

INPUT CONSISTENCY IN THE ACQUISITION OF QUESTIONS IN
BULGARIAN AND ENGLISH:
A HYPOTHESIS TESTING MODEL

by

LIDIYA TORNYOVA

A dissertation submitted to the Graduate Faculty in Linguistics in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

2011

© 2011

LIDIYA TORNYOVA

All Rights Reserved

This manuscript has been read and accepted for the
Graduate Faculty in Linguistics in satisfaction of the
dissertation requirement for the degree of Doctor of Philosophy.

Virginia Valian

Date

Chair of Examining Committee

Gita Martohardjono

Date

Executive Officer

Virginia Valian

Helen Smith Cairns

Marcel den Dikken

Supervisory Committee

THE CITY UNIVERSITY OF NEW YORK

Abstract

INPUT CONSISTENCY IN THE ACQUISITION OF QUESTIONS IN

BULGARIAN AND ENGLISH:

A HYPOTHESIS TESTING MODEL

by

Lidiya Tornyova

Adviser: Professor Virginia Valian

The goal of this dissertation is to address several major empirical and theoretical issues related to English-speaking children's difficulties with auxiliary use and inversion in questions. The empirical data on English question acquisition are inconsistent due to differences in methods and techniques used. A range of proposals about the source of auxiliary omission and inversion errors have been presented but they remain with a limited cross-linguistic scope and cannot explain the data in full. This dissertation addresses the issues by investigating the influence of various target-specific properties on children's production of *wh*- and *yes/no* questions in a cross-linguistic perspective.

We propose a Hypothesis Testing model of language acquisition in which target specific properties of the language determine the types of errors and how difficult they are to correct. The more contrasts the language supports, the greater the number of incorrect hypotheses the child can entertain, and the longer it takes for children to acquire the target. Cross-linguistic variation in language acquisition is determined by differences in the amount of relevant contrasts

supported in various target grammars. Languages with uniform properties facilitate the hypothesis-testing process by providing a narrow range of hypotheses to be considered and are learned easily. Languages with non-uniform properties extend the course of acquisition by providing a broad range of hypotheses to be tested.

To test the proposed hypothesis testing model we conducted four elicited imitation experiments investigating 2-year-old children's auxiliary use and inversion in Bulgarian and English *wh-* and *yes/no* questions. We predicted similar performance on auxiliary use for the two language groups because English and Bulgarian are both inconsistent and support relevant contrasts regarding auxiliary inclusion. With respect to auxiliary inversion, Bulgarian is consistent and English is not. English supports three relevant contrasts that Bulgarian does not. Thus, we predicted that Bulgarian-speaking children would perform better on auxiliary/verb inversion than English-speaking children. Our results support the Hypothesis Testing model.

Acknowledgments

I wish to express my deepest gratitude to my adviser, Dr. Virginia Valian for her continuous guidance and support throughout my graduate-school career, and for always encouraging me to see the big picture and think one step ahead. I greatly appreciate her insights and expertise that contributed so much to developing this research. Working with Dr. Valian has been a lifetime learning experience. I also owe special thanks to the members of my dissertation committee, Professors Helen Smith Cairns and Marcel den Dikken, for invaluable comments and suggestions on numerous versions of this work. I am grateful to Professor Irina Sekerina for the helpful practical advice and encouragement along the way, and for supporting my attempts to secure external funding for my research. Many thanks go out to Professor Martin Chodorow who has taught me all that I know about data analysis and statistics, and has provided very useful suggestions on interpreting the results. I am also thankful to Professor Sandeep Prasada and members of the Language Acquisition Research Center at Hunter College for great feedback and suggestions on many conference presentations of this research.

This project was made possible by a Dissertation Grant # 0720558 from the National Science Foundation and a CUNY Doctoral Student Research Grant. I would like to thank my collaborators in Bulgaria, Krasimira Petrova, Veselina Friedman, and Vania Lambova, who helped with data collection, coding, and analysis. The directors and staff of the preschools in Bulgaria and the US who opened their doors for me to recruit children and conduct the experiments deserve particular recognition. Thank you to all the children and their parents who contributed the data for this dissertation.

I am deeply grateful to my family, my brother and sister-in-law for their love and encouragement. My greatest advocate, my husband Anton Kuzmanov, has been by my side in every single step of the process. Thank you for giving me strength and believing in me. I am thankful for our son Bogdan who gave a new meaning to my work and academic aspirations.

I dedicate this work to two very special women in my life, who will always be in my thoughts, my late mother, Poly Tornyoova, and mother-in-law, Sabka Genovska.

Table of Contents

Abstract.....	iv
Acknowledgments.....	vi
Table of Contents.....	vii
List of Tables.....	x
List of Figures.....	xii
Chapter 1: Introduction and literature review.....	1
1.1 Introduction.....	1
1.2 Literature review.....	5
1.2.1 Empirical findings.....	7
1.2.2 Competing theories of the acquisition of English questions.....	20
1.2.3 Summary and conclusions.....	41
Chapter 2: The structure of Bulgarian and English questions.....	42
2.1 Introduction.....	42
2.2 The auxiliary system in Bulgarian and English.....	42
2.2.1 English auxiliaries.....	43
2.2.2 Bulgarian auxiliaries.....	45
2.3 Question formation.....	47
2.3.1 English <i>wh</i> -questions.....	47
2.3.2 Bulgarian <i>wh</i> -questions.....	48
2.3.3 English <i>yes/no</i> questions.....	51
2.3.4 Bulgarian <i>yes/no</i> questions.....	52
2.4 Theoretical approaches to the structure of questions.....	56
2.4.1 Minimalist approaches to head movement (T-to-C movement).....	56
2.4.2 Against verb movement outside TP in Bulgarian.....	60
2.4.3 The target position of <i>wh</i> -movement: SpecCP, SpecFocP, or both.....	62

2.4.3	Arguments for focus-driven <i>wh</i> -movement	63
2.4.4	The structural projection that licenses Focus in Bulgarian	67
2.5	Our analysis of the structure of questions.....	68
2.5.1	Bulgarian questions	68
2.5.2	English questions	73
2.6	Summary and implications for language acquisition	79
Chapter 3:	The Hypothesis Testing Model of language acquisition.....	82
3.1	The role of abstract linguistic knowledge.....	82
3.2	The notions of contrast, syntactic context, and input consistency	84
3.3	The Hypothesis Testing Model of language acquisition	90
3.4	Predictions of the Hypothesis Testing Model.....	94
3.4.1	Auxiliary inclusion.....	94
3.4.2	Auxiliary inversion.....	95
Chapter 4:	Experiments I – IV	105
4.1	Rationale for controlled elicited imitation experimentation	105
4.2	Procedures common to all experiments on auxiliary use and inversion.....	107
4.2.1	Participants	107
4.2.2	Task.....	108
4.2.3	Materials	109
4.2.4	Scoring, coding, and dependent measures	109
4.2.5	Analyses.....	111
4.3	Experiments on <i>wh</i> -questions	111
4.3.1	Experiment I – Bulgarian <i>wh</i> -questions	111
4.3.2	Experiment II – English <i>wh</i> -questions.....	120
4.3.3	Comparison between Bulgarian and English <i>wh</i> -questions	129
4.4	Experiments on <i>yes/no</i> questions	132

4.4.1	Experiment III – Bulgarian <i>yes/no</i> questions	132
4.4.2	Comparison of Bulgarian <i>wh-</i> and <i>yes/no</i> questions	140
4.4.3	Experiment IV – English <i>yes/no</i> questions	141
4.4.4	Comparison of English <i>wh-</i> and <i>yes/no</i> questions.....	148
4.4.5	Comparison of Bulgarian and English <i>yes/no</i> questions.....	150
Chapter 5:	General discussion and conclusions	152
5.1	Open questions.....	164
5.2	General conclusions and implications	166
References.....		169

List of Tables

Table 1. Percentages of inversion in <i>yes/no</i> and <i>wh</i> -questions.	12
Table 2. Percentage inversion as a function of <i>wh</i> -type	14
Table 3. Target items by condition (Santelmann et al., 2002)	31
Table 4. English auxiliaries and main verb counterparts.....	44
Table 5. Paradigm of English Aux <i>be</i>	44
Table 6. Paradigm of Bulgarian Aux <i>be</i>	46
Table 7. Hypotheses for inversion of auxiliaries and verbs.....	97
Table 8. Hypotheses for auxiliary inversion in root and non-root questions	99
Table 9. Experiment I: Participants summary.....	112
Table 10. Sample stimulus set for Experiment I.....	114
Table 11. Bulgarian <i>wh</i> -questions: Individual inclusion means (and S.D.) in percent correct	115
Table 12. Bulgarian <i>wh</i> -questions: Individual inversion means	117
Table 13. Experiment II: Participants summary.....	120
Table 14. Sample stimulus set for Experiment II*	123
Table 15. English <i>wh</i> -questions: Individual aux inclusion means in percent correct.....	124
Table 16. English <i>wh</i> -questions: Individual inclusion means in percent correct	125
Table 17. English <i>wh</i> -questions: Individual inversion means in percent correct	126
Table 18. Fisher Exact Test 2 x 2 contingency table.....	130
Table 19. Experiment III: Participants summary	133
Table 20. Sample stimulus set for Experiment III*.....	134
Table 21. Bulgarian <i>yes/no</i> questions: Individual inclusion means in percent correct	136
Table 22. Bulgarian <i>yes/no</i> questions: Individual inversion means per variable in percent correct**	138
Table 23. ANOVA results: Bulgarian <i>wh</i> - and <i>yes/no</i> questions	141
Table 24. Experiment IV: Participants summary	142
Table 25. Sample stimulus set for Experiment IV	143

Table 26. English <i>yes/no</i> questions: Individual inclusion means in percent correct	144
Table 27. English <i>yes/no</i> questions: Individual inclusion means in percent correct, non-auxiliary measures	146
Table 28. English <i>yes/no</i> questions: Individual inversion means in percent correct	146
Table 29. Auxiliary Inclusion in English <i>wh-</i> and <i>yes/no</i> questions (in percent)	148
Table 30. Target auxiliary inclusion and substitution in English <i>wh-</i> and <i>yes/no</i> questions (in percent) .	149
Table 31. Contrasts for auxiliary/verb inversion/V2 in English, Norwegian, and Bulgarian	160

List of Figures

Figure 1. Contrasts for auxiliary inclusion in Bulgarian and English	94
Figure 2. Contrasts for auxiliary inversion in Bulgarian and English	97
Figure 3. English <i>wh</i> -questions - Overall aux and Target aux inclusion by aux type	125
Figure 4. Aux type effect on auxiliary inclusion and overall imitation rate in Bulgarian <i>yes/no</i> questions	137
Figure 5. Aux inclusion in English <i>yes/no</i> questions.....	145

Chapter 1: Introduction and literature review

1.1 Introduction

Two major errors in young English-speaking children's production of questions are failure to include an obligatory auxiliary (1-2) and failure to invert an included auxiliary before the subject (3-4). Despite a long history of research on the topic, the source of these errors is still unknown.

- (1) *Where daddy going?
- (2) *Daddy going home?
- (3) *What mommy will do?
- (4) *Mommy help me?

This thesis addresses the following central issues related to the problem of auxiliary use and inversion in English questions: 1) there are multiple proposals of the source of the errors but none can explain the data in full; 2) existing accounts of children's errors in questions are limited in cross-linguistic range and are largely confined to analyzing data from English; 3) the empirical evidence on children's questions is inconsistent due to differences in methods and techniques; 4) in order to be able to provide a generalized account of acquisition of questions, *wh*- and *yes/no* questions need to be analyzed in parallel; to our knowledge, no experimental study has systematically looked at both types of questions.

The first issue, namely, the lack of an adequate explanation for the errors in English-speaking children's early questions is primarily due to the limited cross-linguistic outlook of the research body on the topic (i.e., issue 2 above). This led us to seek a model of language acquisition that takes a cross-linguistic perspective. To address the first two issues, we propose a Hypothesis

Testing model in which language-specific structural characteristics of the target grammar determine the types of errors children produce and the length of time required for acquisition. The range of hypotheses to be considered is closely related to the level of input consistency in the target language. On this analysis, the learner starts with a null hypothesis assuming consistent properties of the target grammar. Languages with consistent properties support a narrow range of hypotheses and are learned easily. The initial null hypothesis is compatible with the input and that results in early target-like performance. Languages with non-uniform properties extend the course of acquisition by providing a broad range of hypotheses to be tested. In those languages, the starting null hypothesis is rejected based on mixed input and new hypotheses will be generated to fit the input data. Until the learner generates a hypothesis that is confirmed by the input, his/her performance will differ from the adult target.

In order to test the model, we chose to investigate auxiliary use and inversion in Bulgarian and English questions. The cross-linguistic study enables us to establish that auxiliary errors in English are indeed determined by language-specific properties of the target. The choice of Bulgarian was motivated by our goal to compare children's performance to peers learning a language whose input is similar in one respect but different in another. Thus, we investigate and compare a language pair that demonstrates both similarities and differences in the range of hypotheses supported. Bulgarian is a good test because its properties are inconsistent with respect to auxiliary inclusion and it supports a wide range of hypotheses to be considered. In that respect, Bulgarian is similar to English. However, Bulgarian is different from English because for auxiliary inversion its properties are very consistent and thus it supports a narrow range of hypotheses to be considered.

On our model, the level of input consistency or lack of consistency with respect to the requirement for auxiliary inclusion and auxiliary inversion in questions impacts the speed of children's acquisition of those syntactic requirements. English and Bulgarian both support relevant, albeit different, contrasts with respect to auxiliary inclusion and this makes the input in both languages inconsistent. As a result, the initial null hypothesis will be disconfirmed by the input in both languages and will necessitate the generation of an additional hypothesis. Until the incorrect hypothesis is disconfirmed by input, they are expected to show similar, non-target-like performance on auxiliary inclusion in questions.

In the case of auxiliary inversion, Bulgarian is consistent and English is not. English supports two main contrasts with respect to auxiliary inversion in questions: 1) the auxiliary – main verb dissociation, and 2) matrix vs. embedded clause differences. In a language like Bulgarian, which makes none of the two distinctions described for English, learning of auxiliary inversion in questions will be faster even though the English learner and the Bulgarian learner start with the same null hypothesis. Since Bulgarian input supports the initial null hypothesis of consistency, we predict that Bulgarian-speaking children a) will master inversion in questions earlier than their English-speaking peers, b) will correctly invert auxiliaries when present, c) will invert the verb and the subject at a high rate. English-speaking children are expected to show slower acquisition of inversion than Bulgarian-speaking children. Thus, the hypothesis testing model makes specific predictions about the time-course of cross-linguistic language acquisition and accounts for both auxiliary omission and auxiliary inversion errors.

