Case is 97.26% ($SD=2.67$). As for accusative and genitive Cases, the figures are 100% ($SD=0$) and 94.03% ($SD=2.9$) respectively. These figures show that the children's Case marking of pronoun is almost adult-like. This suggests that the few Case-marking errors found among the SLI children in the Leonard corpus may be Case spellout errors rather than Case assignment errors.

3.3. Agreement marking and A-movement

Although the CGC hypothesis does not provide any specific explanation for the connection between SLI children's performance with agreement marking and A-movement, it asserts that they have an impaired syntactic ability to mark agreement and treat movement as optional grammars, which should lead to the similar frequency of errors with agreement marking and A-movement, since current thinking within the Minimalist Program (Chomsky 1998, 1999) maintains that agreement plays a central

role in A-movement.

However, it is found that the SLI children in the Leonard corpus commit no word order errors in obligatory contexts where A-movement is required. This finding indicates that A-movement is far from “optional” as predicted by the CGC hypothesis in these SLI children. Additionally, these children correctly prepose subjects to the Spec-TP position even when they commit other errors such as tense/agreement marking errors and auxiliary-omission errors in the sentences below:

- (1) It not work. (Child B)
- (2) He not clean. (Child G)
- (3) It not working. (Child H)
- (4) This be not the doctor. (Child H)
- (5) It not this one. (Child J)

3.4. *Wh*-movement and auxiliary inversion

Since the CGC hypothesis asserts that movement is an optional operation for children with SLI, it predicts that they will have deficits in the formation of *wh*-questions. The formation of object *wh*-questions is especially difficult. According to van der Lely and Battell (2003), the reason lies in the fact that the formation of object *wh*-questions involves two forms of movement, namely the A-bar movement of the *wh*-operator and T-to-C head movement of the auxiliary. They adopt the analysis of *wh*-questions proposed by Rizzi (1996), under which *wh*-questions involve a *wh*-feature dependency between a *wh*-marked noun/pronoun expression and a *wh*-marked auxiliary. It is interesting to explore the extent to which the Leonard children’s performance with *Wh*-movement and auxiliary inversion can be explained in terms of the CGC hypothesis.

Nevertheless, it is found in the present study that the SLI children in the Leonard corpus do not commit any *wh*-errors in obligatory contexts where *Wh*-movement is required. This finding is incompatible with the CGC hypothesis because it shows that *Wh*-movement is far from “optional” as predicted by the CGC hypothesis in these SLI children. On the contrary, some of these children produce sentences with auxiliary inversion errors. Five of them perform auxiliary inversion only at chance level.

4. Discussion

4.1. Tense marking and agreement marking

The CGC hypothesis proposes that children with SLI have a deficit with structure-dependent relationships. As a result, it predicts that SLI children will achieve lower scores for agreement marking and past tense marking because both of them are dependent on a syntactic relationship between two constituents. For instance, the use of the 3SgPres suffix *-s* requires a syntactic relationship between the verb and its subject and the specification of the grammatical [PERSON] and [NUMBER] features. As for the past tense marking, it relies on a syntactic relationship¹ between the verb and the functional head T (van der Lely and Stollwerck 1997). The low correctness scores for tense marking and agreement marking from the SLI children in the Leonard corpus seem to support the CGC hypothesis.

However, there is a statistically significant difference found in these children's performance with past tense marking and agreement marking on main verbs ($t(10)=3.26$, $p=.009$, two-tailed). Yet the CGS hypothesis does not offer any explanation for such a difference. There are two possible accounts for this finding. One is that the agreement marking is controlled by specification of the [PERSON] and [NUMBER] features whereas past tense marking is only controlled by one single [TENSE] feature. Hence, agreement marking constitutes a more difficult process for these SLI children. The other explanation as suggested by Clahsen, Bartke and Göllner's (1997) "Agreement Deficit Model" is that the [TENSE] feature on T is an interpretable feature whereas the [PERSON] and [NUMBER] features on T are uninterpretable features, which cause major problems of acquisition for SLI children. Since the second account assumes that agreement features are not always fully specified, the first explanation is preferred because it is shown in 4.2 and 4.3 that past tense marking and agreement marking errors may all be spellout errors instead of syntactic errors, for the [TENSE], [PERSON] and [NUMBER] features are fully specified in these SLI children's grammars.

Another theoretical problem for the CGC hypothesis is whether the past tense marking errors are truly dependency errors or not. If they result from the underspecification of the [TENSE] feature on T, they are not dependency errors. On the other hand, if the errors are caused by failing to copy a [TENSE] feature from T onto V, they are indeed dependency errors. However, if the past tense marking errors are merely spellout errors, they are not classified as dependency errors.

¹ The tense relation between T and V is mediated in standard accounts by *Affix Hopping*, which is a PF operation, not a syntactic one. On the contrary, Adger (2003) tries to treat this as a form of agreement.

4.2. Case marking

The CGC hypothesis predicts that Case marking should be impaired in SLI children's grammars because they have a deficit in using and understanding sentence elements that mark syntactic dependencies. What Case marking relies on is a syntactic dependency relationship between the Case assigner (i.e. the functional head T) and the NP or DP to which the Case is assigned.

