Journal of Language Teaching, 3(3), 26-38, 2023
https://doi.org/10.54475/jlt.2023.007

ORIGINAL RESEARCH

A corpus-based study to evaluate the generativist explanation of children's error patterns in questions

Yiran Du

Department of English, University of Liverpool, Liverpool, United Kingdom

Received: January 29, 2023 / Accepted: February 20, 2023 / Published Online: March 1, 2023

Abstract

This study explores whether the generativist account, specifically the integration theory, could explain children's percentage of errors in questions in general and whether it also applies to yes-no and non-subject wh-question. The current study adopts a corpus-based method to compare 2-to-3-year-old children's percentages of errors in questions (and in yes-no and wh-question separately) including auxiliary DO and auxiliary HAVE. The results show that children's rate of errors in questions including auxiliary DO is higher than that including auxiliary HAVE, which is also applicable to yes-no and non-subject wh-questions. The findings indicate that the generativist theory of child language acquisition could successfully explain children's patterns of errors in questions. This study also emphasises the impact of the question type which should be carefully considered when constructing and improving the generativist theory of child question formation. The study provides empirical evidence for improving and refining the generativist account of child language acquisition generally and language question acquisition specifically.

Keywords Generativism; child language acquisition; Universal Grammar; yes-no question; wh-question; error

1. Introduction

Generativism, developed by Noam Chomsky, has been an influential approach to studying child language acquisition since the 1950s after it supplanted the behaviourist approach to exploring language behaviour (Traxler, 2016). Its assumption that children are born with innate linguistic knowledge termed Universal Grammar (UG) and the subsequent Principles and Parameters framework is widely used in language acquisition research (Kania, 2016). Particularly, children question formation which involves inversion (or movement) has attracted many researchers' interests (Santelmann et al., 2002), and their research in inversion and child question formation make great contributions for constructing and improving generative account of child question acquisition (e.g., Borer & Wexler, 1987; De Villiers, 1991; Erreich, 1984; Ingram & Tyack, 1979; Klee, 1985; Klima & Bellugi, 1966; Kuczaj, 1976; Labov & Labov, 1978; Radford, 1990, 1994; Rowland, 2007; Theakston et al., 2001, 2005; Valian, 1991). Specifically, many generativists propose that inversion or movement is an essential component of UG which is constantly available to children (e.g., De Villiers, 1991; Stromwold, 1990), and children could utilise this innate linguistic knowledge to form adult-like questions from the very beginning of the language acquisition process (Rowland, 2007; Theakston et al., 2005). However, children also produce a considerable number of questions with various errors at the same time (see Bellugi, 1965, 1971), and the error tends to show systematic patterns (Kania, 2016), which should be explained by any theory aiming to describe the process of child language acquisition (Rowland, 2007). Although different solutions are proposed by many researchers such as the maturation theory (e.g., Babyonyshev et al., 2001; Borer & Wexler, 1987, 1992; Klima & Bellugi, 1966; Radford, 1990, 1994; Vainikka, 1993) and the production limitation theory (e.g., Bloom, 1990; Valian, 1991), a more promising idea is that children gain all components of UG at birth, but they also have to acquire specific rules of inflexion system from input and integrate them with the innate knowledge of inversion or movement to form questions (e.g., Santelmann et al., 2002; Stromwold, 1990), which could explain children's systematic question error patterns. For example, Santelmann et al. (2002) predict that children will make more mistakes when

producing English questions including auxiliary DO[1] than those including auxiliary HAVE[2] and modal auxiliaries because the former requires additional knowledge of English inflexional rules. However, Rowland (2007) points out that this theory only applies to yes-no questions rather than non-subject wh-question[3] by comparing children's percentage of errors in yes-no and non-subject wh-question including auxiliary DO and modal auxiliaries. Due to the controversy of whether the generativist idea could explain the error patterns in children's questions, particularly non-subject wh-question, more empirical evidence is needed and this study aims to replicate Rowland's (2007) study to compare children's percentage of errors of questions including auxiliary DO and auxiliary HAVE. This study could help construct and improve the generativist account of child language acquisition, particularly child question acquisition.

2. Literature Review

2.1. The generativist theory of child language acquisition

The generativist theory of child language acquisition (sometimes also referred to as nativism or gernerativism) started from the cognitive revolution (see Miller, 2003 for an overview) initiated by Noam Chomsky, one of the founders of cognitive science, with his work on linguistic theory and theory of language acquisition (Chomsky, 1957, 1959, 1964, 1965) together with others' influential publications (e.g., Miller, 1956; Newell et al., 1958) after the mid 20th century. Particularly, Chomsky's review (Chomsky, 1959) on representative behaviourist B. F. Skinner's *Verbal Behavior* (Skinner, 1957) challenged the foundations of behaviourism, and rejected its explanations of child language acquisition.

Behaviourism was the leading approach to studying psychology (including language behaviour) from the early 20th century to the late 1950s after it supplanted introspection as the primary paradigm to understand the cognitive abilities of humans in psychology (Traxler, 2016). The critical principle of behaviourism is that the invisible mental representations and processes in the 'black box' cannot be observed directly. Therefore, any theory in psychology can only be constructed by studying the relationships between observable external stimuli and human behaviour, and any theory appealing to invisible mental events should be abandoned (Kania, 2016; Traxler, 2016). The behaviourist tried to explain behaviour by studying how animals learn associations between stimuli (e.g., classical conditioning; Pavlov, 1927; Watson & Rayner, 1920) or situations (e.g., instrumental/operant conditioning through reward and punishment; Skinner, 1957). Specifically, Skinner (1957) claims that instrumental conditioning could also be used to explain human verbal behaviour, namely language, and children imitate caregivers' speech to acquire language because there is a reward for their speech behaviour. However, behaviourism and Skinner's explanation of child language acquisition was almost abandoned and supplanted by gernerativism due to the inadequacy of behaviourism to explain the certain phenomenon of human language behaviour (Traxler, 2016). For example, Chomsky (1959) points out that the native speaker (or even a 5-year-old child) can easily know *Colourless green ideas sleep furiously* is grammatical regardless of its strange semantics and *Sheep green colourless furiously ideas* is ungrammatical even though they never hear or encounter these sentences before, which cannot be simply explained by imitation.

On the contrary, the generativist constructs the theory of language and theory of child language acquisition by appealing to hypothetical or invisible mental representations and processes even though they are not directly observable (Kania, 2016; Traxler, 2016). The main assumption of generativism comes from the famous poverty of stimulus argument (see Chomsky, 1980, 1986), which is summarised by (Rowland, 2013) as follows: children can only acquire language through information from environment or their genetic inheritance; given that data provided by the environment is not sufficient for children to learn a language, some innate linguistic knowledge must be encoded in genes. Based on this assumption, i.e., innate linguistics knowledge in human genes, Chomsky (1965) argues that there should be an inborn language faculty, also named Language Acquisition Device, hard-wired in humans' minds. Language Acquisition Device is also regarded as a language-specific cognitive module for language development, independent of other cognitive modules (Fodor, 1983) and needs biological explanation (Garnham, 2013). This Language Acquisition Device or language-specific cognitive module contains innate linguistic knowledge, termed UG by Chomsky (1965). Because of UG, children can acquire language within a short period under the condition that there is a lack of rich linguistic input around them (Kania, 2016). Based on the hypothesis of UG, the strong continuity hypothesis claims that the theory of grammar for adults are supposed to be applied to the theory of children's grammar, which should explain their production of grammatical and ungrammatical sentences (Hyams, 1986; Pinker, 1984) while the weak continuity hypothesis argues that children do not have to mater all grammar of adults and they only need to utilise general UG principles (see next paragraph) to produce sentences (Clahsen, 1990; Haan, 1987; Jordens, 1990). However, there is almost

[1] Capital letters DO refer to all its auxiliary subtypes (*do, does, did*) in this article.