To test the proposed hypothesis testing model and its predictions we conducted a cross-sectional study using elicited imitation to compare English- and Bulgarian-speaking children's production of questions. The study consists of four experiments investigating 2-year-old

children's acquisition of *wh*- and *yes/no* questions. All experiments examine subject-verb inversion and subject-auxiliary inversion in Bulgarian and English questions: experiments I and II investigate *wh*- questions; experiments III and IV investigate *yes/no* questions.

To address the third and fourth issues, we examine auxiliary use and inversion in both *yes/no* and *wh*-questions which allows for a generalized account of auxiliary inclusion and auxiliary inversion errors in questions. Another important empirical contribution of this study is the use of two different measures of children's auxiliary inversion rates; one measure represents inversion in sentences that contain an auxiliary, the other reflects inversion rates regardless of the presence/absence of an auxiliary. Since auxiliary omission and inversion errors are interdependent, investigating these two aspects of inversion in conjunction provides a better representation of children's knowledge and the complex factors involved in their difficulties with auxiliaries in questions.

The dissertation is organized as follows. We continue the current Chapter 1 with a review of the vast literature on the acquisition of questions in English and identify key problematic points. In Chapter 2, we outline the specifics of question formation in Bulgarian and English followed by a review of the literature on the syntax of questions in both languages, ending with suggested structural representations of questions. Chapter 3 introduces the Hypothesis testing model of language acquisition adopted in the dissertation. Chapter 4 presents the experimental part of the study and discusses in detail the four experiments on Bulgarian and English *wh*- and *yes/no* questions. We end with a general discussion and conclusions in Chapter 5.

1.2 Literature review

The acquisition of English *yes/no* and *wh*-questions has been extensively studied and a fair amount of data has been collected. The research body on this topic offers a number of approaches which differ substantially both theoretically and empirically. The theoretical debate has concentrated on the questions of whether language is innate or learned exclusively on the basis of input, and of whether children's grammars are qualitatively different from the target adult grammars, i.e., whether errors in children's questions are due to competence limitations. Empirically, analyses disagree in terms of issues such as the frequency of errors and the contexts in which they occur.

The studies on question acquisition vary in terms of their assumptions about the source of children's knowledge of language. In particular, some work from the innateness hypothesis of language and develop various transformational rule analyses; such approaches are nativist, also known as generativist (Erreich, Valian & Winzemer, 1980; Klima & Bellugi, 1966; Labov & Labov, 1978; Plunkett, 1991; Radford, 1981; Santelmann, Berk, Austin, Somashekar, and Lust, 2002; Stromswold, 1990; Valian & Casey, 2003; Valian, Lasser, & Mandelbaum, 1992; Valian, Winzemer & Erreich, 1981; Van Valin, 2002; de Villiers, 1991). Other theories (Ambridge, Rowland, Theakston, & Tomasello, 2006; Dąbrowska, 2000, 2001; Dąbrowska & Lieven, 2005; Rowland, 2007; Rowland & Pine, 2000; Rowland, Pine, Lieven, and Theakston, 2003, 2005) favor an empiricist (also constructivist) view where a fundamental factor in the process of language acquisition is learning on the basis of the input. While nativist theories acknowledge that input plays a role in acquisition, empiricist theories assume that it is the only basis of learning. Furthermore, a crucial hypothesis in the empiricist analysis is that young children do

not have adult-like syntactic competence and their structural representations of language are not abstract, thus challenging the essential pillars of the generative approach.

Studies of English question acquisition differ enormously in their empirical findings, as this review will demonstrate. The existing evidence from children's production of *yes/no*- and *wh*-questions is inconclusive as to what mechanisms are involved in the developmental process and a number of issues are still left open. For instance, the great variability in the data leads to disagreement among researchers on several major problems: a) how frequent auxiliary inversion errors are; b) whether they are specific to *wh*-questions or occur with *yes/no* questions as well; c) why children fail to invert or include auxiliaries; d) why correct inversion is acquired earlier with certain *wh*-words.

Most accounts, regardless of the approach and methodology they adopt, agree on the fact that the most common errors in young children's construction of grammatical questions are: a) failure to include an auxiliary (5), b) failure to correctly place the auxiliary before the subject even when the aux is present (6). This review focuses on analyses of these main errors.

(5) *Where daddy going?

(6) *Where daddy **is** going?

The chapter is organized as follows. First, we summarize the empirical findings on auxiliary inversion in questions. Next, we discuss the various accounts in more detail and outline the major issues that still need to be addressed.

1.2.1 Empirical findings

The existing data on auxiliary use in questions are inconclusive and inconsistent with respect to how frequently children omit auxiliaries or fail to invert them when present in the sentence, and whether auxiliary inclusion and inversion rates differ with respect to question type (e.g., *wh*- or *yes/no* questions), *wh*-word type (e.g., *what* vs. *where*), or aux type (e.g., copula/aux *be*, modals, aux *do*, etc.). The facts come from three principal data sources: **observational studies** (Bellugi, 1965; Brown, Cazden & Bellugi, 1969; Dąbrowska, 2000; Klima and Bellugi, 1966; Ingram and Tyack, 1979; Klee, 1985; Labov & Labov, 1978; Plunkett, 1991; Rowland, 2007; Rowland & Pine, 2000; Rowland, Pine, Lieven, and Theakston, 2005; Stromswold, 1990; Valian, Lasser, and Mandelbaum, 1992), **elicited imitation** or **elicited production studies** (Ambridge, Rowland, Theakston, & Tomasello, 2006; Erreich, 1984; Kuczaj and Brannick, 1979; Santelmann, Berk, Austin, Somashekar, & Lust, 2002; Valian and Casey, 2003), and **grammaticality judgment studies** (Stromswold, 1990). Some studies (Bellugi, 1971; Dąbrowska, 2000; Labov & Labov, 1978; Plunkett, 1991; Rowland & Pine, 2000) use data from a single child; others have larger samples, ranging from 10 to 65 participants. They are summarized in Table 1 (see similar table in Ambridge et al., 2006).

Aux inclusion and inversion – general

The data on children's production of questions demonstrate considerable inconsistency in rates of auxiliary inclusion and inversion. Reported auxiliary inclusion ranges from 44 % to 98 % for *wh*-questions and from 22 % to 100 % in *yes/no* questions. Inversion error rates range from 0 % to 55 % in *wh*-questions and from 0.1 % to 51 % in *yes/no*-questions (Table 1).

Dąbrowska (2000), Plunkett (1991), and Rowland et al. (2005) reported that aux omission was

the most frequent error (among inversion, subject omission and other commission errors) while Ambridge et al. (2006) found that it was the least frequent error (among inversion, auxiliary doubling and other errors). In general, the data suggest that questions with missing auxiliaries decrease over time, while the number of correctly inverted questions increases (Ingram & Tyack, 1979; Klee, 1985; Rowland & Pine, 2000; Rowland et al., 2005; Valian et al., 1992). Some observational studies (Dąbrowska, 2000; Labov & Labov, 1978; Rowland & Pine, 2000; Rowland et al, 2005, Stromswold, 1990) argue that the percentage of non-inverted¹ auxiliaries in questions follows a U-shaped pattern, showing a period of high correct inversion at the beginning followed by a stage of non-inversion and finally a new increased correct inversion period. Most analyses attribute the inversion before the “uninversion” period to instances of formulaic rote-learned questions.

In a grammaticality judgment task (Stromswold, 1990) children showed a preference for grammatical questions – they judged as good 76 % of the grammatical sentences and 57% of the ungrammatical ones. Although children seemed to like inverted questions more than uninverted ones, the acceptability rate for the ungrammatical ones was fairly high, suggesting that the acquisition of auxiliary inversion might not be complete even by age 6.

Aux inclusion and inversion in *yes/no* questions vs *wh*-question

Klee (1985) reports higher rates of auxiliary omission in *wh*-questions (22%) than *yes/no* questions (12%). In Erreich (1984), auxiliary omission is similar for *yes/no* (14%) and *wh*-questions (18%). Ingram & Tyack (1979) and Valian et al. (1992) found higher aux omission

¹ The terms “non-inversion” (non-inverted) and “uninversion” (uninverted) are used interchangeably in the literature. They are used as synonyms here as well.

rates for *yes/no* questions (21%) than *wh*-questions (14%). The results summarized in Table 1 show that auxiliaries develop gradually in the course of acquisition and occur relatively frequently in both *yes/no* and *wh*-questions from the earliest stages of combinatorial speech (see Table 1, data from Ingram & Tyack, Klee, and Valian et al.). These studies will be discussed in more detail in the next section of this chapter.

Findings are variable also with respect to auxiliary inversion in the two question types. Bellugi (1965), Brown, Cazden, and Bellugi (1969), and Klima and Bellugi (1966) reported that children consistently invert the auxiliary only in *yes/no* questions but not in *wh*-questions (0 % of the time in *wh*-questions vs. 100 % for *yes/no* questions, as reported by Klima & Bellugi, 1966, but see Bellugi, 1971). These results suggest that subject-auxiliary inversion in *yes/no* questions is acquired earlier than in *wh*-questions (Labov & Labov, 1978) and that inversion errors are specific to the latter. However, data from other observational studies (Dąbrowska, 2000; Ingram & Tyack, 1979; Klee, 1985; Plunkett, 1991; Rowland, 2007; Stromswold, 1990; Valian, Lasser, & Mandelbaum, 1992) and imitation studies (Erreich, 1984) challenge these findings.

Two studies reported very few errors for both *yes/no* and *wh*-questions (Klee, 1985 for inversion; Rowland, 2007 for any errors, excluding aux omission). Some studies found that correct inversion was higher for *wh*- than *yes/no* questions (Dąbrowska, 2000; Erreich, 1984; Ingram & Tyack, 1979 for younger children; Valian et al., 1992). In fact, Dąbrowska (2000) claims that “uninverted *wh*-questions are extremely rare” (p 90). Others found more errors with *wh*-questions (28%) than *yes/no* questions (12%) (Rowland, 2007, for any errors, excluding aux omission; difference is largely due to errors with modal auxiliaries) or no difference between the two question types (Stromswold, 1990; Ingram & Tyack, 1979 for older children; Klee, 1985). Moreover, the low percentage of non-inversion in *wh*-questions containing auxiliaries indicates

that when children include an auxiliary, they invert it correctly most of the time (Plunkett, 1991 for non-modal auxiliaries; Rowland, 2007 for aux *do* and modals in *wh*- and *yes/no* questions; Stromswold, 1990; Valian et al., 1992). These results contradict earlier claims about the existence of a developmental stage in which children fail to invert in *wh*-question while inverting in *yes/no* questions.

Auxiliary inversion as a function of *wh*-word type

Kuczaj and Brannick (1979) elicited imitation of *wh*-questions with modal auxiliaries and found that overall inversion performance was highest with *what* (92%) followed by *where* (90%), *why* (84%), *how* (78%), *when* (78%), and *who* (74%). Stromswold (1990) also reported variation in inversion as a function of *wh*-word type. Inversion rate was higher with questions containing *who* (100%), *what* (94%), *where* (95%), and *how* (97%) than those with *why* (87%), *which* (79%) and *when* (77%).

Rowland and Pine (2000) found that all *wh*-words except for *why* were produced in inverted questions more often than non-inverted questions. Similar to Stromswold's results, Rowland and Pine found that interrogatives with *who* were correctly inverted 100 % of the time. The data, however, indicate that for all other *wh*-words inversion rate was higher for the subjects in Stromswold's analysis than for Adam. One possible reason is the fact that Rowland and Pine (2000) analyzed *wh*-questions from a single child (Adam, Brown Corpus) whose inversion pattern may be different from average. This is unlikely to be the only factor, as Labov & Labov (1978), who used data from a different child, found similar results for *how*, *what*, *where* and *why*. Note that the age range is similar in Rowland & Pine (2000) and Labov & Labov (1978) while it was wider in Stromswold (1990) and narrower in Kuczaj and Brannick (1979). It is possible that

the higher inversion rates reported by Kuczaj & Brannick and Stromswold (1990) are due to a concentration of highly inverted *wh*-questions after the age of 3;2. This idea is supported by the fact that Stromswold (1990) and Kuczaj & Brannick (1979)

Table 1. Percentages of inversion in *yes/no* and *wh*-questions.

STUDY	DATA SOURCE	STAGE/AGE/ MLU	N	-AUX		-INV		+INV	
				Y/N	WH	Y/N	WH	Y/N	WH
Ambridge et al. (2006)	Elicited production	3;6-4;6	28	N/A	2	N/A	11	N/A	76
Bellugi** (1971)	Observation Elicited production	2;3-5;1	1	N/A	N/A	4	33	96	67
Dąbrowska (2000)	Observation (CHILDES)	1;6 2;0 2;6 3;0 3;8	1	N/A 11 12 5 2		N/A 34 64 50 28	N/A	N/A 89 80 89 91	
Erreich (1984)	Elicited Production	2;5-3;10	18	14	18	51	36	49	64
Guasti (2000)	Observation CHILDES	1;6-5;1/ 1.2- 5.0	4	N/A	45	N/A	4	N/A	96
Ingram & Tyack (1979)	Observation (diaries)	I-2;0-2;5 II-2;6-2;11 III-3;0-3;5 IV-3;6-3;11	21	78 32 11 0	56 30 12 7	45 19 9 2	23 9 4 5	55 81 91 98	77 91 96 95
Klee (1985)	Observation (diaries)	2.50-2.99 3.00-3.49 3.5-3.99 Overall	18	28.6 5.3 1.2 12	37 16.5 16.7 22	≈0.1 ≈0.3 ≈0.2 ≈0.5	≈ 1 ≈ 1 ≈ 2.5 ≈ 4	≈ 99.9 ≈ 99.7 ≈ 99.8 ≈ 99.5	≈ 99 ≈ 99 ≈ 97.5 ≈ 96
Kuczaj and Brannick (1979)	Elicited Imitation	3;2 4;10	20	N/A		N/A		N/A	
Labov & Labov (1978)	Observation (diary)	2;3 – 4;9	1	N/A	N/A	N/A	N/A	N/A	21
Rowland (2007)	Observation	2;1 – 5;1	9	N/A	N/A	N/A	6	N/A	88
Rowland & Pine (2000)	Observation (CHILDES)	1.84-3.24 3.24-4.10 4.11-4.97 Overall	1	N/A	≈93 ≈73 ≈36 ≈67	N/A	≈5 34.1 ≈8 ≈15	N/A	≈8 65.9 ≈55 ≈43

Table 1: Continued

STUDY	DATA SOURCE	STAGE/AGE/ MLU	N	-AUX		-INV		+INV	
				Y/N	WH	Y/N	WH	Y/N	WH
Rowland et al. (2005)	Observation	I-1.00-1.99 II-2.00 – 2.49 III-2.50 – 2.99 IV- >3.00	12	N/A	35 51 32 24	N/A	< 1.39 for all stages	N/A	57 44 59 68
Santelmann et al. (2002)	Elicited imitation	I-2;1-3;0 II-3;1-4;0 III-4;1-5;3 Total	65	N/A	N/A	16.2 (26)* 7.6 (19.2)* 3.2 (65)* 8.2 (24.8)*	N/A	41 61 94 67	N/A
Stromswold (1990)	Observation (CHILDES)	0;11-7;10	14	N/A	N/A	6.3	7	93.7	93
Stromswold (1990)	Grammaticality Judgment***	3;0-6;1	22	N/A	N/A	N/A	51.5	N/A	76.5
Valian et al. (1992)	Observation (tapes)	Lo I-1.53-2.76 Hi II-3.07-4.38	20	537 5	19 9	6 5	0 5	29 61	53 77
Valian & Casey (2003)	Elicited imitation	2;6-3;2	29	N/A	43	N/A	55	N/A	45

*First number indicates percent [-inversion] errors of total items, number in parentheses is percent [-inversion] errors of total errors (“mismatches”).