Nevertheless, the adult-like performance on Nom Case marking found in the Leonard corpus is incompatible with the CGC hypothesis which proposes that SLI children have difficulties in building feature-dependencies between two constituents. It would only be consistent with a more restricted variant of the CGC hypothesis which supposes that children have problems in handling certain types of dependency — but this would raise the question of which types and why?

A further theoretical problem for the CGC hypothesis is that it should be able to explain why Nom Case marking is intact in these SLI children's grammars whereas tense marking and agreement marking are impaired, since Chomsky (1998, 1999, 2001) assumes that the unvalued [CASE] feature of subjects is valued as Nom (and is deleted) by a finite [TENSE] feature carried by a T which is fully specified for the [PERSON] and [NUMBER] features. An alternative account is that tense marking and agreement marking errors are all spellout errors. They are the result of a problem retrieving regular inflections and irregular inflected forms. Another possible account as suggested by Radford and Ramos's (2001) Mood-and-Agreement model is that Nom Case is assigned by a [MOOD] feature on T. If the few Case-marking errors are indeed Case assignment errors but not spellout errors, it is due to the underspecification of the [MOOD] feature and/or ϕ -features within the Mood-and-Agreement model. This issue remains open to further discussion.

4.3. Agreement marking² and A-movement

In terms of Chomsky's theory (1998, 1999, 2001), A-movement involves an active Probe in T by virtue of its uninterpretable and unvalued ϕ -features searching for an active nominal Goal (by virtue of its uninterpretable and unvalued [CASE] feature) to match and delete its ϕ -features and to delete its uninterpretable [EPP] feature by movement. Furthermore, Chomsky claims that the [EPP] feature on T can attract an expletive such as *there* which carries only the [PERSON] feature. Hence, he assumes

² As one of the anonymous reviewers points out that the 3SgPres suffix marks tense as well, one may ask whether failing to add the marker *-s* is an agreement error or a tense error. No matter whether it involves a tense marking error or not, both nominative Case assignment and A-movement are still related to the Agree relation in the narrow syntax.

that T attracts a nominal goal with which it agrees in respect of all ϕ -features carried by the goal. In other words, the movement of the nominal from Spec-vP, Spec-VP or VP-complement to Spec-TP requires the preposed nominal to agree with T in all shared ϕ -features.

Nevertheless, the finding that the SLI children in the Leonard corpus do not have any difficulty with A-movement implies that they specify person and/or number agreement between T and the preposed subject. Furthermore, since these children correctly assign Nom Case to the subjects, it indicates that agreement is fully specified. On the other hand, agreement marking errors and auxiliary-omission errors are found among these SLI children. These findings are incompatible with the CGC hypothesis, which claims that the syntactic relationship between the verb and its subject is impaired in SLI children's grammars. An alternative account proposed by this paper is that all these agreement marking errors and auxiliary-omission errors are merely spellout errors. In other words, the agreement marking errors do not result from the impaired syntactic relationship between the verb and its subject. Moreover, the present account indicates that these SLI children's low percentage implementation of the suffix *-s* in obligatory contexts may be the result of either a problem retrieving the regular *s*-inflection or irregular *s*-inflected forms.

4.4. *Wh*-movement and auxiliary inversion

It is shown in 3.4 that the SLI children in the Leonard corpus do not commit any errors concerning *Wh*-movement whereas some of them have problems with auxiliary inversion. The CGC hypothesis cannot explain the discrepancy between these children's performance on *Wh*-movement and auxiliary inversion. A possible account for this discrepancy is that *Wh*-movement and auxiliary inversion are two unrelated operations (Chomsky 1995, 1998, 1999, 2001). As proposed by Chomsky (2005), the mechanism which triggers *Wh*-movement is an edge feature [EF] on the functional head C. More specifically, the head C in questions carries an [EF] feature requiring C to be extended into a CP projection containing a specifier just as T in finite clauses carries an [EPP] feature requiring T to be extended into a TP projection containing a Specifier. In principle, the [EF] feature on C allows it to attract any maximal projection to move to Spec-CP. Nevertheless, Radford et al. (1999) posit that a clause is interpreted as a non-echoic question if (and only if) it is a CP with an interrogative Specifier (i.e. a Specifier containing an interrogative word). As a result, it follows that the [EF] feature on an interrogative C is required to attract an interrogative expression to move to Spec-CP in order for the relevant clause to be interpreted as interrogative.

As for the mechanism of auxiliary inversion, it is more complicated. According to Pesetsky and Torrego (2001) and Radford (2004), auxiliary inversion is triggered by an affix on C carrying a [TENSE] feature requiring it to attract the closest head marked for tense. Viewing the mechanism in another way, Radford (2005) proposes that auxiliary inversion is triggered by an affix on C which carries a set of agreement features triggering movement of the closest head carrying a matching set of agreement features (ϕ -features) — the closest such head being the head T constituent of TP.