[2] Capital letters HAVE refer to all its auxiliary subtypes (*have, has, had*) in this article.

[3] This study focuses on non-subject wh-questions which includes all object and adjunct non-subject wh-questions because inversion is not required in subject non-subject wh-question formation (see also the corpora section below).

no agreement regarding the exact content of UG (Kania, 2016). Chomsky changed his description of UG several times (Rowland, 2013) from Standard Theory (see Chomsky, 1957, 1965) to Principles and Parameters (based on Government and Binding Theory) (see Chomsky, 1981) to the Minimalist program (see Chomsky, 1995) to recursion as the narrow language faculty which is unique to humans (see Hauser et al., 2002).

Because the Principles and Parameters framework is one of the most influential generative explanations of child language acquisition and is still widely used by many language acquisition studies (including this study) (Kania, 2016), it is therefore reviewed here briefly. Children are assumed to be encoded biologically with a set of principles and parameters of linguistic knowledge which help them to acquire language (Kania, 2016; Lust, 2006; Rowland, 2013). The principles manifest themselves in all languages universally, while the parameters can set different values based on different languages (Rowland, 2013). Children set parameters of their language at the very beginning of their lives with limited exposure to their mother language (Kania, 2016). For example, Santelmann et al. (2002) claim that the knowledge of movement or inversion is a principle in UG universally available to all natural languages, and different languages can use this principle specifically, which implies a set of possible parameters. For instance, I to C movement is considered a UG parameter (Fodor & Sakas, 2004). Principles and Parameters can help explain the differences in syntactic rules in various languages and children's unexpectedly sophisticated linguistic knowledge (Rowland, 2013).

However, even though the generativist theory gains a lot of credit in explaining children's performances in language acquisition (including question acquisition), it still faces some criticisms such as the problem of poverty of stimulus argument (see empirical assessment in Pullum & Scholz, 2002), the linking problem (see Tomasello, 2005), and inadequacy to explain various errors in children's early speech (see Rowland, 2013). Therefore, more empirical evidence is required to support and improve the generativist theory of child language acquisition.

2.2. The generativist theory to explain child question acquisition

The generativist theory of child question acquisition is closely related to how the questions are formed based on the theory of generative transformational grammar (Chomsky, 1981). Four English examples concerning the topic of this study are listed below:

A) *Does LeBron James eat Taco*[4] *?* (yes-no question including auxiliary DO)

B) *Has LeBron James eaten Taco?* (yes-no question including auxiliary HAVE)

C) *What does LeBron James eat?* (non-subject wh-question including auxiliary DO)

D) *What has LeBron James eaten?* (non-subject wh-question including auxiliary HAVE)

Figure 1 presents information about the formation of A and B. A is formed from its declarative counterpart (*LeBron James eats Taco*). According to the inflexional rules (number, tense, and person), the auxiliary DO (*does*, in this case) is generated automatically in the inflexion phrase's (IP) head position and the inflexional suffix of the main verb *eats* (-s) disappears. It then moves to the head position of the complementizer phrase (CP) (so-called I to C movement) (*Does LeBron James eat Taco*) and leaves a deletion trace (x) in the initial position. Similarly, originating from B's declarative counterpart (*LeBron James has eaten Taco*), its auxiliary HAVE (*has*, in this case) moves from the head position of IP to that of CP (*Has LeBron James eaten Taco*) and leaves a deletion trace.

Figure 1. Examples of formal representation of the formation of the yes-no question including auxiliary DO and auxiliary HAVE

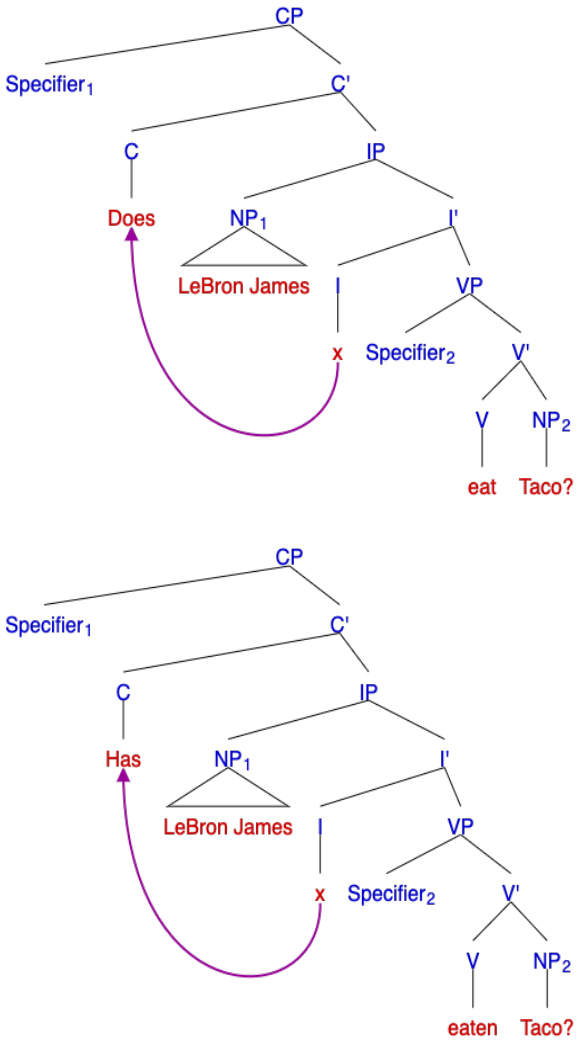
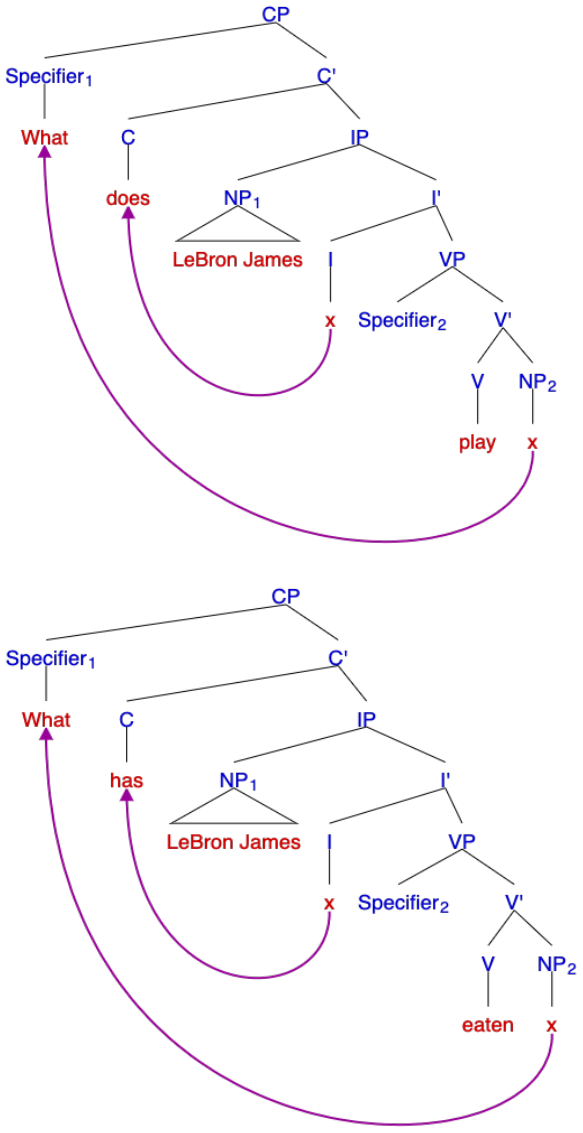