** Only data for modal auxiliaries are available

*** Overall judged good

have similar results for all *wh*-words except *who* and *how* which had lower inversion rates than both other studies.

Table 2. Percentage inversion as a function of *wh*-type

	Age	Who	How	What	Where	Which	Why	When
Kuczaj and Brannick N=20	3;2 – 4;10	74	78	92	90	N/A	84	78
Labov & Labov N=1	2;3- 4;9	87	89	66	78	88	15	56
Rowland & Pyne N=1	2;3-4;10	100	85	78.6	73.3	66.7	8.3	N/A
Stromswold N=14	0;11 – 7;11	100	97	94	95	79	87	77

Other studies found no differences in auxiliary inversion with respect to *wh*-word (Ambridge et al., 2006 for *what*, *who* (object), *how*, and *why*; Valian & Casey, 2003 for *when* and *where*; Rowland et al., 2005 for *what* and *where*).

The issue of variable inversion rates as a function of *wh*-word type is addressed in the adjunction proposal (Plunkett, 1991; Stromswold, 1990; de Villiers, 1991) suggesting that children treat argument and adjunct *wh*-elements as having different structural positions in the sentence. We discuss the adjunction approach in detail later in this chapter.

Overall correct auxiliary use and error rates as a function of aux type

A comparison of children’s correct imitation of *yes/no* questions and lexically matched declarative sentences (Santelmann et al., 2002) revealed that imitation of copula *be* and dummy auxiliary *do* was significantly worse for *yes/no* questions (62% and 63%) than for declaratives (81% and 75%). Imitation for aux *be*, aux *can*, and aux *can* + copula *be* (e.g., *can be*) did not

differ. Rowland (2007) found similar results in a study of spontaneous *yes/no* questions where *aux do* showed higher error rates than modals.

Rowland et al. (2005) report contradictory results for the Manchester Corpus (N=12) where copula *be* showed significantly lower error rates (28%) in *wh*-questions than *aux be* (46%) and *aux have* (35%). A similar pattern was found for the diary data from a single child. In the Manchester Corpus, questions requiring *aux do* or modals occurred correctly less often (50%) than *aux be* (54%) and *aux have* (65%) but the difference was not significant. The diary data, however, showed a significant difference between correct use of *aux do/modals* (41% and 48%) and *aux have* (71% and 66%) in Months 1 and 2, respectively. Ambridge et al. (2006) also found just a trend of *aux do* showing higher inversion error rate (16%) than *aux be* (8%) and *aux can* (9%). The data in Labov & Labov (1978) are also inconsistent with Santelmann et al. (2002): *aux do* was inverted more often (48%) than modal *can* (35%) and *should* (40%), and *aux/copula be* was inverted more often (59% for *is, am*; 65% for *are*) than modal *can*. According to Valian and Casey's (2003) baseline *aux* inclusion rates, *aux can* and copula *be* were included at a higher rate (66%) than *aux do* and *aux will* (48%). Inversion rate with *can/be* was also higher (50%) than with *will/do* (40%).

The discrepancies between the results in Santelmann et al. (2002) on one hand, and Labov & Labov (1978), Rowland et al. (2005) and Ambridge et al. (2006), on the other, may be due to differences between *wh*- and *yes/no* questions with respect to auxiliary *do*. Evidence for this is provided in Rowland (2007) where *aux do* showed higher error rates than modals in *yes/no* but not *wh*-questions. These findings can explain the lack of significant differences in Rowland et al. (2005) and Ambridge et al. (2006).

In summary, we have shown that the existing evidence on children's acquisition of questions demonstrates substantial variability in all aspects that have been studied, namely, overall auxiliary omission and inversion rates, auxiliary inclusion and inversion rates with respect to question type, *wh*-word type, and aux type. As Stromswold (1990) notes, this variability is partly due to differences in the methodological characteristics of the studies. The studies differ in terms of the a) data source they use, e.g., observational data vs. experimental data, b) the coding/scoring schemes, c) data analysis, and d) sample sizes and grouping criteria.

Observational vs. experimental data

Data from spontaneous speech tend to yield lower error rates (7-10%) than experimental data, perhaps because they reveal what children feel confident to say correctly and, typically, these would be structures they have had the most exposure to. For instance, Valian and Casey (2003) found that children's spontaneous questions lacked variety (70% of them were *what*-questions), inversion occurred with main verb *be* and Aux *be* only (e.g., *What is that?*) and not with modals or *do*. In experimental settings, when imitating target questions beyond their range, the same children show more limited knowledge. In Rowland et al. (2005) children produced significantly more questions requiring copula *be* (200) than questions requiring aux *be* (31) and aux *have* (36), which was reflected in the lowest error rates found with copula *be*. Erreich (1984) also notes that inversion was more likely in spontaneous speech (46%) than elicited questions (34%). Studies of the role of sampling in interpreting children's spontaneous speech data (Rowland & Fletcher, 2006) showed that the reliability of error rate estimates varies with sample size and that it is most compromised for infrequently produced constructions.

Further, for observational data it is important to take into account who collected them and how – an experimenter or a parent, via diary or audio-taping. For example, Ingram & Tyack (1979) and Klee (1985) used parent diaries of children’s speech where inversion errors may have been overlooked or misrepresented. Interestingly, Klee (1985) reported particularly high inversion rates.

Coding and scoring procedures

Coding and scoring procedures also vary enormously across analyses. The differences can be classified in terms of whether the studies make certain important distinctions such as: a) correct auxiliary use vs. inversion error rates, b) auxiliary omission vs. auxiliary inversion, c) auxiliary *be* vs. copula *be*

Correct aux use vs. error rates in questions

Some analyses work with the percentage of correct use of auxiliaries in questions (Rowland & Pine, 2000; Stromswold, 1990; Valian et al. 1992; Valian & Casey, 2003), other use error rates (Rowland et al., 2005; Rowland, 2007; Santelmann et al., 2002). Further differentiation exists with respect to the level of detail within the analysis. Some studies are only interested in rates of inversion vs. non-inversion, whether an auxiliary is present or not, while others conduct more detailed analyses and differentiate between several types of auxiliary errors. For example, Rowland et al. (2005) tracked various kinds of omission (e.g., aux/copula omission, subject omission, subject+aux (copula omission), inversion errors (e.g., double marking, raising errors,

noninversion), and other commission errors (e.g., agreement, case), see Ambridge et al. (2006) for a similar coding scheme. Since the percentages reported by such studies are usually based on the total number of questions and/or the number of errors, the figures in Table 1 do not sum up to 100%. Some studies (Guasti, 2000; Rowland & Pine, 2000) purposefully ‘clean up’ their data by eliminating utterances containing errors irrelevant to the analysis (e.g., auxiliary omission, tense doubling errors).

Auxiliary omission vs. auxiliary inversion

Analyzing auxiliary omission and auxiliary inversion together is another factor that may influence the results. Some studies (Valian et al., 1992; Valian & Casey, 2003) analyze auxiliary omission errors as failure to invert. However, omission does not necessarily reflect lack of knowledge about inversion (Plunkett, 1991; Guasti, 2000) as it could be due to other competence or performance issues such as problems with realization of tense and/or agreement. Plunkett (1991) notes that children omit copula *be* even after they have acquired an inversion rule. Since a large part of children’s errors in questions are errors of omission, conflating auxiliary omission and inversion tends to lower the overall inversion rates.

Copula *be* and Aux *be* Distinction

A number of studies do not distinguish between copula *be* and auxiliary *be* (Labov & Labov, 1978; Plunkett, 1991). There is evidence, both from naturalistic and experimental data, that children perform better on copula *be* than on auxiliary *be* (Ambridge et al., 2006; Rowland et al.

2005). More importantly, copula *be* and aux *be* differ syntactically so children's performance may be sensitive to their properties.

The complexity of the equivalent class of auxiliary verbs in English may also be a factor influencing the data inconsistencies. The equivalent class of auxiliaries consists of various members that differ in their syntactic and semantic characteristics (e.g., aux *be*, modals *can*, *will*, *should*, dummy *do*) and can be expected to be acquired at different rates and patterns. Since the majority of studies of children's questions examine only a subset of the entire class of auxiliaries (e.g., Bellugi studies only modals, Plunkett, 1991 studied copula and aux *be*; Rowland, 2007 studied *do* and modals) effects may reflect idiosyncratic properties of particular members rather than apply to the entire class.

Another reason for the inconsistent results is that most studies analyze *wh*-questions and *yes/no* questions independently, which, as we will see, creates theoretical problems as well. Although the data on children's performance on *wh*- and *yes/no* questions show differences in some respects, they should be interpreted in association because the two question types are related structurally and share certain syntactic properties.

Sample sizes and grouping criteria

Finally, variable sample sizes, dividing subject groups according to age or MLU, as well as using different age ranges also contribute to the large variability in the data. Four of the studies summarized in Table 1 are based on data from a single child, which often happens to be the same child (Adam, Brown corpus). This raises the question of whether the reported data are

representative of the general population. Even studies with larger group sizes have this problem as they use the same or overlapping data sets available through the CHILDES system.

1.2.2 Competing of the acquisition of English questions theories

Although the literature on children's acquisition of questions presents a broad range of analyses in attempt to account for the considerable amount of data on the topic, the mechanism of how children acquire questions in English is still unclear. Competing accounts differ with respect to how they approach the following main issues: a) the nature of linguistic knowledge at the onset of acquisition (e.g., innate knowledge vs. learned knowledge based on input frequencies); b) whether children's grammars differ from the adults' version (e.g., immature functional projections vs. competence issues); c) the source of auxiliary omission errors; d) the source of auxiliary inversion errors (with several subcases, namely, inversion as a function of *wh*-type or aux type, or inversion as a function of lexical learning). We will review each account with respect to the above questions.

Generativist and constructivist theories make different assumptions about children's linguistic knowledge at the initial state of acquisition. Generativists assume that children start the process of language acquisition with access to a universal set of principles and parameters that comprise Universal Grammar (UG). Universal principles are abstract and hold for all human languages; parameters define language variation and have binary values that the child determines based on linguistic experience. Children use their input to integrate the language-specific characteristics of the target grammar (i.e., the associated parameter values) with their innate knowledge of abstract grammatical categories and relations (i.e., universal principles). In

the case of question formation, syntactic movement and phrase structure governing subject-auxiliary inversion and *wh*-fronting in questions are universal principles and are available from the earliest stages of language acquisition. What children need to learn from experience are the parameter values or conditions of inversion (+/- Inversion) and *wh*-fronting (+/- *wh*-movement) in their particular target grammar, i.e., the language-specific aspect of these phenomena. In this sense, generativists assume a top-down model of learning where children start with an abstract system (principles) and gradually fill in the details according to the requirements of the target grammar (parameters). Thus, nativists support a Continuity theory of acquisition where children continuously develop their abstract knowledge of the target language based on the input in their environment.

Constructivists assume that children start with no abstract knowledge and are able to learn language on the basis of linguistic experience alone. Children accumulate structural frames (e.g., *what + is*; *what + are*) based on their frequency in the input and gradually generalize over simple constructions to create more complex ones. The mechanisms used in the process of generalization are not language-specific but general learning mechanisms. Thus, constructivists assume a bottom-up learning model.

It is important to note that syntactic distributional properties are a major factor of language acquisition in both theories, not just the usage-based analysis. For example, Valian and Casey (2003) conducted an intervention study using elicited imitation to investigate the role of structured input in children's acquisition of questions. The study consisted of 4 sessions: a pre-intervention session, two intervention sessions, and a post-intervention session. Participants (n=29) were divided into two experimental groups and one quasi-control group. The quasi-control condition was identical to the pre- and post-intervention procedures in which the

experimenter said a target question once and the child was asked to repeat it. In the modeling condition, the experimenter said each question twice before the child attempted her repetition. In the implicit correction condition the experimenter produced the question, waited for the child to attempt the repetition, and then repeated the question correctly. The results suggest that frequency and variety of the linguistic environment are related to improvement of children's performance. The fact that the two experimental groups excelled compared to the control group on auxiliary inversion suggests that the frequency of the input can affect children's ability to generalize syntactic knowledge. The reason for this, the authors claim, is the increased attention available for parsing during the second hearing of the particular construction. Valian and Casey (2003) propose that children learn by attempting to provide a syntactic structure for the utterances they hear. They refer to this mechanism as "attend-and-parse". According to the authors, children's errors in *wh*-questions may be due to misparses of the noisy and unstructured input they receive from their natural environment.

The second issue we address here is whether children's grammars differ qualitatively from the adults'. Early analyses within the nativist approach are not uniform and often propose contrasting points of view. One reflection of this issue is the debate on whether errors in children's questions are the result of structural differences in their grammar or due to competence and/or performance limitations. For instance, Radford (1981) claims that young children's grammar, unlike the target adult grammar, lacks functional projections and can only make use of small clause structures. Klima and Bellugi (1966) propose a transformational model of *wh*-question acquisition in which the number of transformational rules necessary to derive the target *yes/no* and *wh*-questions define children's performance. In the adult grammar, *wh*-questions involve two transformations – *wh*-movement and subject-aux inversion, while *yes/no*

questions require only one – auxiliary inversion. The claim is that young children are limited in the number of transformations they can carry out and this is the reason they would invert in *yes/no* questions but not in *wh*-questions.