The tense account predicts no inversion when C is underspecified for the [TENSE] feature, and the agreement account predicts no inversion when C is underspecified for ϕ -features. In other words, if tense is the factor triggering auxiliary inversion, the children's performance on auxiliary inversion is expected to mirror their performance on tense marking. On the other hand, if agreement is the factor triggering inversion, the children's performance on auxiliary inversion should reflect their performance on Nom Case assignment, since Chomsky (2005) claims that C hands over its agreement properties to T so that T must be underspecified for agreement and this leads to a non-Nom subject if the ϕ -features on C are not specified.

Nevertheless, the present study shows that these children's performance on auxiliary inversion (52.45% correct) more closely reflects their performance on tense marking (53.87% correct) than on Nom Case assignment (97.26% correct). In addition, according to the findings in the previous two sections, ϕ -features seem to be unimpaired in these SLI children's grammars. Therefore, their problems with auxiliary inversion may be due to the underspecification of the [TENSE] feature on C. Alternatively, a very different account for these errors is that SLI involves a PF deficit rather than a syntactic deficit. Given that the Nom Case is assigned to a noun or pronoun expression via "agreement" with a "tensed" head, this paper argues that tense-marking errors are spellout errors, rather than the result of syntactic underspecification. Based on this view, neither tense nor agreement would be underspecified in the syntax, but SLI children would have considerable problems in spelling out tense and agreement features on verbs in the PF component. If one generalizes this conclusion and supposes that SLI children have substantial problems with PF operations, this can also account for why these children perform well (100% implementation) on the syntactic operations such as A-movement and *Wh*-movement but poorly (52.45% implementation) on auxiliary inversion which Chomsky (1999) argues to be a PF operation.

5. Conclusion

In this paper, van der Lely's (2005) Deficit in Computational Grammatical

Complexity hypothesis concerning the “syntactic” errors produced by SLI children has been evaluated on the basis of the Leonard corpus. It is reported in the present study that the SLI children in the Leonard corpus do indeed have problems in the use of the 3SgPres *-s* and the preterit verb forms as predicted by the CGC hypothesis. However, it is also found that these SLI children mark tense much better than agreement. The CGC hypothesis cannot explain the discrepancy between their performances on 3SgPres *-s* and preterit inflected forms. Furthermore, it is indicated that Case marking and A-movement are unimpaired in these children’s grammars. According to Chomsky’s theories of Nom Case marking and A-movement, the findings suggest that ϕ -features on T are fully specified. Therefore, the agreement marking errors found among these children are merely spellout errors but not syntactic errors. Moreover, the present study found that auxiliary inversion rather than *Wh*-movement causes problems for these SLI children. The observation that these children do not experience difficulties in A-movement and *Wh*-movement empirically falsifies the claim of the CGC hypothesis that movement operations are optional in SLI grammar. Furthermore, this paper argues that auxiliary inversion errors may result from the underspecification of the [TENSE] feature on C.

Alternatively, a very different account for these findings is that SLI may involve a PF deficit but not a syntactic deficit. Given that the Nom Case is assigned to a noun or pronoun expression via agreement with a tensed head, this paper argues that tense-marking errors are spellout errors, instead of the result of syntactic underspecification. According to this view, both tense and agreement features are not underspecified in the syntax, but SLI children would have considerable problems in spelling out tense and agreement features on verbs in the PF component. If one generalizes this conclusion and supposes that SLI children have few problems with syntactic operations but substantial problems with PF operations, this can account for why these children perform well (100% correct) on the syntactic operations such as A-movement and *Wh*-movement but poorly (52.45% correct) on auxiliary inversion which Chomsky (1999) argues to be a PF operation.

Given that SLI is a heterogeneous disorder, this paper does not argue that SLI must be a PF deficit. Instead, what is suggested here is that one should take more syntactic operations into consideration together before claiming that SLI involves a syntactic deficit.

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反對「建構語法複雜性的缺陷」假設： 以語料為基礎的研究

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運用 MacWhinney (1995) 研發之「兒童語言資料交換系統」(Child Language Data Exchange System, 簡稱 CHILDES) 內的 Leonard 語料庫, 本研究期望藉由語料的分析, 了解以英語為母語的特定型語言障礙 (Specific Language Impairment, 簡稱 SLI) 兒童其句法發展的問題所在, 並檢證 van der Lely (2005) 宣稱 SLI 兒童具有句法異常而提出的「建構語法複雜性的缺陷」(Deficit in Computational Grammatical Complexity, 簡稱 CGC) 假設。

本研究的結果顯示 Leonard 語料庫中的 SLI 兒童, 儘管在時態標記 (-ed)、一致標記 (-s) 和助動詞移位 (auxiliary inversion) 上經常犯錯, 但在其他句法結構的生成上 (例如: 格位指定、A 移位、WH 移位) 卻顯現沒有問題。依據 Chomsky (1998, 1999, 2001, 2005) 的「極簡理論」(Minimalist Program, 簡稱 MP), 本文提出的結論是: SLI 涉及的是 PF 部份裡的問題, 而非句法操作上的缺陷。因此, 顯示「建構語法複雜性的缺陷」假設無法與本研究之結論相容。

關鍵詞: 建構語法複雜性的缺陷、特定型語言障礙、極簡理論