Figure 2 shows the formation of C and D. To form C, the wh-word (*what*) moves from its original position in IP (*LeBron James plays what*) to the specifier position of CP (specifier$_1$) (*What LeBron James plays*)

[4] Taco is a Mexican food, which is treated as an uncountable noun here.

and leaves a deletion trace. The rest of the process is similar to the formation of A. Based on the inflexional rules, the auxiliary DO (*does*, in this case) is generated automatically in head position and the inflexional suffix of the main verb *plays* (-s) disappears. It then moves to the head position of CP (*What does LeBron James play*) and leaves a deletion trace in the initial position. Similarly, to form D, the wh-word (*what*) moves from its original position in IP (*LeBron James has eaten what*) to the specifier$_1$ and leaves a deletion trace. The rest of the process is similar to the formation of B. Its auxiliary HAVE (*has*, in this case) then moves from the head position of IP to that of CP (*What has LeBron James eaten*) and leaves a deletion trace.

Figure 2. Examples of formal representation of the formation of the non-subject wh-question including auxiliary DO and auxiliary HAVE



Based on the formation of these sample yes-no and non-subject wh-question, it can be found that all of them require the process of movement. Therefore, many generativist theories of child question acquisition maintains that movement is one of the principles contained in UG that children born with (Ambridge et al., 2006; Kania, 2016; C. F. Rowland, 2007; C. F. Rowland et al., 2005; Santelmann et al., 2002). According to this account, children quickly know English could allow movement operations (e.g., subject auxiliary inversion) in yes-no and non-subject wh-question under, albeit, limited exposure to English from their care givers (Rowland, 2007; Santelmann et al., 2002). This explains why children can produce adult-like questions from the very beginning of the language acquisition process (Rowland, 2007; Rowland et al., 2005), which is proved by the data (see Bellugi, 1965, 1971).

However, this account also has some problems. For example, there is a period when children are found to produce adult-like questions and non-adult-like questions including various errors at the same time (Ambridge et al., 2006). Theories appealing to early parameter setting are hard to explain this phenomenon, although they could successfully explain children's early adult-like question production (Rowland, 2007; Rowland et al., 2005; Santelmann et al., 2002). Furthermore, the question errors produced by children tend to show systematic patterns (Kania, 2016). For example, it was found in both corpus studies and experiments that children are more likely to make mistakes in questions including auxiliary DO (Hattori et al., 2003; Labov & Labov, 1978; Maratsos & Kuczaj, 1978; C. F. Rowland et al., 2005; Santelmann et al., 2002; Valian & Casey, 2003). A successful theory of child language acquisition (child question acquisition, in this case) should also explain these systematic errors in the early period of children's question production (Rowland, 2007). Nevertheless, although many generativists proposed different solutions (e.g., Bloom, 1990; De Villiers, 1991; Hyams, 1986; Radford, 1990, 1994; Santelmann et al., 2002; Stromwold, 1990), they still did not reach an agreement and constructed an integrated theory.

2.3. The generativist theory to explain children's question error patterns

There are mainly three influential generative accounts of questions error patterns (or error patterns from a broader view) in children's speech: the maturation theory (e.g., Babyonyshev et al., 2001; Borer & Wexler, 1992; Klima & Bellugi, 1966; Radford, 1990, 1994; Vainikka, 1993), the performance limitation theory (e.g., Bloom, 1990; Valian, 1991), and the integration theory (e.g., Santelmann et al., 2002; Stromwold, 1990).

The maturation theory posits that children produce non-adult-like sentences with errors in the multi-word speech stage because their brains have not matured enough to gain the full knowledge or full set of principles in UG, which means certain aspects of UG or certain principles have not been available to children yet (Babyonyshev et al., 2001; Borer & Wexler, 1987, 1992). Specifically, it is contended that movement or inversion is not available in children's early grammar (Klima & Bellugi, 1966; Radford, 1994); therefore, children is hard to utilise the grammatical knowledge of movement or inversion in their question formation,

thus making various errors (Radford, 1994; Vainikka, 1993) (e.g., **what you are doing?*). However, there are also criticisms. For example, although the maturation theory predicts that the knowledge of functional categories in UG is not available to children at birth (Radford, 1994), it is found that children do rely on fictional categories when they begin to produce multi-word utterances (Lust, 1999). Moreover, Lust, (2006) argues that children master the tensed verb, determiner, and preposition in a period which is earlier than the maturation theory expects. Furthermore, if researchers suppose that the understanding of movement that allows inversion is a basic aspect of UG which is constantly accessible to children, then the alleged slow development of inversion in child grammar poses a challenge to the Strong Continuity Hypothesis of UG (see section 2.1 paragraph 3 for the detailed explanation) as a framework of language faculty of the children (Santelmann et al., 2002). The performance limitation theory claims that children's linguistic performance is limited by other immature cognitive abilities (e.g., working memory; attention), although they have access to all aspects of UG at first (Bloom, 1990; Valian, 1991). This idea is supported by many studies (e.g., Bloom, 1990; Hamburger & Crain, 1982). For example, some studies attribute children's difficulty in understanding relative clauses to the fact that they do not master relevant syntactic rules (e.g., Tavakolian, 1981). However, Hamburger and Crain (1982) reject this view and assert that task design confuses children. They redesigned the experiment and found that children understood relative clauses once given appropriate tasks. This indicates that researchers always underestimate children's grammatical competence due to their challenging experiment designs for children (Rowland, 2013). Nevertheless, the theory still fails to explain the auxiliary omission patterns (see Theakston et al., 2005) and the problem of lexical specificity (see Rowland, 2013 for detailed explanation).

The integration theory is believed to be more promising (Rowland, 2007). It also points out that children have access to all aspects of UG at birth, but they have to learn specific rules of inflexion (e.g., tense; number; person) in their mother language (e.g., English) and integrate them with the innate knowledge of movement to form questions (e.g., Santelmann et al., 2002; Stromwold, 1990). Santelmann et al. (2002) used an elicited imitation method to test the extent to which 2-to-5-year-old children master grammatical knowledge of inversion in English yes-no questions. The results showed that children could use the knowledge of inversion from the earliest tested age and did not change over time. They also showed the development of their knowledge of English inflexional rules. As Santelmann et al. (2002) predict, for example (see Figure 1 and section 2.2 for an detailed explanation of question formation), children will make more errors in questions including auxiliary DO because they have to learn "reconstruction of inflexion through do-support" (p. 814); in contrast, fewer errors would be produced in questions including auxiliary HAVE because children only need to utilise the innate knowledge of inversion to form such questions. Rowland (2007) further tested this theory through a corpus-based study. She examined children's percentage of errors in questions including auxiliary DO and modal auxiliaries and found that the percentage of errors of question including auxiliary DO was significantly higher than that with modal auxiliaries, which was consistent with Santelmann et al.'s (2002) study. However, she also noticed that yes-no questions account for a much more significant proportion than non-subject wh-question, which might affect the conclusion. Rowland then reanalysed the yes-no questions' and non-subject wh-question' percentage of errors independently and found that the percentage of errors of yes-no questions including auxiliary DO was also significantly higher than that with modal auxiliaries, in line with Santelmann et al.'s (2002) study. However, the results for the percentage of errors of non-subject wh-question were not as predicted. There was no significant difference between the mean percentage of errors of non-subject wh-question including auxiliary DO and that with modal auxiliaries (Rowland, 2007), although the researcher excluded the influences of the wh-word "why" (see Labov & Labov, 1978; Rowland et al., 2003; Rowland & Pine, 2000) and negative auxiliaries (see Bellugi, 1971; Guasti et al., 1995; Thornton & Houser, 2005).