There have been both theoretical and empirical objections to these studies. Maratsos (1984) points out that children consistently front the *wh*-element. Under Klima and Bellugi's analysis, it is not clear why young learners would perform the *wh*-movement transformation rather than auxiliary inversion if they have already acquired an auxiliary inversion rule for *yes/no* questions. Furthermore, the transformational analysis predicts that children will apply each of the two transformations on a random basis, which implies that aux inversion in *wh*-questions will occur at least some of the time, if not all of the time. Thus, *wh*-questions with inverted auxiliary and the *wh*-element in situ should be equally likely as the ones with moved *wh*-word and uninverted auxiliary. This is not what the results show. On the transformational analysis, the learner treats *yes/no* and *wh*-questions differently, suggesting that children's grammar is qualitatively different from the target adult grammar. This issue has been addressed differently in the more recent literature. Generally, current generativist theories assume that children's grammars are **not** fundamentally different from the adult target but rather show surface differences that are due to either limited competence about language-specific properties (Valian et al., 1992; Santelmann et al., 2002; Van Valin, 2002; Plunkett, 1991) or to noisy data that do not allow children to parse their input properly (Valian & Casey, 2003)

Accounts of auxiliary omission

As mentioned in the previous section, a substantial part of children's errors in producing *wh*-questions is represented by omission of the auxiliary. Since proponents of the constructivist approach do not present an independent analysis of this kind of error, we will only discuss proposals within the nativist framework. The major accounts of aux omission link the errors to a) the presence of an optional auxiliary (e.g., the Null Aux Hypothesis of Guasti & Rizzi, 1996; Guasti, 2000; see also Boser, 1997; Boser et al., 1992; Josefsson, 1999, and Santelmann et al., 2002 for similar analyses), b) problems with verb raising (Stromswold, 1990); and c) optionality (Valian et al. 1992) or difficulty with tense lexicalization (Plunkett, 1991).

According to the **Null Aux Hypothesis** (Guasti & Rizzi, 1996; Guasti, 2000) aux omissions are due to children having an optionally Null Aux that is legitimate in the head of the root clause. Following the Truncation analysis (Guasti and Rizzi, 1996; Rizzi, 1994a, 2000, 2005), Guasti (2000) assumes that the child grammar allows for a truncation of the highest phrase in the layered CP, ForceP. As a result, the next maximal projection under ForceP, FocP, becomes the root of the clause. The fronted *wh*-element is located in [SpecFocP] and the null aux moves to the head of FocP, Foc⁰, in order to satisfy the *Wh*-criterion and establish a spec-head agreement with the fronted *wh*-word. Since FocP is the root of the clause, the null aux is legitimate in its head and is not subject to the principle of empty category – antecedent identification. Assuming that overt and null auxes behave similarly, the Null Auxiliary Hypothesis predicts that if an overt aux is present, it has to be inverted. This approach cannot account for variations in children's inversion rates with different aux types as has been documented by a number of studies. For example, aux *do* and *be* are inverted more often than modals *should*, *can* and *will* (Labov & Labov, 1978). Rowland (2007) reported higher inversion rates with aux *have* than with aux *do*

and modals. Valian and Casey (2003) found differences in inversion with *can* and *be* vs. *will* and *do*.

A problem for all accounts attributing children's aux-less questions to a null auxiliary is the fact that they do not account for utterances in which the auxiliary is missing and the main verb is tensed, e.g., *she talks?* Stromswold (1990) addresses this issue by suggesting that children's omissions are due to problems with verb raising and *do-support*. She argues that at least half of children's questions lacking an auxiliary contain a tensed verb, and therefore represent failures of verb-raising rather than optional use of the auxiliary. A serious limitation of this analysis is that it does not give a clear explanation as to why children would have verb raising problems with modal verbs or the auxiliary *be*.

Guasti (2000) handles this issue differently. She argues that, in addition to the null aux in the head of the root, the child grammar allows for base-generation of the *wh*-word in C, and thus does not require checking of the [+wh] feature via verb-raising to C. The availability of this option predicts the following cases where no verb raising is necessary: a) questions with missing auxiliaries and inflected verbs; b) uninverted overt auxiliaries and c) lack of *do*-insertion and uninversion with aux *do*.

According to Valian et al. (1992), English-speaking children's errors of aux omission are a consequence of two separate processes: the head of a Question Phrase, Q, optionally lowering to C and Tense raising to Q in C. A more detailed description of this proposal follows in the next subsection. As a result, *do*-support cannot apply because the Q head is already occupying C and Tense is morphologically unrealized. In the case of a missing aux *be*, Valian et al. (1992) suggest that the lack of a verb to carry the Tense+Aspect complex prevents the complex from

receiving any expression. This analysis, however, does not explicitly say why a child would not include an auxiliary. It is also not clear what motivates Tense to raise to Q in C in child English while the adult grammar prohibits it when Q has lowered to C.

Accounts of Aux Inversion Errors

Representatives of both the nativist and constructivist approach have proposed several analyses to account for the source and pattern of auxiliary inversion errors in children's questions. We will discuss in more detail the following proposals: a) within the nativist framework: the optional rule account (Valian et al., 1992), the morphology-based account (Plunkett, 1991; Santelmann et al., 2002; Van Valin, 2002²), and the adjunction analysis (Stromswold, 1990; Plunkett, 1991; de Villiers, 1991); b) within the constructivist framework: variations of the usage-based theory (Ambridge et al., 2006; Rowland & Pine, 2000; Rowland et al., 2005; Rowland, 2007), the cognitive grammar account (Dąbrowska, 2000; 2001);

Optional inversion rule account

Valian et al. (1992) propose that children's concurrent production of inverted as well as non-inverted *wh*-questions is a result of their application of an optional inversion rule based on the fact that in English subject-auxiliary inversion is optional for *yes/no* questions. Following Plunkett (1991), Chomsky (1989), and Katz and Postal (1964), Valian et al. (1992) argue that questions contain a maximal projection Question Phrase (QuesP) that indicates that the sentence

² Note that this is a functionalist account based on Role and Reference Grammar but for reasons of organization we include it here with the nativist analyses.

is interrogative. QuesP is headed by an abstract Q marker and takes CP as its complement. QuesP allows for Infl movement to C. Since QuesP appears only in root questions the absence of QuesP in embedded questions prevents Infl from moving to C. The analysis of young children's early questions is based on two major hypotheses regarding the syntactic structure of questions in adult grammar. Valian et al. (1992) assume that the lack of subject-auxiliary inversion is related to Q lowering to C. Thus, in English *yes/no* questions where inversion is optional, the head of QuesP, Q, can lower to C, preventing inversion in observance of the doubly filled COMP constraint. On the other hand, in *wh*-questions inversion is obligatory and no lowering of Q to C is possible. Since there are languages such as French in which Q-to-C lowering is possible for both *yes/no* and *wh*-questions, the authors hypothesize that, in English, Q can occupy C only if [SpecCP] is empty, i.e., in *yes/no* questions. In *wh*-questions, [SpecCP] is filled with the fronted *wh*-word and blocks Q-to-C lowering. Hence, children's errors in questions are consistent with a continuity theory and are attributed to a grammar allowing optional Q-to-C lowering in all questions, which is licit in French but prohibited in adult English. In this way, Valian et al.'s analysis explains why on the surface children's speech is different from adult speech. Although a lowering analysis is not compatible with current syntactic theories, the optional rule account could be reformulated so that movement always proceeds in one direction: upwards. An alternative could be an account in terms of feature movement.

Morphology-based accounts: Inversion as a function of aux type

Several studies (Plunkett, 1991; Van Valin, 2002; Santelmann et al., 2002) assume that children's inversion errors in questions do not result from lack of knowledge about auxiliary inversion but a different type of competence deficit. For instance, Plunkett (1991) argues that

questions lacking copula/aux *be* do not present evidence for non-inversion. She claims instead that inversion is acquired early and copula-less questions are instances of inflectional features not yet obligatorily realized in the child grammar. In this regard, child English is like adult Arabic – it does not require the obligatory realization of present tense and 3rd person agreement features. English-speaking children have not yet learned the requirements of their target grammar. Thus, Plunkett argues that questions without auxiliaries are compatible with an inversion analysis. However, a downside of the analysis is that it does not make a distinction between copula *be* and auxiliary *be*, which behave differently syntactically – one is a main verb which raises, the other is an auxiliary. We saw evidence that children treat copula and aux *be* differently, exhibiting lower error rates with the copula (Rowland et al., 2005). In fact, some studies (Valian et al., 1992) even exclude cases of copula *be* from the analysis of auxiliary inversion errors, because of its status of a main verb.

Another potential problem for Plunkett's analysis is the fact that auxiliary/copula omission is predicted only for forms with present tense features and 3rd person singular agreement, and not for forms which require 1st or 2nd person agreement or carry past tense inflections. More interestingly, Plunkett's analysis cannot account for errors of *do*-insertion like in '*Where he goes?*', in which the auxiliary is missing but the verb inflection *-s* is overt.

A similar approach is presented by Van Valin (2002) and Santelmann et al. (2002), who relate inversion errors to children's knowledge of tense and formal features associated with inflections on the verbal element. According to Van Valin, each sentence has only one syntactic representation and there are no syntactic movement rules. In English, *wh*-elements appear sentence-initially. English declarative and interrogative sentences differ with respect to the position of the tense bearing morpheme. It is before the subject NP in interrogative sentences

and after the subject NP in declarative sentences. Thus, children's ability to recognize tense and their knowledge about its position in the sentence is crucial in the analysis of the acquisition of subject-aux inversion in English. Further, Van Valin assumes that young children recognize English auxiliaries like *is*, *does*, *did*, *has*, and *had* as tense bearing elements because "despite being morphologically irregular, [they] are clearly tensed, as they enter into clear-cut tense oppositions, e.g., *do/does* vs. *did*; *am/are/is* vs. *was/were*; *have/has* vs. *had*." For modals such as *can/could*, *shall/should*, *will/would*, *may/might*, tense oppositions are not so obvious due to lack of inflection for the present, e.g., *-s*. Thus, children are expected to have trouble recognizing them as tensed. Furthermore, auxiliaries ending in *-n't* would not be analyzed as tensed because *-n't* does not signal tense. Thus, assuming Slobin's (1979) principle that children pay attention to the ends of the words, the prediction is that they would invert only tensed auxiliaries and not modals or negative auxiliaries.

Van Valin's proposal raises the question of how robust the distinction between tensed and untensed auxiliaries is. For instance, under his hypothesis the inflection of *was* could lead young children to wrongly interpret it as a present form of the auxiliary because it ends with *-s*. Thus, children are expected to use the present and past forms of auxiliary *be* (e.g., *is/was*) interchangeably. Similarly, while the analysis explains why present forms of modals (*can*, *shall*, and *will*) would not be inverted in children's questions, it does not exclude the possibility of inversion with their past tense counterparts (*could*, *should*, and *would*), since they all end in *-d* just like *did* and *had*.

Perhaps most important, Van Valin's analysis does not address the fact that children fail to include the auxiliary in *wh*-questions more often than in *yes/no* questions. The data could be explained on the grounds that auxiliary inversion is the only structural question marker for *yes/no*

questions and therefore auxiliaries have to be included. Van Valin (2002) suggests that in *wh*-questions, the *wh*-word at the beginning of a sentence is already a signal for a question and, from a child's point of view, the presence of an auxiliary is not so crucial. This analysis is compatible with a performance-deficit account in which children's omission of auxiliaries in *wh*-questions is attributed to their limited cognitive resources. Van Valin's explanation, like the transformational analysis of Klima and Bellugi (1966), also faces the logical problem of why a child would use a *wh*-word rather than a tensed auxiliary to signal an interrogative sentence, especially if he/she has already learned to use tensed auxiliaries to signal *yes/no* questions.

Another weakness of Van Valin's model is that it fails to predict errors of the type "*Where he goes?*" which lack an auxiliary and are well attested in children's speech (Valian et al., 1992). These errors raise two difficulties for Van Valin's analysis. First, the model does not account for errors with aux *do* (both *do*-insertion and inversion) (see Ambridge et al., 2006 for inversion): if the auxiliary *do* is among the ones that children easily recognize as a tense bearer, it is unclear why they would not insert it, or even if they insert it, why would they not invert it. Second, Van Valin's model would predict that if a verbal element is recognized as tensed (e.g., *goes*), it would be incorrectly inverted, e.g., *Where goes he?* It could be that within Van Valin's framework there is a rule which says that, in English, lexical verbs like *go* can never precede the subject NP. This, in turn, raises the difficulty of how to explain children's violation of the rule for placing tense bearing elements before the subject NP in questions, e.g., *Where he goes?*

Another study which links children's acquisition of subject-auxiliary inversion to knowledge about morphology is presented by Santelmann et al. (2002). They hypothesize that children's grammars initially contain competence for inversion; development in question formation involves integration of language-specific knowledge about the inflectional system. Santelmann

et al. predict that performance will be similar for declaratives and questions across all age groups when the only difference between them is inversion of the auxiliary (e.g., conditions a), c) and e) in Table 3). Conditions b) and d), on the other hand, involve either realization of inflectional features in addition to auxiliary inversion (condition b)) or raising of the main verb *be* which has to be distinguished from aux *be* (condition d)). Thus, performance on conditions b) and d) is expected to be worse for interrogatives and should improve with development as knowledge about the interaction of language-specific factors with inversion is acquired over time.

Table 3. Target items by condition (Santelmann et al., 2002)

Verb Type	Declarative	Question
a) Aux be (baseline)	i. Kermit is eating a cookie.	ii. Is Kermit eating a cookie?
b) Main verb No Modal	i. Mickey Mouse opens a present.	ii. Does Mickey Mouse open a present?
c) Main Verb with Modal	i. Aladdin can draw a picture.	ii. Can Aladdin draw a picture?
d) Copula be No Modal	i. Mufasa is a lion king.	ii. Is Mufasa a lion king?
e) Copula be with Modal	i. Ariel can be a princess.	ii. Can Ariel be a princess?

As predicted, the results show main effects of age and of sentence type only with conditions b) and d) and not with a), c), and e). Along with the issue of the interaction between non-inversion and language-specific knowledge, Santelmann et al.'s findings point to another important problem of auxiliary inversion acquisition, namely, the omission of auxiliaries in child speech. The similar performance on both questions and declaratives suggests that failure to include an auxiliary is common to both types and it is not necessarily due to lack of knowledge about auxiliary inversion.

The Adjunction analysis: Inversion as a function of wh-word type

As mentioned earlier in this chapter, an important issue discussed in the nativist literature concerns children's variable inversion rates with respect to the type of the *wh*-question (i.e., argument vs. adjunct). The data from a number of studies (Erreich, 1984; Klee, 1985; Kuczaj & Brannick, 1979; Labov & Labov, 1978; Plunkett, 1991; Rowland & Pine, 2000; Stromswold, 1990; de Villiers, 1991) are consistent with a conclusion that children experience more inversion difficulties with certain types of *wh*-words than others. Nativist studies diverge in terms of their interpretation of the results. For instance, Erreich (1984) considers this outcome due to individual differences in the acquisition of *wh*-term concepts rather than to a uniform acquisition principle. De Villiers (1991), Plunkett (1991), and Stromswold (1990) treat the inversion rate as a function of a landing-site difference between argument and adjunct questions. Thus they support the so-called **adjunct analysis** of the phenomenon.