Even though the generativist theory of child language acquisition successfully explains the question formation of children's utterances, it is still controversial whether it is applicable to explain various question error patterns in children's utterances, particularly in non-subject wh-question. Therefore, more empirical evidence from naturalistic data is needed to fill the research gap. This study aims to examine the generativist theory of child language acquisition to explain the question error patterns in children's utterances by examining 2-to-3-year-old children's percentage of errors of questions including auxiliary DO and auxiliary HAVE from their naturalistic speech. This study aims to address the following research questions.

RQ1: To what extent can the generativist theory explain children's overall error patterns in questions?

RQ2: To what extent can the generativist theory explain children's error patterns in yes-no questions and wh-questions respectively?

3. Methodology

This research adopts a cross-sectional corpus-based design to collect naturalistic data for quantitative analysis to compare percentage of errors in 2-to-3-year-old children's yes-no and non-subject wh-question including auxiliary DO and auxiliary HAVE.

3.1. Participants

The participants were chosen to collect required types of questions in a naturalistic setting. The

participants were 12 British children (Anne, Aran, Becky, Carl, Dominic, Gail, Joel, John, Liz, Nicole, Ruth, Warren) from the Manchester corpus (Theakston et al., 2001) on CHILDES database (MacWhinney, 2000). All children are monolingual native English speakers from middle class families. All of them have typical language development paths and none of them suffer from cognitive problems or language disorders. Six of them are female and the rest of them are male. Table 1 [5] lists basic information of participants including the numbers of children, their names, their age ranges, and their MLU ranges. Their ages approximately range from 2 (1;08.22 - 2;00.25) to 3 (2;08.15 - 3;00.1). This age range is chosen because Santelmann et al.'s (2002) contends that the knowledge of inversion is available to children from the earliest testable age, i.e., the multi-word speech stage, which is around 2 years old (Lust, 2006). More information about children and can be found in the description page of the Manchester corpus and participants section in (Theakston et al., 2005).

Table 1. Basic information of participants

Number	Name	Age range	MLU* range
1	Anne	1;10.07 - 2;09.10	1.61 - 3.46
2	Aran	1;11.12 - 2;10.28	1.41 - 3.84
3	Becky	2;00.07 - 2;11.15	1.46 - 3.24
4	Carl**	1;08.22 - 2;08.15	2.17 - 3.93
5	Dominic**	1;10.24 - 2;10.16	1.20 - 2.85
6	Gail	1;11.27 - 2;11.12	1.76 - 3.42
7	Joel	1;11.01 - 2;10.11	1.33 - 3.32
8	John	1;11.15 - 2;10.24	2.22 - 2.93
9	Liz	1;11.09 - 2;10.18	1.35 - 4.12
10	Nicole**	2;00.25 - 3;00.10	1.06 - 3.26
11	Ruth**	1;11.15 - 2;11.21	1.41 - 3.35
12	Warren**	1;10.06 - 2;09.20	2.01 - 4.12

*MLU refers to the mean length of the utterance.
**Because Carl, Dominic, Nicole, Ruth, and Warren do not produce enough required types of questions, their data was excluded.

3.2. Transcription

Children's naturalistic utterances were transcribed orthographically. More details on the transcription can also be found in the description page of the Manchester corpus and transcription section in Theakston et al. (2005). The selected transcripts in the Manchester corpus are used for analysis.

3.3. Corpora

The corpora are built for required types of questions from the transcripts for coding and analysis. All yes-no questions including auxiliary HAVE and those including auxiliary DO from the transcripts were included in the corpora. They must contain the auxiliary, subject, and main verb. All non-subject wh-question including auxiliary HAVE and auxiliary DO from the transcripts were also incorporated in the corpora. They should have the wh-word, subject, auxiliary, and main verb. The questions including xxx marked in the transcripts (e.g., *where did he xxx?*) were excluded because it is hard to judge whether children are producing right (e.g., *where did he go?*) or non-adult-like questions (e.g., *where did he went?*). The subject non-subject Wh-question were not included in the corpora because children does not need inversion to produce such questions (e.g., *who did it?*), which is therefore irrelevant for the analysis. The non-inverted yes-no question were excluded (e.g., *you did it?*) because it is hard to judge whether it was a non-adult-like question without inversion or an intonation-only question produced on purpose.

3.4. Coding criteria

Coding criteria were adapted from Rowland et al. (2005) and Rowland (2007). All yes-no and non-subject wh-question including auxiliary DO or HAVE produced by the 12 children in the corpora in this study were coded by the researcher as follows.

3.4.1. Adult-like questions

In terms of adult-like questions, they were coded as (1) adult-like yes-no question including auxiliary DO, (2) adult-like yes-no questions including auxiliary HAVE, (3) adult-like non-subject wh-question including auxiliary DO, and (4) adult-like non-subject wh-question including auxiliary HAVE. All coded adult-like yes-no questions including auxiliary DO or HAVE should have the adult-like form and placement of the auxiliary, tense, agreement, case, main verb, and subject. All coded non-subject wh-question including auxiliary DO or HAVE should have the adult-like form and placement of the wh-word, tense, agreement, case, main verb, and subject. However, questions including omission and other minor grammatical errors were also coded as adult-like questions accordingly if they could show children's abilities to use inversion adult-likely in English. For example, *do you like play with dog?* is grammatically non-adult-like because *dog* should be plural or have the determiner, but it was also coded as adult-like yes-no question including auxiliary DO because *do you like play* already demonstrated

[5] The information is checked and calculated by the researcher himself. However, Theakston et al. (2005) has a similar table showing more detailed information about children.

children's good master of inversion in yes-no question formation.

3.4.2. Non-adult-like questions

In terms of non-adult-like questions, they were coded as (1) non-adult-like yes-no question including auxiliary DO, (2) non-adult-like yes-no questions including auxiliary HAVE, (3) non-adult-like non-subject wh-question including auxiliary DO, and (4) non-adult-like non-subject wh-question including auxiliary HAVE. All coded non-adult-like yes-no questions should at least have the auxiliary, subject, and main verb. All coded non-adult-like non-subject wh-question should at least have the wh-word, auxiliary, and main verb, and they should have at least one grammatical problem in tense, agreement, case, subject omission, or inversion.

3.5. Data extraction

CLANc was used for the data extraction from the transcripts. The retrieval algorithm (combo +s"do+did+does+don't+didn't+doesn't" @ +t*CHI) was used for searching the transcripts for the utterances containing adult-like and non-adult-like yes-no and non-subject wh-question including auxiliary DO. Another retrieval algorithm (combo +s"have+has+had+haven't+hasn't+hadn't" @ +t*CHI) helped to search the transcripts for utterances including adult-like and non-adult-like yes-no and non-subject wh-question including auxiliary HAVE. All required adult-like and non-adult-like questions were then categorised by the researcher according to the coding criteria (see section 3.4).