Stromswold (1990) proposes that the structural (syntactic) difference between argument and adjunct questions is responsible for this asymmetry in inversion rates. The central argument focuses on several major points a) *wh*-operators which have left a trace in their base-generation site have to be in [SpecCP] position to be able to properly govern their traces; b) within the Government-Binding framework arguments and adjuncts play different roles with respect to the subcategorization requirements of the main verb. Argument *wh*-elements have to leave a trace in their base position in order to meet the Theta Criterion. Adjunct *wh*-elements, on the other hand, are not subject to the Theta Criterion and therefore do not need a trace, i.e., they can be base-generated directly into a sentence-initial position which need not be a specifier position; c) a *wh*-element moved to [SpecCP] triggers auxiliary inversion because of the need for spec-head agreement. Thus, argument *wh*-words would always occupy a specifier position and will trigger

auxiliary inversion while adjunct *wh*-words may occupy a non-specifier position and need not trigger inversion.

Although the correlation between children's inversion rate and the type of questions is an interesting finding, the explanation for it is problematic. The assumption about government would only account for cases of external arguments (i.e., subjects), where indeed the *wh*-operator has to be in a specifier position from where it can c-command in order to antecedent-govern its trace. Traces of internal arguments (i.e., objects) can meet the ECP by being theta governed by the verb, and do not require antecedent-government.

Another problem for this account is the fact that, contrary to Stromswold's assumption, in the G-B theory topicalization does leave a trace behind, which implies that it involves movement. If we accept that a topicalized *wh*-element is the result of movement, we have to observe the requirement that every *wh*-operator binds its variable (trace). Then the desired structural distinction between argument and adjunct questions will be lost because both require the presence of a variable and a proper binding relationship with their antecedent.

Plunkett (1991) and de Villiers (1991) further extend the adjunct vs. argument analysis, arguing that children apply two different movement rules when forming *wh*-questions. Inversion errors are viewed as either due to an adjunct scrambling rule independently present in the adult grammar (Plunkett, 1991), or to IP adjunction of non-argument *wh*-phrases (De Villiers, 1991).

The scrambling analysis implies that young children wrongly analyze argument and adjunct *wh*-words differently by moving them to different positions in the structure. Since the scrambling rule, which Plunkett claims children use when failing to invert the auxiliary, is

independently available, it is not clear how the young learner would recover from the wrong hypothesis that argument and adjunct *wh*-words have different landing sites.

De Villiers (1991) attempts to address this issue by suggesting that a child would abandon his/her wrong analysis of adjunct *wh*-phrases as adjoined to IP only after he/she has acquired enough evidence from embedded questions. De Villiers's analysis, however, still does not quite capture the acquisition data. It makes two wrong predictions: 1) all adjunct questions will appear uninverted all the time until embedded questions with the relevant *wh*-words are learned. Obviously, as Valian et al. (1992) point out, there is no stage in child's development when she/he produces 100 % uninverted questions with any *wh*-word; 2) de Villiers's analysis wrongly predicts that no (or very few) single-clause adjunct questions with a correctly inverted auxiliary will occur in a child's speech before the respective *wh*-word starts to appear in embedded questions. Once again, the presented data do not seem to support such a claim. The fact that non-inversion is rare with adjuncts such as *how* and *where* (Stromswold, 1990) implies that children may treat different *wh*-adjuncts differently. De Villiers's analysis fails to establish a clear basis on which adjunct *wh*-words might be distinguished so that some of them would be consistently moved to [SpecCP] and others adjoined to IP.

Another crucial problem for the adjunct vs. argument explanation, as Valian et al. (1992) note, is that it does not account for the fact that not all argument *wh*-questions are inverted in children's speech. For example, data from several studies (Stromswold, 1990; Valian et al., 1992) show that inversion errors do exist with argument questions such as *what* and *which*.

Usage-based accounts of inversion errors

An alternative analysis of children's inversion rates is proposed by Ambridge et al., (2006), Dąbrowska (2000, 2001), Dąbrowska & Lieven (2005), Rowland (2007), Rowland & Pine (2000), and Rowland et al. (2005), who adopt an empiricist, usage-based view of language acquisition. Unlike the nativist accounts, which suggest that input is just one factor involved in language acquisition, empiricists propose that *wh*-question development is influenced **only** by the relative frequency of particular *wh*-words and verbs in the child's input. In their view, children's early questions with correctly inverted auxiliaries are the result of rote-learned lexical knowledge of certain *wh+auxiliary* combinations rather than of using a general syntactic rule. Variations in inversion rates with respect to auxiliary type and *wh*-type are attributed to differences in the distributional properties of certain unique *wh+auxiliary* collocations in the input (e.g., *what is*, *who is*). The major prediction of a usage-based theory is that the child will invert those *wh+auxiliary* pairs that occur most frequently in the input while low-frequency *wh+auxiliary* combinations would be expected to appear uninverted. Non-inversion errors are viewed as a child's attempt to produce a question before he/she has heard enough instances of the relevant *wh+auxiliary* combination. Errors are expected to disappear gradually and productive correct inversion emerges as the child learns more *wh+auxiliary* combinations and as the initially lexically-specific knowledge generalizes over all members of the auxiliary category. Whether a question should be inverted or uninverted is predicted by the frequency of the particular *wh+auxiliary* combination in the input. Then no (or little) overlap between the inverted and uninverted version of any given *wh+auxiliary* combination is expected, i.e., it is unlikely for the child to produce "What can daddy do?" at the same time as "What daddy can do?" However, it is not clear why a low *wh+aux* frequency would mean that auxiliary inversion with this *wh*-word

is not available to the child (Rowland & Pine, 2000). It is more likely that in such situations the child does not know whether to invert or not, because perhaps she has encountered instances of inversion where the same auxiliary occurred with a different *wh*-word, or the same *wh*-word occurred with a different auxiliary. If the auxiliary from a low-frequency *wh+aux* combination also occurs in a high frequency combination (e.g., *which is* vs. *what is*), the child is expected to consistently invert in the high frequency item but not with the low-frequency one. A usage-based theory also predicts that children's inversion errors would not pattern according to *wh*-word or aux type alone but rather exhibit differences with respect to specific *wh*-words and aux forms, e.g., *what is* vs. *what are*; *what is* vs. *who is* (Ambridge et al, 2006). However, the data reported by Rowland & Pine (2000), p.175, show that the child inverted the auxiliary in both low and high frequency *wh*-aux combinations; although *who are*, *who do*, *which does* did not occur in the input sample, Adam inverted the aux correctly just like in the highest frequency collocations *what are*, *what do*, and *what does*.. Similarly, the low-frequency *what was* and *where is* were inverted as well as the high-frequency *what are* and *where did*. This suggests that a certain level of generalization over the categories *auxiliary* and *wh-word* has taken place. This is more consistent with a nativist account than an empiricist account, which does not recognize a-priori knowledge of linguistic categories such as *aux* and *wh-operator*. The empirical contradictions show clearly that the data cannot be explained by input frequencies alone.

Ambridge et al. (2006) suggest that input frequencies should be analyzed in terms of the interaction between type and token frequencies. Type frequencies can be thought of as the variety of a certain construction (e.g., *what is X*, where X = that, he, daddy, etc.) and token frequency is the number of times a particular combination occurs in the input (e.g., *what is that*). Since high type frequency items with low token frequency are more productive than high token

frequency items with low type frequency (Bybee, 1995), this could explain the fact that some *wh+auxiliary* combinations with high frequency in the input occur non-inverted in children's speech. This analysis, however, goes beyond the fundamental idea that children rely on frequencies of simple *wh+auxiliary* combinations; it assumes that children keep track of more complex frames such as *wh+auxiliary +subject* combinations.

Another open issue is the fact that usage-based analyses are primarily concerned with the acquisition of *wh*-questions only and fail to provide an integrated account of the development of both English *yes/no* and *wh*-questions which have similar structural properties, namely, subject-auxiliary inversion. One exception is an observational study by Rowland (2007) who investigated error rates in *wh*- and *yes/no* questions with auxiliary *do* and modal verbs. If Rowland and Pine's analysis is to be applied to *yes/no* questions, it would require a study of the frequency of different collocations – *Aux+XP* rather than *wh+aux* combinations. The variety of these collocations is arguably much greater for *yes/no* questions than for *wh*-questions and therefore they are likely to occur less frequently. Although there has been evidence that a large part of the subjects in parental speech lack variety and are represented by pronouns or proper nouns (Cameron-Faulkner et al., 2003; Childers & Tomasello, 2001; Pine & Lieven, 1993), children still need to keep track of the frequency of all possible occurrences of an aux and another XP constituent, e.g., *Aux-Pron* (*are they*), *Aux-Adv* (*is today*), *Aux-Proper Name* (*is Andrew*), *Aux-Det* (*are the*), *Aux-Bare Noun* (*are monkeys*), etc. in order to learn that the auxiliary must invert in *yes/no* questions. This is not only computationally demanding for the child, but chances are that some of these frequencies will be much lower and will lead to the wrong prediction that inversion does not occur with them, e.g., *Are dinosaurs extinct?*

Another empiricist account is presented by Dąbrowska (2000, 2001) and Dąbrowska and Lieven (2005) who study the process of language acquisition in the light of usage-based theory relying on certain ideas and concepts of the Cognitive Grammar framework (Langacker, 1987, 2000). The major merit of this account compared to other frequency-based analyses of language acquisition is that it specifies a mechanism of **how** children generalize from lexically specific utterances in the input. On the cognitive grammar analysis, humans store symbolic units (also called constructional schemas), which can vary in specificity (e.g., *open - the door* is more specific than *open THING*, which in turn is more specific than *PROCESS – THING*). Individual lexical items represent the highest-specificity level of constructional schemas (e.g., *open*) and are the building blocks of lower-specificity level schemas (e.g., *open – THING*). Constructional schemas are organized in a hierarchy where the higher the level of the schemas, the broader the grammatical regularities they represent.

Dąbrowska (2000, 2001) and Dąbrowska and Lieven (2005) propose that language acquisition involves learning of concrete and general symbolic units and their hierarchy. Adult competence and productivity in question formation is achieved via analyzing and extracting constructional schemas from rote-learned interrogative structures. Constructional schemas are crucial for the child to be able to construct novel utterances. Thus, the process of acquiring productivity in the use of *wh*-questions takes place in several related stages: a) the accumulation of rote-learned formulae; b) analysis of the formulae into their component units; c) schematization, i.e., generalization over the formulae. The third phase may involve sub-stages in which low-level schemas are further analyzed in order to extract more general ones until a state of full adult-like productivity is reached.

Based on data from one child from the Sachs corpus – Naomi at ages 1;6 through 3;8 – Dąbrowska (2000) claims that children’s early questions are largely formulaic (88%) and that real productivity is observed only after analysis and generalization have taken place. The percentage of formulaic questions is highest at the earliest stages (94.8%) and drops in the last few months of the studied developmental period (63.5%). Dąbrowska interprets the fact that Naomi’s first uses of formulae are often more complex than subsequent uses as evidence supporting the formula-to-schema hypothesis. In particular, the author points out that all *wh*-words (except for *why*) occur in combination with auxiliaries before they appear on their own, e.g., *what?*, *where?* For instance, *what* and *where* appear on their own only after they have occurred with other constructions. Similarly, by the age of 2;6, almost all of Naomi’s early *wh*-questions contain contracted auxiliaries. At a later stage, (between 2;11 and 3;8) the number of uncontracted forms increases and amounts to about 65 % of all contractible auxiliaries. Finally, between ages 4;7 and 4;9, the proportion of uncontracted auxiliaries rises to 73%. This U-shaped pattern of acquisition is analyzed as evidence that more simple forms are schema extractions from more complex rote-learned phrases. Thus, Dąbrowska concludes that grammatical categories are not available innately to the child and are acquired by generalizing on the basis of previous linguistic experience.

Further evidence for this claim is provided from the domain of filler syllables in child speech. More specifically, Dąbrowska (2001) notes that filler syllables cannot be considered precursors of emerging grammatical categories because in Naomi’s speech fillers are used only for preposed auxiliaries and *wh+auxiliary* combinations but not for auxiliaries in declarative sentences. In addition, filler syllables are not more frequent in positions of expected novel forms as would be predicted if they were ‘placeholders’ for already established auxiliary and *wh*- categories.

An important drawback of this study, like Rowland and Pine's (2000), is that it relies on data from a single child and therefore the findings cannot be generalized for all children's acquisition of *wh*-questions. Another downside concerns the claim that children's early *wh*-questions are extremely stereotypical. Dąbrowska does not offer a set of objective criteria for classifying children's utterances as formulaic; it is not clear on what grounds she assumes that highly frequent questions in children's speech are necessarily formulaic rather than acquired syntactic structures. A possible reason could be that these questions occur very frequently in the parents' speech. Since it is known that most of these early questions contain contracted auxiliaries, one way to further investigate their nature is to conduct an elicited imitation study with the same questions observed in children's speech but containing the full form of the auxiliaries rather than the contracted version.

Further, Dąbrowska analyses utterances like "*Can do this?*" at the of age 1;11 as instances of correct inversion although the absence of an overt subject does not allow for such a conclusion, i.e., the utterance may well be a case of uninversion. It has been well documented that children at this age frequently omit overt subjects in their production (Valian, 1991; Valian, Hoeffner, & Aubry, 1996; Valian & Aubry, 2005).

A further complication for the above claim comes from the fact that in the course of language acquisition children systematically omit elements such as auxiliaries, overt subjects, or function words. The assumption that early *wh*-questions are memorized as lexical units implies that all instances of omitted or incorrectly used forms in that period (e.g., *Do want melon?*; *What's Nomi do?*; *What doing?*) have been present in the child's input. It is clear that this is not the case since utterances like these are not allowed in the adult grammar.

1.2.3 Summary and conclusions

In summary, the literature on the acquisition of English questions presents a wide variety of views. Two main streams are defined by the central approach to language acquisition: nativist theories which maintain that children are born with innate knowledge about grammatical categories and relations, and constructivist (empiricist) theories which claim that language is learned only on the basis of linguistic experience. These two lines of research differ in terms of how they interpret children's errors in question formation. Nativists attribute the difficulties to limited syntactic knowledge and constructivists – to limited lexical experience. Further differentiation exists among the champions of both of these views. The nativist account is represented by the null auxiliary analysis (Guasti, 2000; Guasti & Rizzi, 1996), the adjunct analysis (Stromswold, 1990; de Villiers, 1991; Plunkett, 1991), the optional inversion rule analysis supported by Valian, et al. (1992), and Valian & Casey (2003) and the morphology-based account (Santelmann et al., 2002; Van Valin, 2002). Promoters of the constructivist approach present different interpretations as well. One version of the constructivist account is suggested by Dąbrowska (2000, 2001) who applies ideas from the domain of cognitive grammar. Rowland and Pine (2000, 2003) offer another perspective, related to the role of input distribution and frequencies in the process of language acquisition.