3.6. Data analysis

SPSS 28 was the key software selected for the quantitative analysis. Descriptive data was calculated for the means and standard deviations of the numbers of children's different types of questions. Next, the means and standard deviations of the percentage of errors those questions were calculated accordingly (the percentage of errors = the number of non-adult-like questions / the total number of adult-like and non-adult-like questions). A paired sample t-test was then conducted to evaluate the influence of the auxiliary type (auxiliary DO or auxiliary HAVE) on the overall percentage of errors of children's questions. Another paired sample t-test were conducted to evaluate the effect of the question type (yes-no or non-subject wh-question) on the overall percentage of errors of children's questions. Next, a 2 x 2 within-subjects ANOVA was conducted with two factors. The first factor (the auxiliary type) had two levels (auxiliary DO or auxiliary HAVE), and the second factor (the question type) also had two levels (yes-no or non-subject wh-question). After that, a paired sample t-test was conducted to examine the impact of the auxiliary type on children's percentage of errors in yes-no questions. A paired sample t-test was conducted to examine the impact of the auxiliary type on children's percentage of errors in non-subject wh-question. A paired sample t-test was conducted to examine the impact of the question type on children's percentage of errors in questions including auxiliary DO. Another paired sample t-test was conducted to examine the impact of the question type on children's percentage of errors in questions including auxiliary HAVE.

4. Results

4.1. Error patterns in questions including auxiliary DO and auxiliary HAVE

Table 2 shows the mean and standard deviation of the number of adult-like and non-adult-like questions including auxiliary DO and auxiliary HAVE and the percentage of errors of questions including auxiliary DO and auxiliary HAVE. It can be observed that the mean percentage of errors with questions of auxiliary DO (5.78%) is higher than that with auxiliary HAVE (2.03%). However, due to large standard deviation, a paired sample t-test was conducted to examine the impact of auxiliary type (auxiliary DO or auxiliary HAVE) on children's percentage of errors in questions. The results show that there is no significant difference between children's percentage of errors of questions including auxiliary DO and those including auxiliary HAVE (t (6) = 1.565, p = .169, two-tailed, 95% confidence interval level [-.02116, .09620]). The Cohen's d (.063 < .2) indicates a very small effect size (Pallant, 2020).

Table 2. The mean (M) and standard deviation (SD) of the number of adult-like and non-adult-like questions including auxiliary DO and auxiliary HAVE and the corresponding percentages of errors

	Questions including auxiliary DO			Questions including auxiliary HAVE		
	N_a[6]	N_n[7]	Percentage of errors (%)	N_a	N_n	Percentage of errors (%)
Mean	91.14	8.86	5.78	17.86	.86	2.03
(SD)	(110.64)	(18.25)	(6.76)	(15.78)	(1.86)	(3.62)

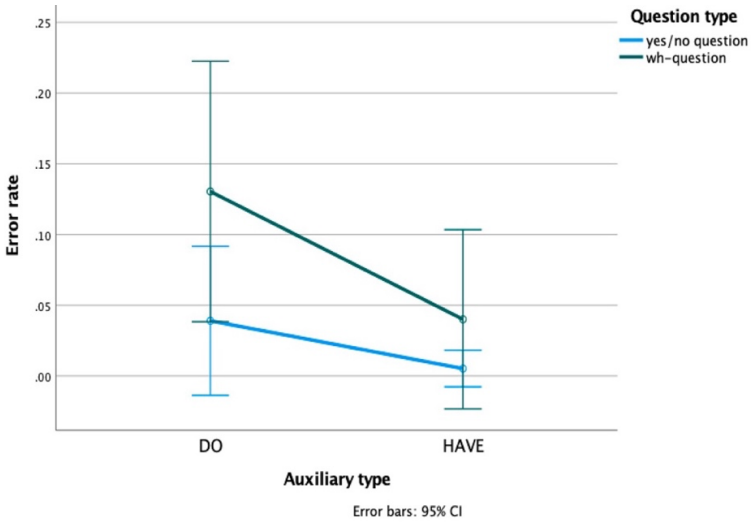
Furthermore, Rowland (2007) claims that the question type (yes-no or non-subject wh-question) can impact children's percentage of errors in questions, and it is better to analyse children's percentage of errors of yes-no and non-subject wh-question separately. Therefore, a paired sample t-test was conducted to evaluate the influence of the question type (yes-no or non-subject wh-question) on children's percentage of

[6] This symbol refers to the number of adult-like questions in this paper.
[7] This symbol refers to the number of non-adult-like questions in this paper.

errors. The data shows that children's percentage of errors differ significantly in yes-no questions (M = .0348, SD = .01925) and non-subject wh-question (M = .1155, SD = .03051, t (6) = -3.327, p = .016 < .05, two-tailed) with a 95% confidence interval (CI) level ranging from -.14016 to -.02135 (see Table 3). However, the effect size is very small (Cohen'd = .064 < .2) (Pallant, 2020). It indicates that the question type could have an impact on children's percentage of errors in questions.

To further confirm the impact of the question type and the auxiliary type on the percentage of errors and examine their interaction effect, a 2 x 2 within-subjects ANOVA was conducted with two factors (see Figure 3). The first factor (the auxiliary type) had two levels (auxiliary DO or auxiliary HAVE), and the second factor (the question type) also had two levels (yes-no or non-subject wh-question). The results show that the main effect of the auxiliary type is significant (F (1, 6) = 6.298, p = .046 < .05). The size effect is very large (η^2 = .509 > .138) (ibid.). The main effect of the question type is also significant (F (1, 6) = 10.913, p = .016 < .05). The size effect is very large (η^2 = .651 > .138) (Pallant, 2020). However, there is no interaction effect between the auxiliary type and the question type (F (1, 6) = 2.039, p = .203 > .05). The size effect is very large (η^2 = .273 > .138) (Pallant, 2020). Figure 3 shows children's percentage of errors in yes-no and non-subject wh-question including auxiliary DO and auxiliary HAVE respectively. The two lines shows the similar tendency, implying that there is less likely to have an interaction effect between two factors (Harrison *et al.*, 2022, p. 280), which is consistent with the statistical data. Due to the main effect of the question type, children's percentage of errors of questions including auxiliary DO and auxiliary HAVE were analysed separately below according to the question type.

Figure 3. Children's percentage of errors (with error bars) in yes-no and non-subject wh-question including auxiliary DO and auxiliary HAVE



4.2. Error patterns of yes-no questions and non-subject wh-questions including auxiliary DO and auxiliary HAVE

Table 3 presents the information about the mean and standard deviation of the number of adult-like and non-adult-like yes-no questions including auxiliary DO and auxiliary HAVE and the percentage of errors of yes-no questions including auxiliary DO and auxiliary HAVE. It can be found that the mean percentage of errors of yes-no questions including auxiliary DO (3.91%) is larger than that of yes-no questions including auxiliary HAVE (0.53%). A paired sample t-test was conducted to examine the impact of the auxiliary type on children's percentage of errors in yes-no questions. The data shows that there is no significant difference in children's percentage of errors in yes-no questions including auxiliary DO (M = .0391, SD = .05693) and those including auxiliary HAVE (M = .0053, SD = .01400, t (6) = 1.685, p = .143 > .05, two-tailed) with a 95% confidence interval level ranging from -.01527 to -.08281 (see Table 5). However, the effect size is very small (Cohen'd = .053 < .2).

Table 3. The mean and standard deviation of the number of adult-like and non-adult-like yes-no questions including auxiliary DO and auxiliary HAVE and the corresponding percentages of errors

	Yes-no questions including auxiliary DO			Yes-no questions including auxiliary HAVE		
	N_a	N_n	Percentage of errors (%)	N_a	N_n	Percentage of errors (%)
Mean (SD)	73.00 (95.31)	4.43 (10.42)	3.91 (5.69)	12.00 (8.64)	.14 (.38)	.53 (1.40)

Table 4 presents the information about the mean and standard deviation of the number of adult-like and non-adult-like non-subject wh-question including auxiliary DO and auxiliary HAVE and the percentage of errors of non-subject wh-question including auxiliary DO and auxiliary HAVE. It can be found that the mean percentage of errors of non-subject wh-question including auxiliary DO (13.05%) is larger than that of non-subject wh-question including auxiliary HAVE (4.01%). A paired sample t-test was conducted to examine the impact of the auxiliary type on children's percentage of errors in non-subject wh-question. The data shows that children's percentage of errors in non-subject wh-question including auxiliary DO (M = .1305, SD = .0996) is significantly larger than those including auxiliary HAVE (M = .0401, SD = .026,

t (6) = 1.685, p = .033 < .05, one-tailed) with a 95% confidence interval level ranging from -.00772 to -.1884. However, the effect size is very small (Cohen'd = .106 < .2) (Pallant, 2020).

Table 4. The mean and standard deviation of the number of adult-like and non-adult-like yes-no questions including auxiliary DO and auxiliary HAVE and the corresponding percentages of errors

	Non-subject wh-question including auxiliary DO			Non-subject wh-question including auxiliary HAVE		
	N_a	N_n	Percentage of errors (%)	N_a	N_n	Percentage of errors (%)
Mean	18.14	4.43	13.05	5.86	.71	4.01
(SD)	(17.112)	(7.913)	(.0996)	(8.688)	(1.496)	(.026)

4.3. The impact of the question type on children's percentage of errors in questions including auxiliary DO and HAVE

To further examine the impact of the question type on children's percentage of errors in questions including auxiliary DO and HAVE, a paired sample t-test was conducted to examine the impact of the question type on children's percentage of errors in questions including auxiliary DO (see Table 5). The data shows that children's percentage of errors in yes-no questions including auxiliary DO (M = .0391, SD = .05693) is significantly lower than non-subject wh-question including auxiliary DO (M = .1305, SD = .09957, t (6) = -2.907, p = .027 < .05, two-tailed) with a 95% confidence interval level ranging from -.16833 to -.01446 (see Table 6). However, the effect size is very small (Cohen'd = .083 < .2) (Pallant, 2020).

Table 5. The result of the paired sample t-test to compare percentage of errors in yes-no and non-subject wh-question including auxiliary DO (two-tailed)

		M	SD	t	Sig.	95% CI	
						Lower	Upper
Pair	Auxiliary DO (yes-no)	.0391	.05693	-2.907	.027	-.16833	-.01446
	Auxiliary DO (wh)	.1305	.09957				

Another paired sample t-test was conducted to examine the impact of the question type on children's percentage of errors in questions including auxiliary HAVE (see Table 6). The data shows that There is no significant difference between children's percentage of errors in yes-no questions including auxiliary HAVE (M = .0053, SD = .01400) and non-subject wh-question including auxiliary HAVE (M = .0401, SD = .06852, t (6) = -1.518, p = .180 > .05, two-tailed) with a 95% confidence interval level ranging from -.09095 to .02131 (see Table 9). However, the effect size is very small (Cohen'd = .06069 < .2) (Pallant, 2020).

Table 6. The result of the paired sample t-test to compare percentage of errors in yes-no and non-subject wh-question including auxiliary HAVE (two-tailed)

		M	SD	t	Sig.	95% CI	
						Lower	Upper
Pair	Auxiliary HAVE (yes-no)	.0053	.0140	-1.518	.180	-.09095	.02131
	Auxiliary HAVE (wh)	.0401	.0685				

5. Discussion

5.1. To what extent can the generativist theory explain the error patterns in questions?

It is found that the mean percentage of errors of questions including auxiliary DO is higher than that with auxiliary HAVE, although there is no significant difference between children's percentage of errors of questions including auxiliary DO and those including auxiliary HAVE with a very small size effect. This is partially consistent with Santelmann et al.'s (2002), who proposes the integration theory, experiments that indicate that the percentage of errors in questions including auxiliary DO are more likely to be higher. It is also in line with other studies contending that children are more likely to make errors in questions including auxiliary DO (Hattori et al., 2003; Labov & Labov, 1978; Maratsos & Kuczaj, 1978; C. F. Rowland et al., 2005; Valian & Casey, 2003). Moreover, according to the integration theory, children should produce less errors in questions including the modal auxiliaries and auxiliary HAVE because questions including then do not require the integration of infection system to be produced. Therefore, the finding also echoes the finding in Rowland's (2007) corpus study that percentage of errors in questions including modal auxiliaries is lower than those including auxiliary DO. It is also found that the main effect of the auxiliary type is significant with a large size effect. This is against Rowland's (2007) finding that the main effect of the auxiliary type is not significant. However, this

finding is consistent with the finding that auxiliary DO attracts a higher percentage of errors. In conclusion, the findings indicate that the generativist theory could successfully explain children's general percentage of errors in questions.

Moreover, it is found that children's percentage of errors differ significantly in yes-no questions and non-subject wh-question and the main effect of the question type is significant with a large size effect. Santelmann et al. (2002) did not notice the impact of the question type. However, Rowland (2007) found and emphasised the impact of question type: the main effect of the question type is significant, which is in line with the findings in the current study. Furthermore, it is also found that children's mean percentage of errors in yes-no questions including auxiliary DO is significantly lower than non-subject wh-question including auxiliary DO and the mean percentage of errors in non-subject wh-question including auxiliary DO is also lower than non-subject wh-question including auxiliary DO, although there is no significant difference between children's percentage of errors in yes-no questions including auxiliary HAVE and non-subject wh-question including auxiliary HAVE with a very small size effect. This further confirm the impact of the question type. Moreover, this study also finds that there is no interaction effect between the auxiliary type and the question type with a large size effect, which is contrary to Rowland's (2007) finding that the interaction effect is highly significant. It is hard to explore the implication based on the interaction effect, and it is therefore inconclusive here. In conclusion, the findings indicate that the generativist explanation of children's question error pattens should be constructed based on different question type (yes-no or wh-question).

5.2. To what extent can the generativist theory explain the error patterns in yes-no questions?

It is found that the mean percentage of errors of yes-no questions including auxiliary DO is larger than that of yes-no questions including auxiliary HAVE, although there is no significant difference in children's percentage of errors in yes-no questions including auxiliary DO and those including auxiliary HAVE and the effect size is very small. This finding is consistent with the prediction from Santelmann et al. (2002). Together with Rowland's finding that children's percentage of errors in questions including modal auxiliaries is higher than those including auxiliary DO, the finding in the current study could support the integration theory from generativists (e.g., Santelmann et al., 2002; Stromwold, 1990). This indicates that the generativist theory could also successfully explain the error patterns in yes-no questions.

This study also finds that the mean percentage of errors of non-subject wh-question including auxiliary DO is larger than that of non-subject wh-question including auxiliary HAVE. Moreover, children's percentage of errors in non-subject wh-question including auxiliary DO is significantly larger than those including auxiliary HAVE. This finding echoes the finding in Rowland et al.'s (2005) study that auxiliary HAVE attracts lower percentage of errors than auxiliary DO in non-subject wh-question formation. However, in terms of the generativist account, this finding is against Rowland's (2007) study which contents that children produce more errors in non-subject wh-question including modal auxiliaries than those including auxiliary DO because based on the integration theory, wh-question including auxiliary DO should attract higher percentage of errors due to integration with inflexional system in formation. Moreover, although many studies challenge the generativist theory to explain children's error pattern in wh-question and proposed a constructivist solution (Rowland, 2007; Rowland et al., 2005; Rowland & Pine, 2000), the finding in the current study supports the integration theory which proposed by the generativists. This indicates that the generativist theory could also successfully explain the error patterns in non-subject wh-question.