This review has shown that the body of research on the acquisition of *wh*-questions is not only comprised of various competing analyses but it also offers contradictory and inconclusive data on children's inversion errors and auxiliary inclusion rates. Furthermore, none of the analyses to date capture the acquisition facts in their entirety. A number of questions are left unanswered: why do children omit auxiliaries, why do children fail to invert auxiliaries, why is auxiliary inversion higher with some *wh*-words than with others?

Chapter 2: The structure of Bulgarian and English questions

2.1 Introduction

In this dissertation we argue that language-specific properties of the target language influence the pattern of acquisition. Certain differences between English and Bulgarian questions determine what types of errors occur and how difficult they are to correct. In this chapter, we outline the main differences in the auxiliary systems and question formation in the two target languages, and review the major theoretical approaches to the structure of questions and their implications for language acquisition.

2.2 The auxiliary system in Bulgarian and English

Auxiliaries are a sub-group of the lexical category Verb. In most Indo-European languages, auxiliaries are used in combination with main verbs to express subtle variations in tense, aspect, and modality. In many languages, auxiliaries share certain properties of main verbs but also demonstrate some idiosyncrasies. Similarities include subject-verb agreement and tense marking on auxiliaries, and subject-auxiliary inversion (note that in languages like English this is a point of diversion between verbs and auxiliaries). Auxiliaries differ from main verbs in that they do not have independent meaning associated with an action, process, state, etc., and generally cannot appear autonomously (i.e., without a following main verb) in non-elliptical sentences³, hence the name ‘auxiliary’ (helping).

³ Most Germanic languages except English allow modal verbs to be followed by non-verbal complements. Based on facts from Swiss German, van Riemsdijk (2002) argues that in those cases there is a phonetically empty super-light verb.

2.2.1 English auxiliaries

In English, the auxiliary system has a central role in the expression of subject-verb agreement and tense that extends beyond enhancing the meaning and pragmatics conveyed by the corresponding main verb. Due to the fact that English main verbs cannot invert with the subject auxiliaries are crucial in marking tense and agreement in interrogative and negated structures. Thus, auxiliaries are necessary in all root non-highest-subject questions⁴ and negated sentences containing the negation marker *not*, regardless of whether their declarative counterparts also contain an auxiliary or just a main verb. Note that this requirement does not apply to constructions with interrogative illocutionary force (i.e., the speaker's intention to ask a question) and declarative-clause word order, such as '*He said that?*' Since illocutionary force is relatively independent of syntactic form, these constructions are not considered syntactic questions.

The English equivalence class of auxiliaries is large and includes members from several categories with different morpho-syntactic behavior. A common syntactic feature for all auxiliary verbs in English is the requirement to undergo T-to-C movement in all root non-highest-subject questions, root long-distance subject questions, and negated sentences containing *not*. Highest-subject root questions do not allow T-to-C movement of the auxiliary and that is why *do*-support does not apply in those cases (Koopman, 1983; Pesetsky & Torrego, 2000). The subject vs. non-subject asymmetries regarding auxiliary T-to-C movement in root questions (1-3)

(1) What did John say?

(2) *Who did say that?

⁴ Auxiliaries are also required in root long-distance subject questions as in '*Who do you think kissed Mary?*'

(3) Who said that?

will be discussed in greater detail in the section that describes various approaches to T-to-C movement within the Minimalist framework.

The equivalence class of auxiliaries can be divided into two major groups:

- 1) **True auxiliaries** are aux *Be*, aux *Do*, and aux *Have* which all have main verb counterparts, as the examples in Table 4 show.

Table 4. English auxiliaries and main verb counterparts

	Auxiliary	Main verb
<i>Be</i>	She is eating.	She is happy.
<i>Do</i>	She does not eat.	She does homework.
<i>Have</i>	She has eaten.	She has a cookie.

Copular *Be* and, in some varieties of English, main verb *have* behave differently from main verb *do* in that they invert with the subject and thus do not require an additional auxiliary to carry tense and agreement features in interrogative or negated sentences. Aux *be* is used to express present or past progressive aspect (e.g., *She is/was eating.*) and present or past passive voice (e.g., *She is/was born.*). Aux *be* has a suppletive paradigm of agreement and tense (Table 5).

Table 5. Paradigm of English Aux *be*

	Present Tense		Past Tense	
Person	Singular	Plural	Singular	Plural
1	Am	Are	Was	Were
2	Are	Are	Were	Were
3	Is	Are	Was	Were

Aux *do* is a special auxiliary (aka *dummy do*) that is only used in interrogative, negated, or emphatic sentences. It does not have meaning and its only function is to carry agreement and tense markings from the main verb that does not invert. Aux *do* has two forms for present tense:

the 3rd person singular *does* and *do* for all other persons and numbers. There is only one past tense form of this auxiliary: *did*.

Aux *have* is used to express present or past perfect aspect (e.g., *I have/had been in London*). Like aux *do*, aux *have* has two present forms (e.g., *have/has*) and one past form (e.g., *had*). The main verb counterpart of aux *have* can take an infinitival complement to express necessity/obligation (e.g., *I have to go*.) This form of *have* cannot invert with the subject and does not appear to the left of the negative marker *not*, in line with its non-auxiliary status.

2) **Modal auxiliary verbs** are used in combination with main verbs to express certain modes, moods and intentions. English modal auxiliary verbs are *can, may, must, ought, shall, and will*. In addition, the modal verbs *need* and *used* behave as auxiliaries when combined with bare infinitives (e.g., *Need you do this?*; *He used not to like me*). Although some modal auxiliaries have different forms for present and past tense (e.g., *can – could, will – would, shall – should, may – might*), none inflect for 3rd person agreement (e.g., *I can – He can*). Interestingly, this characteristic feature of modal auxiliaries is also seen with the modal verb *need* when used as an auxiliary with a bare infinitive (e.g., **He needs not do it*.) but not in main-verb contexts when it has to be marked for 3rd person agreement (e.g., *He needs to see a doctor*.) English modal verbs require the following main verb to be in a non-finite form, without the infinitival marker *to*.

2.2.2 Bulgarian auxiliaries

The Bulgarian auxiliary system is much smaller and more uniform than its English counterpart. There are only two members in the Bulgarian auxiliary equivalence class.

Aux *sum (be)* is used to express present and past perfect aspect as well as present and past passive voice. Bulgarian does not have the equivalent of English present progressive aspect

(e.g., *is going*), and past progressive is marked through aspectual morphology on the main verb. Aux *sum* has a suppletive paradigm that changes with person, number, and tense, much like the English auxiliary *be* (shown in Table 6). As in English, aux *sum* has a main verb counterpart that behaves as a regular main verb that inverts with the subject. However, in Bulgarian, this behavior is not uncommon as all lexical verbs also invert with the subject.

Table 6. Paradigm of Bulgarian Aux *be*

Person	Present Perfect		Past Perfect	
	Singular	Plural	Singular	Plural
1	Sum	Sme	Byah	Byahme
2	Si	Ste	Beshe	Byahte
3	E	Sa	Beshe	Byaha

Bulgarian has a contrast with respect to the inclusion requirements for auxiliary *sum* (*be*) in third person singular and plural; aux *sum* has to be included in perfect aspect (4) and it cannot be included in reported (also inferential) mood (5). Reported status (or mood) indicates that the speaker has not witnessed the action described in the message and conveys it as reported by a third party.

(4) Kakvo e vidyal chovekut?
 What be-3p.sg. seen person-the
 What has the person seen?

(5) Kakvo vidyal chovekut?
 What has the person (reportedly) seen?

Similarly to the English aux *will*, the Bulgarian aux *shte* is a fixed form but, unlike English *will*, it requires a finite verb in present form to express future tense. It functions as a particle which always precedes the main verb. The only difference between a future tense (6) and a present tense (7) form of a sentence is the occurrence of auxiliary *shte* in (6).

(6) Kakvo shte chete s nas tatko?
What will read-3 p.sg. with us daddy?
What will daddy read with us?

(7) Kakvo chete s nas tatko?
What read-3p.sg. with us daddy
What does daddy read with us?

Inclusion of aux *will* in all persons and numbers expresses future tense. If the auxiliary *will* is not included, the meaning of the sentence changes (i.e., it depicts an event in the present) but not its grammaticality status. The result is a completely grammatical and acceptable utterance with a different interpretation. Note that in some cases, as in English, futurity in Bulgarian can also be expressed by simple present as in '*I start school next week.*' In those cases, omission of the auxiliary preserves both the meaning and grammaticality of the sentence. In English, by contrast, the lack of *will* or third person *be* results in an ungrammatical sentence with a non-finite verb (e.g., *He go.*, *He going.*).

2.3 Question formation

2.3.1 English *wh*-questions

The **underlying** structure of English questions initiated by a word like *what*, *where*, *when*, etc., or *wh*-questions, is subject-verb-object (SVO, e.g., *Mary kissed who?*); the **surface** word order is obtained via obligatory fronting of the *wh*-word to sentence-initial position (e.g., *Who did Mary kiss?*). In the theoretical linguistics literature this fronting is known as *wh*-movement. As a result of *wh*-movement, English questions require that elements marked for tense and agreement be adjacent to the moved *wh*-element. In many languages (e.g., all Germanic languages except English; Spanish, Bulgarian) this requirement is met by an operation called *subject-verb inversion*, in which the tense- and agreement-marked lexical verb 'moves' between

the fronted *wh*-word and the subject. In English *wh*-questions, however, lexical verbs have to remain in their underlying position following the subject, and thus they cannot bear the tense or agreement markers, as shown in (8). As a result, all questions in English require the presence of an auxiliary verb that undergoes *subject-auxiliary inversion* to fulfill this function (e.g., *-s* in *has*, *was*; *-d* in *had*, *could*). When a question is related to a declarative sentence that only contains a lexical verb, a dummy auxiliary *do* is inserted to ‘host’ the tense and agreement markers, as shown in (9). While tense and agreement can be realized either on an auxiliary or a main verb in declaratives, they are always marked on an auxiliary in main questions.

Subject-auxiliary inversion is obligatory in English non-subject root questions and is not allowed in embedded *wh*-clauses such as in (10) where both the auxiliary and the lexical verb are in their original positions as they would be in declarative sentences.

- (8) Daddy is working at home.
Where is daddy working?
*Where is working daddy?

- (9) Daddy goes to work.
Where does daddy go?
*Where goes daddy?

- (10) I see where daddy is going.
*I see where is daddy going.

2.3.2 Bulgarian *wh*-questions

Bulgarian and English *wh*-questions share three general features: a) an underlying SVO word order, b) obligatory placement of the *wh*-word at the beginning of a sentence and c) obligatory auxiliary inversion (Bošković, 1998, 2002; Lambova, 2001; Rudin, 1988; Rudin, Kramer, Billings, & Baerman, 1999). But Bulgarian diverges from English in three important ways.

1) In Bulgarian, the lexical verb is marked for tense and agreement, which results in required verb movement to the left of the subject as in (11).

- (11) Kakvo iska Ivan?
What want-3p.sg.pres. John?
What does John want?

There are two main consequences of this difference: a) Bulgarian does not need or have a specialized auxiliary such as the English dummy *do* and b) Bulgarian *wh*-questions do not require the presence of an auxiliary to carry tense and agreement markers; auxiliaries appear in *wh*-questions only when the related declarative sentence also contains an auxiliary. In such questions both the auxiliary and the lexical verb occur to the left of the subject, i.e., both the auxiliary and the verb invert. When an auxiliary is present as in (12a), it has to precede the inverted verb. A sequence where the verb comes before the auxiliary is ungrammatical (12b).

- (12a) Kakvo e vidyal Ivan?
What. be-3p.sg.pres. see-participle masc. John?
What has John seen?
- (12b) *Kakvo vidyal e Ivan?
What. see-participle masc. be-3p.sg. pres. John?
What have John seen?

Thus, in Bulgarian, tense and agreement is marked on the auxiliary and/or the main verb both in declaratives and interrogatives.

2) Subject and verb inversion are obligatory in both matrix **and** embedded *wh*-clauses (13a, 13b). This is a well-established fact about Bulgarian (Rudin, 1986; Kraskow, 1990; Rivero, 1993; Izvorski, 1995).

(13a) Kude e igrat Ivan futbol?
Where be-3p.sg. pres. play-participle masc. Ivan football
Where has Ivan played football?

(13a') *Kude Ivan e igrat futbol?

(13b) Tia me popita kude e igrat Ivan futbol.
She me ask-3p.sg.past where be-3p.sg. pres. play-participle masc. Ivan football.
She asked me where Ivan has played football.

(13b')*Tia me popita kude Ivan e igrat futbol.

3) Unlike English, all Bulgarian interrogative pronouns are morphologically distinct from their relative-pronoun counterparts (e.g., *kude* vs. *kudeto*, the equivalent of English *where*). Although relative pronouns are derived from *wh*-words, they have the relative suffix *-to* that distinguishes them from the interrogative form. Note that the English *wh*-word *what* does not appear in headed relatives and has a distinct relative counterpart, *which* or *that*. However, all other English interrogative *wh*-words (*who*, *where*, *when*, *why*, *how*, etc.) are also used as relative pronouns in the exact same form. From a learner's point of view, this could be confusing as the child may incorrectly generalize non-inversion with relative pronouns to interrogative pronouns, which do require inversion. Unlike English *wh*-questions, the lack of inversion in Bulgarian relative clauses starting with *kudeto* cannot count as misleading input for lack of inversion in *wh*-questions (14a, 14b). The reader is directed to Chapter 3 *The Hypothesis testing model of language acquisition* for a more detailed description of this point of difference between Bulgarian and English, and its implications for children's learning of auxiliary inversion in questions.

(14a) Kude zivee Maria?

Where live-3p.sg.pres. Maria?
Where does Maria live?

(14b) Maria obicha grada, kudeto zivee.
Maria love-3p.sg.pres. city-the where-rel. live-3p.sg.pres.
Maria loves the city where she lives

2.3.3 English *yes/no* questions

English *yes/no* questions are structurally similar to *wh*-questions and they share the following common features: a) both *wh*- and *yes/no* questions involve subject-auxiliary inversion where the inverted auxiliary is in a pre-subject position. As mentioned previously, there are sentences with the illocutionary force of a *yes/no* question and declarative-clause word order that do not have inversion (e.g., *He said this?*). Bulgarian also allows this type of *yes/no* questions. In a later chapter, we will discuss the implication of those constructions for children's acquisition of inversion in questions. There are also questions that are partially elliptical and lack a finite auxiliary (e.g., *Got milk?*; *Want more bread?*). The latter type of constructions, however, does not have the potential to confuse the learner's generalization about subject-auxiliary inversion since those questions are missing both an auxiliary and an overt subject.

b) all non-highest-subject root *wh*- and *yes/no* questions in English require the presence of an auxiliary verb that undergoes subject-auxiliary inversion to bear the tense and/or agreement markers. When a question is related to a declarative sentence that only contains a lexical verb, a dummy auxiliary *do* is inserted to 'host' the tense and agreement markers. While tense and agreement can be realized either on an auxiliary or a main verb in declaratives, they are always marked on an auxiliary in main questions.

c) *wh*- and *yes/no* questions exhibit a main vs. embedded clause asymmetry with respect to

subject-auxiliary inversion; see examples (15) and (16). Main *yes/no* questions require inversion and embedded *yes/no* questions disallow it.

(15) Does he like this book?

(16) I wonder if/whether he likes this book.

2.3.4 Bulgarian *yes/no* questions

Bulgarian main clause and embedded *yes/no* questions are formed with the question particle (Q-particle) *li* or the complementizer *dali* (Rudin, 1986). Note that the use of the complementizer *dali* in root *yes/no* questions is pragmatically marked⁵ and the preferred way of forming matrix *yes/no* questions is by using the particle *li*. The complementizer *dali* in root questions adds a nuance to the interpretation, as shown in the example below (Rudin, 1986). In that sense, the question can be interpreted as having a preceding clause ‘*I wonder*’.

(17) Dali decata yadoha sladoled?
Whether children-the ate ice cream
(I wonder) Did the children eat ice cream?
I wonder whether the children ate ice cream.

Later in the chapter, we will review the literature on Bulgarian question formation and will present syntactic analyses of *yes/no* questions using both *li* and *dali*. In our experimental design, however, we have limited ourselves to studying *yes/no* questions with *li*, which are the predominant variety.

Early analyses of Bulgarian *yes/no* questions assume that both *li* and *dali* are complementizers in the head of C (Rivero, 1993; Rudin, 1993). More recent work suggests that

⁵ Similar pragmatically marked *yes/no* questions can be formed with other interrogative complementizers such as *nima* and *nali* (Tilkov et al., 1983).

the question marker *li*, unlike the complementizer *dali*, is a focus element in the head of a Focus Phrase (Izvorski, 1995) or in T that also contains focus features (Iovtcheva, 2010). Izvorski, King, & Rudin (1997) and Rudin, Kramer, Billings, & Baerman (1999) adopt the following analysis of *li*. As a clitic, *li* requires a prosodic host to its left. If there is a focused phrase in [SpecFocP], it serves as a host for *li*, as shown in (18) where the focused phrase is marked with capital letters.

- (18) Futbol li shte igrae Ivan navun?
 FOOTBALL Q-li aux-will play-3p.sg.pres. Ivan outside
 Will Ivan play FOOTBALL outside?

If no focused constituent is available to the left of *li*, the clitic attaches to the right edge of the prosodic word to its right, i.e., the verbal complex, via a PF operation called Prosodic Inversion (Halpern, 1992). The derivation of the question in (19) is illustrated in (20). Note that in the example below, the auxiliary *shte* forms a prosodic word with the lexical verb. Questions like (19) and (21) lack a specific focused phrase and have a neutral (non-focused) reading.

- (19) Shte igrae li Ivan futbol navun?
 Aux-will play-3p.sg.pres. Q-li Ivan football outside?
 Will Ivan play football outside?

- (20) *li* [shte igrae] → shte igrae *li*

Q aux-will play → aux-will play Q

In cases where the verbal complex contains an auxiliary clitic (21), prosodic inversion of *li* leaves the 3rd person auxiliary clitic *e* in initial position violating its prosodic requirements.

- (21) Igral li e Ivan futbol navun?
 Play-participle Q-li be-3p.sg.pres Ivan football outside?
 Has Ivan played football outside?

As a result, an extra operation of prosodic inversion of the aux clitic takes place to ensure it also has a host to its left. The operation is illustrated in (22) below:

$$(22) li [e \text{ igral}] \rightarrow [e \text{ [igral } li]] \rightarrow \text{igral } li \text{ e}$$

Q Aux-3p.sg. played \rightarrow Aux-3p.sg. played Q \rightarrow Played Q aux-3p.sg.

Prosodic Inversion is arguably a variation of Morphological Merger (Marantz, 1984, 1988) and Local Dislocation (Embick & Noyer, 2001; Embick, 2003) in the Distributed Morphology framework. Prosodic Inversion refers to prosodic categories while Local Dislocation affects morphological categories.

Although Bošković (2001, 2002) has argued against prosodic inversion, his claims are based on facts from Serbo-Croatian, such as clitic splitting of nominal phrases (23).

(23) Zanimljivu sam knjigu citao.
 Interesting aux-1p.sg. book read.
 I read an interesting book.

Bulgarian, however, does not allow this kind of NP splitting. The argument for Serbo-Croatian is that since nominal phrases can be split by other elements as well (e.g., verbs), there is no need to refer to prosodic inversion (24-25). The splitting phenomena are then attributed to left-branch extraction (Boskovic, 2003) or remnant topicalization and *wh*-movement (Cavar & Wilder, 1994; Franks & Progovac, 1994).

(24) Anina dolazi sestra.
 Anna's arrive sister
 Anna's sister is arriving.

- (25) Kakvu citas knjigu?
What-kind read-2p.sg. book
What kind of book are you reading?

Franks (2008, 2006) presents data from the Bulgarian question particle *li* showing that it separates the verb from clitics (26) and even splits pronominal clitic sequences that are otherwise never separable by other material (27). In example (26), the proclitic negative particle *ne* forms a prosodic word with the element to its right. Since *ne* is post-stressing in Bulgarian, it forms an independent prosodic word with the following clitic *mu* [Ne mú]. The pronominal clitics *mu* and *go* are not separable even by aspectual adverbials such as *veche* ‘already’ or particles such as *uz/maj* ‘maybe’, which sometimes can break up the verb + clitics sequence (27a-c).

- (26) Ne mú li go dade Ana? (Franks,
Neg him-dat Q it-acc gave Ana?
Didn't Ana give it to him?

- (27a) Az sam uz ti go dala (Franks, 2008, p.98-99)
I aux-1p.sg. maybe you-dat. It-acc given
I have maybe given it to you.

- (27b) Az sam ti go uz dala.

- (27c) *Az sam ti uz go dala.

Franks takes the fact that *li* splits pronominal clitics to indicate that its placement is purely prosodic. Thus, following Franks (2008, 2006), we assume that in the case of *yes/no* questions without a focused XP element, prosodic inversion is indeed the only option to satisfy the prosodic requirements on the clitic *li*.

Bulgarian *yes/no* questions differ from English *yes/no* questions in several important ways:

- 1) they have a specialized Q-marker (*li*) which is used in *yes/no* questions to mark the utterance as interrogative;
- 2) they feature both auxiliary **and** verb inversion;
- 3) Bulgarian requires

inversion in main and embedded *yes/no* questions. As in English, there are constructions in Bulgarian that have the illocutionary force of a *yes/no* question but the surface order of a declarative sentence without subject and verb inversion. We will not discuss this type of *yes/no* questions as they are not considered true syntactic questions.

2.4 Theoretical approaches to the structure of questions

The structure of questions has been studied extensively in both English and Bulgarian. However, in both languages *wh*-questions have attracted much more attention than *yes/no* questions. One reason is the focus on the nature of *wh*-movement and its landing site. Another reason is the availability of multiple *wh*-movement in Slavic languages such as Bulgarian. In fact, the literature on Bulgarian *wh*-questions is predominantly concerned with multiple *wh*-fronting rather than any other aspect of the syntax of questions. Although this thesis focuses on subject-auxiliary and subject-verb inversion, we will review the literature on *wh*-movement in order to provide a structural basis for our hypotheses and predictions.

2.4.1 Minimalist approaches to head movement (T-to-C movement)

1) **Feature Strength Accounts** introduce the notion of feature strength that forces or prohibits the movement of a head to C^0 . Following Chomsky (1995), Adger (2001) and Radford (2004) assume a theory of feature strength where: a) strong features trigger an overt operation in order to satisfy feature-checking at PF and b) weak features are bound by the principle Procrastinate, i.e., do not trigger movement until LF.

Adger (2001) assumes that T^0 has an uninterpretable feature that determines the type of the clause. The feature has two possible values: a) interrogative, where the feature is strong (Q^*) and b) declarative where the feature is weak (Decl.) In English main questions, the strong Q feature in T^0 forces it to move⁶ to check its feature against C^0 which has a clause-type interpretable Q feature. In declarative sentences the feature in T^0 is weak (Decl) and thus movement to C^0 is not permitted. In English embedded questions, Adger assumes that the uninterpretable selectional $[C]$ feature in C^0 which merges the embedded CP into the specifier of the main clause is incompatible with the uninterpretable Q^* feature and Q -feature checking, hence overt movement of T^0 to C^0 , does not take place. It looks like this analysis must postulate that the $[Q]$ feature on T is weak in English embedded questions and for this reason does not get checked until LF. Also, it is not clear how this approach will handle the facts from Bulgarian embedded questions where inversion is obligatory in embedded questions as well as in main questions, suggesting that the incompatibility between the $[C]$ feature and $[Q]$ feature is not active.

2) Affixal Q accounts (Chomsky 1995, Ginsburg 2009) assume that C^0 in interrogative clauses hosts an abstract Q affix (see Baker, 1970 for an early variation of this idea). According to Chomsky (1995), Q is an interpretable feature. In English, Q is strong in interrogatives and weak in declaratives. There are two options to satisfy a strong Q feature: *Merge* for embedded *yes/no* questions and *Move* for all non-subject root questions and embedded *wh*-questions. In both cases checking is achieved by substitution of a syntactic object or

⁶ This is a Greed-type approach in which overt movement is determined by the strength of the feature of the *moved* category rather than the category *attracting* the moved element, as the standard approach in the minimalist literature assumes.

adjunction of a head. Thus, embedded *yes/no* questions are formed by either merging the element *whether* into [SpecCP] or the complementizer *if* to C⁰. Non-subject root and embedded *wh*-questions are formed by *wh*-movement to [SpecCP] and/or subject-auxiliary inversion (adjunction to C⁰).

Ginsburg (2009) proposes that all English questions have a Qu morpheme that is directly merged to Typ, a projection that marks the type of the clause as interrogative or declarative (also see Cheng, 1991 for a similar clause-typing proposal). The Qu morpheme is specified with [+/- AFFIX] and [+/- OVERT] values. English *yes/no* questions have a Qu morpheme in Typ while *wh*-questions also have a *wh*-feature that triggers *wh*-movement. The Qu morpheme in English main questions is null, i.e., [-OVERT], with a strong [+AFFIX] feature which forces the tensed element to move into Typ and thus triggers subject-auxiliary inversion. The Qu morpheme in embedded questions is [-AFFIX] so the tense element does not move to Typ and subject-auxiliary inversion does not apply. Embedded *yes/no* questions, require the [+OVERT] [-AFFIX]. Qu morpheme *if* and this is the only context in English where an overt Qu morpheme can occur.

3) Case Accounts (Pesetsky and Torrego, 2000, based on Koopman, 1983)

link subject/object asymmetries in T-to-C movement in main *wh*-questions to abstract nominative Case. T-to-C movement of a tensed auxiliary is obligatory when the moved *wh*-element is non-nominative, i.e., is not the closest subject as in (28). In contrast, T-to-C movement is prohibited when the moved *wh*-phrase *is* nominative, i.e., is the closest subject as in (29 a-b).

(28) What did Mary buy t?

(29a) *Who did t buy the book?

(29b) Who t bought the book?

T-to-C movement is in complementary distribution with abstract nominative Case. Pesetsky and Torrego (2000, P&T henceforth) assume that along with a [+wh] feature C^0 bears an uninterpretable tense [T] feature that gets checked via *Agree*. In addition, the [T] feature in C^0 has an EPP property that requires that *Agree* with the [T] feature in T^0 be followed by a copy operation, *Move*, in which material from T^0 is copied to the local environment of C^0 . The main proposal concerns the checking (or deletion, in P&T's terms) of the [T] feature in view of the contrast between (13) and (14). The authors suggest that nominative Case is an uninterpretable [T] feature on D. Thus, the [T] feature in C^0 is checked by the nominative *wh*-phrase in (14b) and no T-to-C movement is necessary. In fact, T-to-C movement is prohibited (as shown in (14a)) by the Economy Condition under which a head triggers the minimum operations necessary to satisfy the properties of its uninterpretable features. In (13), by contrast, the [T] feature in C^0 cannot be checked by the non-nominative *wh*-phrase and therefore T-to-C movement has to apply. In structures like (13), the features in C^0 can only be satisfied through two separate operations – *wh*-movement and T-to-C movement.

With respect to the root/non-root asymmetry in T-to-C movement in English questions P & T suggest that the [T] feature in embedded interrogative C^0 lacks the EPP property. In English embedded questions, the [T] feature is checked via an *Agree* relationship with another occurrence of the feature rather than *Move*. P&T also note that languages and dialects (e.g., Standard English vs. Belfast English) may differ in the EPP property of the embedded C^0 . For example, Belfast English allows T-to-C movement in embedded questions because the [T] feature in embedded C^0 has an optional EPP property.

2.4.2 Against verb movement outside TP in Bulgarian

In section 2.3 *Question formation* we discussed that both English and Bulgarian require subject-auxiliary inversion in questions. Although traditional accounts of Bulgarian questions (Rudin, 1988; Boskovic, 1998, 2002) suggest that, as in English, subject-verb inversion is the result of T-to-C movement, there are proposals that no movement beyond TP takes place in Bulgarian. Based on evidence from the position of VP-modifying adverbs such as *quickly* and *carefully* vis-à-vis the subject Izvorski (1995) and Iovtcheva (2010) argue that the apparent subject-auxiliary word order in Bulgarian questions is the result of two key phenomena:

- 1) Obligatory V-to-T movement
- 2) VP-internal subject

Once the verb moves to T to check its tense feature, the VP-adjoined adverb appears postverbally:

- (30) Kakvo podade **bârzo** Ivan na Maria? (Izvorski 1995, p.57)
What gave.sg quickly Ivan to Maria
What did Ivan quickly give to Maria?

In addition, example (31) shows the subject cannot precede the postverbal adverb *barzo*, indicating 2 possibilities: a) the subject is located in [SpecTP] and the Verb cannot appear outside of TP, or b) that the verb is inside TP but the subject cannot be in [SpecTP]. Both options suggest that the verb does not move outside of TP.

- (31) ?? Kakvo podade Ivan **bârzo** na Maria? (Izvorski 1995, p.56)
What gave.sg Ivan quickly to Maria
What did Ivan quickly give to Maria?