6. CONCLUSION

In conclusion, this study aims to explore whether the generativist account, specifically the integration theory could explain children's percentage of errors in question in general whether it is also applicable to yes-no and wh-question. The current study adopts a corpus-based method to compare 2-to-3-year-old children's percentage of errors in questions (and yes-no and wh-question separately) with auxiliary DO and auxiliary HAVE. The results show that (1) the mean percentage of errors of questions including auxiliary DO is higher than that with auxiliary HAVE, although there is no significant difference between children's percentage of errors of questions including auxiliary DO and those including auxiliary HAVE with a very small size effect; (2) The mean percentage of errors of yes-no questions including auxiliary DO is larger than that of yes-no questions including auxiliary HAVE, although there is no significant difference in children's percentage of errors in yes-no questions including auxiliary DO and those including auxiliary HAVE and the effect size is very small; (3) The mean percentage of errors of non-subject wh-question including auxiliary DO is larger than that of non-subject wh-question including auxiliary HAVE and children's percentage of errors in non-subject wh-question including auxiliary DO is significantly larger than those including auxiliary HAVE. Therefore, the current study concludes that the generativist theory could successfully explain children's overall percentage of errors in questions and percentage of errors in yes-no and non-subject wh-question. This study provides empirical evidence to support the generativist theory of child question acquisition and theory of child language acquisition in a broader view. Moreover, this study also finds that children's percentage of errors differ significantly in

yes-no questions and non-subject wh-question and the main effect of the question type is significant with a large size effect, which indicates that the generativist explanation of children's question error pattens should be constructed based on different question type (yes-no or non-subject wh-question). This finding provides insights for improving and refining the generativist theory of child question acquisition.

Admittedly, this study does have some problems. Firstly, the sample size is small (only seven participants) due to exclusion of the participants who do not produce enough required types of data, which cause statistical insignificance and very small effect size in many statistical tests in this study. However, the small sample size is common in cross-sectional corpus-based study to explore child question acquisition (e.g., 12 participants in Rowland et al., 2003; 13 participants in Rowland et al., 2005; 10 participants in Rowland, 2007) because it is time-consuming and effortful to collect and analyse data (Rowland et al., 2008). Therefore, this study uses the mean as an important indicator of children's tendency to produce errors in different types of questions including the help of statistical techniques as supplements. However, later research should still consider carefully about the problem of sample size. Moreover, this study also finds that there is no interaction effect between the auxiliary type and the question type with a large size effect, which is contrary to Rowland's (2007) finding that the interaction effect is highly significant. It is hard to explore the implication based on the interaction effect, and it is therefore inconclusive here. Further research could follow this idea and design experiments accordingly to figure out the implications of the interaction effect between the question type and the auxiliary effect in children's questions.

Acknowledgement

Many thanks to my supervisor, Dr Ursula Kania, for her kind suggestions. Thanks for my parents' emotional and financial support for my academic career.

Yiran Du is currently an undergraduate in University of Liverpool and will study in University of Oxford (MPhil in Linguistics, Philology and Phonetics). His research interests are psycholinguistics, semantics, and language acquisition.
E-mail: hsydu14@liverpool.ac.uk

References

Ambridge, B., Rowland, C. F., Theakston, A. L., & Tomasello, M. (2006). Comparing different accounts of inversion errors in children's non-subject wh-questions: 'What experimental data can tell us?' *Journal of Child Language*, *33*(3), 519–557. https://doi.org/10.1017/S0305000906007513

Babyonyshev, M., Ganger, J., Pesetsky, D., & Wexler, K. (2001). The Maturation of Grammatical Principles: Evidence from Russian Unaccusatives. *Linguistic Inquiry*, *32*(1), 1–44. https://doi.org/10.1162/002438901554577

Bellugi, U. (1965). The Development of Interrogative Structures in Children's Speech. In K. Riegel (Ed.), *The development of language functions* (pp. 103–138). University of Michigan.

Bellugi, U. (1971). Simplification in children's language. In R. Huxley & E. Ingram (Eds.), *Language acquisition: Models and methods* (pp. 95–119). Academic Press.

Bloom, P. (1990). Subjectless Sentences in Child Language. *Linguistic Inquiry*, *21*(4), 491–504.

Borer, H., & Wexler, K. (1987). The Maturation of Syntax. In T. Roeper & E. Williams (Eds.), *Parameter Setting* (Vol. 4, pp. 123–172). Springer Netherlands. https://doi.org/10.1007/978-94-009-3727-7_6

Borer, H., & Wexler, K. (1992). Bi-unique relations and the maturation of grammatical principles. *Natural Language and Linguistic Theory*, *10*(2), 147–189. https://doi.org/10.1007/BF00133811

Chomsky, N. (1957). *Syntactic Structures*. Mouton.

Chomsky, N. (1959). *Language*, *35*(1), 26–58. JSTOR. https://doi.org/10.2307/411334

Chomsky, N. (1964). *Current Issues in Linguistic Theory*. Mouton.

Chomsky, N. (1965). *Aspects of the Theory of Syntax*. The MIT Press.

Chomsky, N. (1980). *Rules and representations*. Columbia University Press.

Chomsky, N. (1981). *Lectures on Government and Binding: The Managua lectures*.

Chomsky, N. (1986). *Knowledge of language*. Praeger.

Chomsky, N. (1995). *The minimalist grogram*. MIT Press.

Clahsen, H. (1990). Constraints on Parameter Setting: A Grammatical Analysis of Some Acquisition in Stages in German Child Language. *Language Acquisition*, *1*(4), 361–391. https://doi.org/10.1207/s15327817la0104_3

De Villiers, J. (1991). Why Questions? *University of Massachusetts Occasional Papers in Linguistics*, *17*(1), 155–173.

Erreich, A. (1984). Learning how to ask: Patterns of inversion in *yes – no* and *wh* -questions. *Journal of Child Language*, *11*(3), 579–592. https://doi.org/10.1017/S0305000900005961

Fodor, J. A. (1983). *The modularity of mind: An essay on faculty psychology. A Bradford book*. MIT Press.

Fodor, J. D., & Sakas, W. G. (2004). *Evaluating models of parameter setting*. *1*, 1–27.

Garnham, A. (2013). Language, the Mind, and the Brain. In K. Allan (Ed.), *The Oxford Handbook of the History of Linguistics* (1st ed., pp. 674–690). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199585847.013.0031

Guasti, M. T., Thornton, R., & Wexler, K. (1995). Children's negative questions: The case of English. *Proceedings of the Boston University Conference on Language Development*, *19*, 228–

239.
Haan, G. de. (1987). A theory-bound approach to the acquisition of verb placement in Dutch. In G. de. Haan & W. Zonneveld (Eds.), *Formal parameters of generative grammar* (pp. 15–30). University of Utrecht.
Hamburger, H., & Crain, S. (1982). Relative acquisition. In S. Kuczaj (Ed.), *Language development: Syntax and semantics* (pp. 245–274). Erlbaum.
Hattori, R., Alejn, B., Micciulla, L., & Smith, C. E. (2003). Why do children say did you went?: The role of do-support. *Supplement to the Proceedings of the 28th Boston University Conference on Language Development*.
Hauser, M. D., Chomsky, N., & Fitch, W. T. (2002). The Faculty of Language: What Is It, Who Has It, and How Did It Evolve? *Science*, *298*(5598), 1569–1579. https://doi.org/10.1126/science.298.5598.1569
Hyams, N. (1986). *Language acquisition and the theory of parameters*. Reidel.
Ingram, D., & Tyack, D. (1979). Inversion of subject NP and aux in children's questions. *Journal of Psycholinguistic Research*, *8*(4), 333–341. https://doi.org/10.1007/BF01067137
Jordens, P. (1990). The acquisition of verb placement in Dutch and German. *Ling*, *28*(6), 1407–1448. https://doi.org/10.1515/ling.1990.28.6.1407
Kania, U. (2016). *The acquisition and use of yes-no questions in English: A corpus-study from a usage-based perspective*. Narr Francke Attempto.
Klee, T. (1985). Role of Inversion in Children's Question Development. *Journal of Speech, Language, and Hearing Research*, *28*(2), 225–232. https://doi.org/10.1044/jshr.2802.225
Klima, E. S., & Bellugi, U. (1966). Syntactic Regulation in the Speech of Children. In J. Lyons & R. J. Wales (Eds.), *Psycholinguistic Papers* (pp. 183–203). Edingurgh University Press.
Kuczaj, S. A. (1976). Arguments against Hurford's 'Aux Copying Rule'. *Journal of Child Language*, *3*(3), 423–427. https://doi.org/10.1017/S0305000900007297
Labov, W., & Labov, T. (1978). Learning the Syntax of Questions. In R. N. Campbell & P. T. Smith (Eds.), *Recent Advances in the Psychology of Language* (pp. 1–44). Springer US. https://doi.org/10.1007/978-1-4684-2532-1_1
Lust, B. C. (1999). Universal grammar: The strong continuity hypothesis in first language acquisition. In *Handbook of child language acquisition.* (pp. 111–155). Academic Press.
Lust, B. C. (2006). *Child Language: Acquisition and Growth*. Cambridge University Press.
MacWhinney, B. (2000). *The CHILDES project: Tools for analyzing talk*. Lawrence Erlbaum.
Maratsos, M., & Kuczaj, S. A. (1978). Against the transformationalist account: A simpler analysis of auxiliary overmarkings. *Journal of Child Language*, *5*(2), 337–345. https://doi.org/10.1017/S0305000900007510
Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review*, *63*(2), 81–97. https://doi.org/10.1037/h0043158
Miller, G. A. (2003). The cognitive revolution: A historical perspective. *Trends in Cognitive Sciences*, *7*(3), 141–144. https://doi.org/10.1016/S1364-6613(03)00029-9
Newell, A., Shaw, J. C., & Simon, H. A. (1958). Elements of a theory of human problem solving. *Psychological Review*, *65*(3), 151–166. https://doi.org/10.1037/h0048495
Pallant, J. (2020). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS* (7th edition). Open University Press.
Pavlov, I. P. (1927). *Conditioned reflexes: An investigation of the physiological activity of the cerebral cortex*. Oxford University Press.
Pinker, S. (1984). *Language Learnability and Language Development*. Harvard University Press.
Pullum, G. K., & Scholz, B. C. (2002). Empirical assessment of stimulus poverty arguments. *The Linguistic Review*, *18*(1–2). https://doi.org/10.1515/tlir.19.1-2.9
Radford, A. (1990). *Syntactic theory and the acquisition of English syntax: The nature of early child grammars of English*. Blackwell.
Radford, A. (1994). The syntax of questions in child English. *Journal of Child Language*, *21*(1), 211–236. https://doi.org/10.1017/S0305000900008722
Rowland, C. (2013). *Understanding Child Language Acquisition*. Routledge. https://doi.org/10.4324/9780203776025
Rowland, C. F. (2007). Explaining errors in children's questions. *Cognition*, *104*(1), 106–134. https://doi.org/10.1016/j.cognition.2006.05.011
Rowland, C. F., Fletcher, S. L., & Freudenthal, D. (2008). How big is big enough? Assessing the reliability of data from naturalistic samples. In H. Behrens (Ed.), *Corpora in Language Acquisition Research: History, methods, perspectives*. John Benjamins Publishing Company.
Rowland, C. F., & Pine, J. M. (2000). Subject–auxiliary inversion errors and wh-question acquisition: 'What children do know?' *Journal of Child Language*, *27*(1), 157–181. https://doi.org/10.1017/S0305000999004055
Rowland, C. F., Pine, J. M., Lieven, E. V. M., & Theakston, A. L. (2003). Determinants of acquisition order in wh-questions: Re-evaluating the role of caregiver speech. *Journal of Child Language*, *30*(3), 609–635. https://doi.org/10.1017/S0305000903005695
Rowland, C. F., Pine, J. M., Lieven, E. V. M., & Theakston, A. L. (2005). The Incidence of Error in Young Children's *Wh* -Questions. *Journal of Speech, Language, and Hearing Research*, *48*(2), 384–404. https://doi.org/10.1044/1092-

4388(2005/027)
Santelmann, L., Berk, S., Austin, J., Somashekar, S., & Lust, B. (2002). Continuity and development in the acquisition of inversion in yes/no questions: Dissociating movement and inflection. *Journal of Child Language*, *29*(4), 813–842. https://doi.org/10.1017/S0305000902005299
Skinner, B. F. (1957). *Verbal Behavior*. Appleton-Century-Crafts.
Stromwold, K. (1990). *Learnability and the acquisition of auxiliaries*. MIT Working Papers in Linguistics.
Tavakolian, S. (1981). The conjoined clause analysis of relative clauses. In *Language acquisition and linguistic theory* (pp. 167–187). MIT Press.
Theakston, A. L., Lieven, E. V. M., Pine, J. M., & Rowland, C. F. (2001). The role of performance limitations in the acquisition of verb-argument structure: An alternative account. *Journal of Child Language*, *28*(1), 127–152. https://doi.org/10.1017/S0305000900004608
Theakston, A. L., Lieven, E. V. M., Pine, J. M., & Rowland, C. F. (2005). The acquisition of auxiliary syntax: BE and HAVE. *Cognitive Linguistics*, *16*(1). https://doi.org/10.1515/cogl.2005.16.1.247
Thornton, P., & Houser, C. (2005). Using mobile phones in English education in Japan: Using mobile phones in English education in Japan. *Journal of Computer Assisted Learning*, *21*(3), 217–228. https://doi.org/10.1111/j.1365-2729.2005.00129.x
Tomasello, M. (2005). Beyond formalities: The case of language acquisition. *The Linguistic Review*, *22*(2–4). https://doi.org/10.1515/tlir.2005.22.2-4.183
Traxler, M. J. (2016). Psycholinguistics: Language and cognition. In K. Allan (Ed.), *The Routledge Handbook of Linguistics* (pp. 281–295). Routledge.
Vainikka, A. (1993). Case in the Development of English Syntax. *Language Acquisition*, *3*(3), 257–325. https://doi.org/10.1207/s15327817la0303_3
Valian, V. (1991). Syntactic subjects in the early speech of American and Italian children. *Cognition*, *40*(1–2), 21–81. https://doi.org/10.1016/0010-0277(91)90046-7
Valian, V., & Casey, L. (2003). Young children's acquisition of *wh* -questions: The role of structured input. *Journal of Child Language*, *30*(1), 117–143. https://doi.org/10.1017/S0305000902005457
Watson, J. B., & Rayner, R. (1920). Conditioned emotional reactions. *Journal of Experimental Psychology*, *3*(1), 1–14. https://doi.org/10.1037/h0069608