Further evidence against movement out of TP is presented from the interpretation of certain adverbs that in preverbal position (i.e. TP-adjoined position) are ambiguous between a subject-

oriented and a verb-oriented reading. The word order in (32) is the only one in which the question has both readings. If verb movement out of TP is possible in Bulgarian, then a word order where the verb precedes the TP-adjoined adverb should also preserve the two interpretations but it does not; the question in example (33) has the verb-oriented reading only.

- (32) Na kakvo **pravilno** otgovori Ivan?
To what correctly answered.sg Ivan
What was Ivan right to answer? (subject-oriented reading)
What did Ivan give a correct answer to? (verb-oriented reading)

- (33) Na kakvo otgovori **pravilno** Ivan?
to what answered.sg correctly Ivan?
What did Ivan answer correctly?

Similarly, a question as in (34) where the verb is outside TP and the subject is in [SpecTP] should also have both readings, but it does not.

- (34) Na kakvo otgovori Ivan **pravilno**? (Izvorski 1995, p.58)
to what answered.sg Ivan correctly?
What did Ivan correctly answer?

All the evidence described above suggests that the apparent subject-verb inversion in Bulgarian questions is not the result of verb movement out of the TP but is rather due to the VP-internal position of the subject. However, the subject in Bulgarian declarative sentences usually precedes the verb in TP, as Izvorski (1995) herself acknowledges. She proposes that the widely accepted SVO word order in declaratives results from subject movement to a topic or focus position, depending on the informational structure of the sentence. Iovtcheva (2010) supports this claim with evidence that whenever a direct or indirect object is topicalized and followed by clitic doubling, the subject remains in its original VP-internal position. The only case when a VP-external subject can occur with a topicalized object is when the subject is in focus position:

- (35) Knigata **Ivan** ja dade na Maria, ne Peter. (Iovtcheva, 2010, p. 48)
Book-the Ivan Cl. 3sg.f. gave.sg. to Maria, not Peter.
The book, it was Ivan who gave it to Maria, not Peter.

2.4.3 The target position of *wh*-movement: SpecCP, SpecFocP, or both

Traditionally, it has been assumed that *wh*-movement targets [SpecCP] crosslinguistically (Chomsky, 1981). In the literature on *wh*-movement in Slavic languages this established view is reflected in the seminal work of Rudin (1988). Bošković (1998, 2001), Lambova (2001), and Stjepanović (2003), argue that *wh*-movement is triggered by different needs: the need to check a [+wh] feature (e.g., Bulgarian) or the need to check a [+focus] feature (Serbo-Croatian). However, more recent accounts within the Minimalist framework suggest that *wh*-movement is focus-driven and proceeds to [SpecCP] only if there is a strong [+wh] feature in C that needs to be checked in overt syntax. As a result, *wh*-movement does not systematically target [SpecCP] (Den Dikken, 2003; Den Dikken & Giannakidou, 2002 for English; Izvorski, 1995; Iovtcheva, 2010 for Bulgarian; Kiss, 1993; Lipták, 2001 for Hungarian). The central assumption in Den Dikken (2003) is that C in all (non-echo) questions, in all languages, contains a [+wh] feature. Languages differ regarding the strength of the [+wh] feature in C and, consequently, with respect to where *wh*-phrases raise in embedded questions (i.e., [SpecCP] when [+wh] is strong vs. [SpecFocP] when [+wh] is weak). In languages with a weak [+wh] feature in C (e.g., Hungarian, Bulgarian, Serbo-Croatian) all fronted interrogative *wh*-phrases land in [SpecFocP] (Den Dikken, 2003). The weak [+wh] feature in C does not trigger overt *wh*-movement and it gets checked against the [+wh] feature of the *wh*-word in [SpecFocP] via covert movement. Languages with a strong [+wh] feature in C, such as English, front *wh*-words to [SpecFocP] in main clauses and to [SpecCP] in embedded clauses. In Den Dikken (2003) the root/non-root asymmetry is explained

in terms of the nature of strong features. According to Chomsky (1995), the strong features of a head X must be checked before X is included in a larger structure with a different head Y. Based on this definition of feature strength, Den Dikken argues that nothing will force the strong features of the head of the root node to be checked since the head's projection would never be dominated by a larger structure. In this way, the features of the root node are not active in the overt syntax. The conclusion for English is that the [+wh] feature of C is strong, resulting in overt *wh*-movement to [SpecCP] except for the cases of root CPs.

2.4.3 Arguments for focus-driven *wh*-movement

a. Izvorski (1995) and Den Dikken (2003) show that in Bulgarian, Hungarian, and English, phrases that are assumed to be below [SpecCP], such as topics, can precede the *wh*-element, which is unexpected if the *wh*-element is in [SpecCP] (36-38). Thus, the *wh*-phrase must be in a position different and lower from [SpecCP]. They assume this position to be the specifier of a focus projection [SpecFocP].

(36) Ivan kude igrae futbol? (Bulgarian)
Ivan where play football
Ivan, where does he play football?

(37) Marinak mit adott János? (Hungarian; from Den Dikken, 2003)
To Mari what gave János
What did János give to Mari?

(38a) [?]To Mary, what should we give? (English; from Den Dikken, 2003)⁷
(38b) *What to Mary should we give?

⁷ Den Dikken (2003) points out that for speakers who accept tautoclausal topicalization and *wh*-fronting (38b) is significantly worse than (38a).

b. Based on data from Serbo-Croatian and Hungarian, Stjepanović (2003) and Den Dikken (2003) show that interrogative *wh*-phrases have focus features and are in complementary distribution with non-*wh* focused elements (see Rizzi, 1997 for similar facts in Italian root *wh*-questions). In other words, the focus features of interrogative *wh*-phrases are licensed in the positions of non-*wh* focused elements.

c. Relative and interrogative *wh*-words have different landing sites; relative pronouns consistently move overtly to [SpecCP] and interrogative pronouns to [SpecFocP] even in languages with weak [+wh] features (Den Dikken, 2003 for English and Hungarian; Izvorski, 1995 for Bulgarian; Kiss, 1987, 1993; Lipták, 2001 for Hungarian). We will discuss the underlying reasons for this distribution shortly. To support the idea that *wh*-phrases front to a position other than [SpecCP] Izvorski (1995) shows that interrogative *wh*-words do not block the extraction of a relative pronoun out of embedded *wh*-questions in Bulgarian (39). In English embedded *wh*-questions, however, the *wh*-element is in [SpecCP] for reasons we have discussed earlier, and thus blocks *wh*-relativization out of the interrogative clause.

- (39) Tova e deteto, [koeto Ivan ne znae [koga shte vidi otново t]].
This is child-the, whom Ivan not know 3p.sg. when will see again
This is the child, whom John doesn't know when he will see again.

Now we come back to the question of what distinguishes relatives from questions such that *wh*-fronting to [SpecCP] is always overt in relative clauses. Following Chomsky and Lasnik (1993), Den Dikken (2003) associates the contrast between questions and relative clauses with the fact that the latter are predicates of the noun phrases they modify. Since predication has to be established at S-structure (Williams, 1980), relative clauses must undergo overt operator movement to [SpecCP] in order to function as a predicate. Thus, *wh*-movement in relative

clauses is overt and targets [SpecCP] even in languages with a weak [+wh] feature (e.g., Bulgarian). The overtness of *wh*-movement in relative clauses is a consequence of the need to establish predication, and is independent of the strength of the [+wh] feature.

d. Izvorski (1995) argues that postulating an additional functional projection, namely, FP, is independently motivated by facts from *yes/no* questions in Bulgarian. Bulgarian *yes/no* questions are formed using the complementizer *dali* (as argued by Rudin, 1986) or the question particle *li*. The author challenges previous analyses of both *dali* and *li* as complementizers (Rivero, 1993; Rudin, 1993) and assumes instead that *li* occurs lower than C. Evidence against the claim that *li* is a complementizer is the unacceptability of preverbal subjects (which Izvorski assumes to be in topic position) following *li* (40) and the acceptability of topicalized elements preceding a focused XP-*li* constituent (41).

(40) *Na kino li decata biaha? (Izvorski, 1995, p.63)
At cinema li-Q children-the were?
Was it to the movies that the children went?

(41) Decata na kino li biaha?
Children-the at cinema li-Q were?
Was it to the movies that the children went?

Izvorski demonstrates that although both *dali* and *li* allow focused XP constituents, they pose different restrictions on the word order of questions. In focused constructions, *dali* always precedes the focused XP and the verb whereas *li* cliticizes to the focused element and precedes the verb. This leads Izvorski to propose the following structures (42a-b):

(42) a. [CP C *dali* [FP XP [...]]]
b. [FP [XP F *li* [...]]]

Another possibility would be to assume that the complementizer *dali* is bi-morphemic, composed by the particles *da* and *li*. In this case, *li* is generated in a head that hosts focus and *da* sits in C. *Li* would cliticize to C whenever there is lexical content in it (i.e., the particle *da*) and to the focused element otherwise.

Thus, the need for a unified analysis of *yes/no* questions motivates the proposal that *li* appears in a projection lower than CP; in the head of FocP. Izvorski claims that “*li* is the lexical realization of a [+Q] feature. Head-movement of the verb to F and fronting of XP to [SpecFocP] are ways to provide lexical support for [+Q]”. That is why in non-marked contexts, *dali* still precedes the finite verb but *li* appears post-verbally.

Another piece of evidence that both *wh*-phrases and *li* occupy a focus position is the possibility of *wh*-phrases to co-occur with and host (precede) *li* (43). Such structures are marked for uncertainty about the questioned element (Tilkov et al. 1983, p.50).

- (43) Koi li shte kupi knjigata?
Who li-Q will buy book-the
(I am not sure) who would buy the book (at all)?

Furthermore, Iovtcheva (2010) points out that when *li* is hosted by a *wh*-phrase as in (32), nothing else can be moved to the focus position (44-45). Thus, similarly to focalized subjects, fronted *wh*-words are in complementary distribution with focused [XP-*li*] constituents.

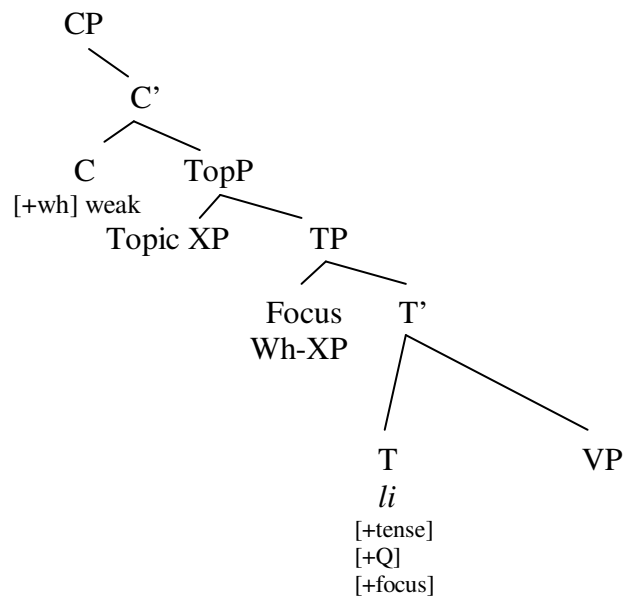
- (44) *Koi knjigata li shte kupi?
Who book-the li-Q will buy?
- (45) *Koi shte kupi li knjigata?
Who will buy li-Q book-the?

To summarize, Izvorski (1995) argues that the highest functional projection hosts focused elements, the question particle *li*, and fronted *wh*-elements. This leads to the conclusion that *wh*-fronting in Bulgarian is a case of focus movement.

2.4.4 The structural projection that licenses Focus in Bulgarian

Following Motapanyane (1997), Iovtcheva (2010) proposes that there is no need for an independent structural focus projection because in the context of Minimalism focus-related phenomena are accessible only at the interface of syntax and semantics. According to Motapanyane (1997), in the lexicon, [+focus] features combine with the semantically related [+wh] and [tense] features to create complex [focus+wh] and/or [focus+tense] features. Crosslinguistic variation is with respect to the feature that can host [+focus]. English, for example is a [focus+wh] language in which [+focus] and [+wh] are checked within CP. Romanian is a [focus+tense] language that checks [+focus] and [tense] within the TP. Iovtcheva (2010) modifies Motapanyane's proposal by proposing that [+focus] is an independent interpretable feature that can be generated in different functional heads (i.e., T or C) depending on the language. In Bulgarian, focus is licensed by TP. Iovtcheva (2010) proposes the following structure of Bulgarian *wh*-questions, shown in (46). By assuming the structure in (46) Iovtcheva is able to account for an important fact about Bulgarian, namely, that a subject cannot appear in [SpecTP]. Furthermore, if preverbal subjects can be topicalized and/or focalized, as argued by Izvorski (1995), it is not clear why an empty [SpecTP] would not give rise to an EPP violation. In Iovtcheva's structure this issue is resolved by assuming that [SpecTP] is filled by the fronted *wh*-word.

(46)



2.5 Our analysis of the structure of questions

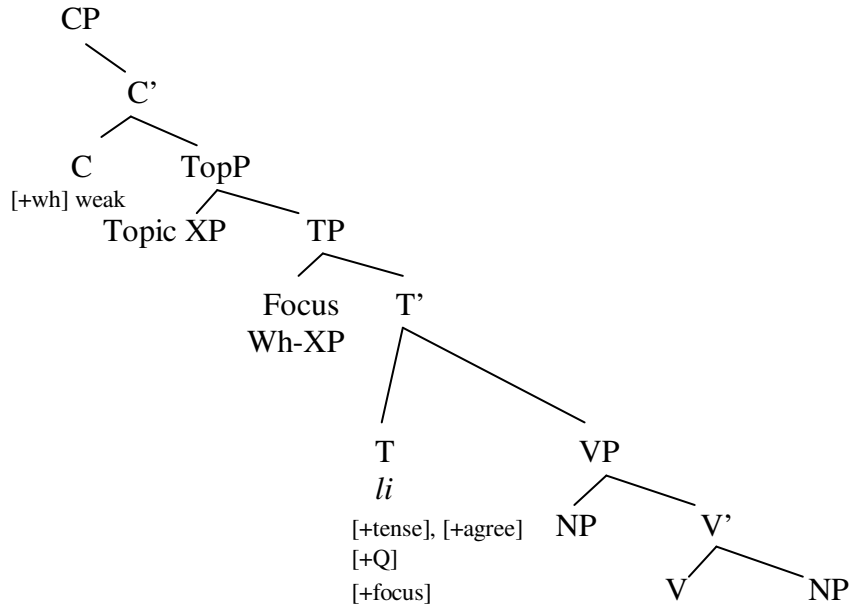
2.5.1 Bulgarian questions

We adopt the analysis proposed by Izvorski (1995) and Iovtcheva (2010). The major points are summarized below:

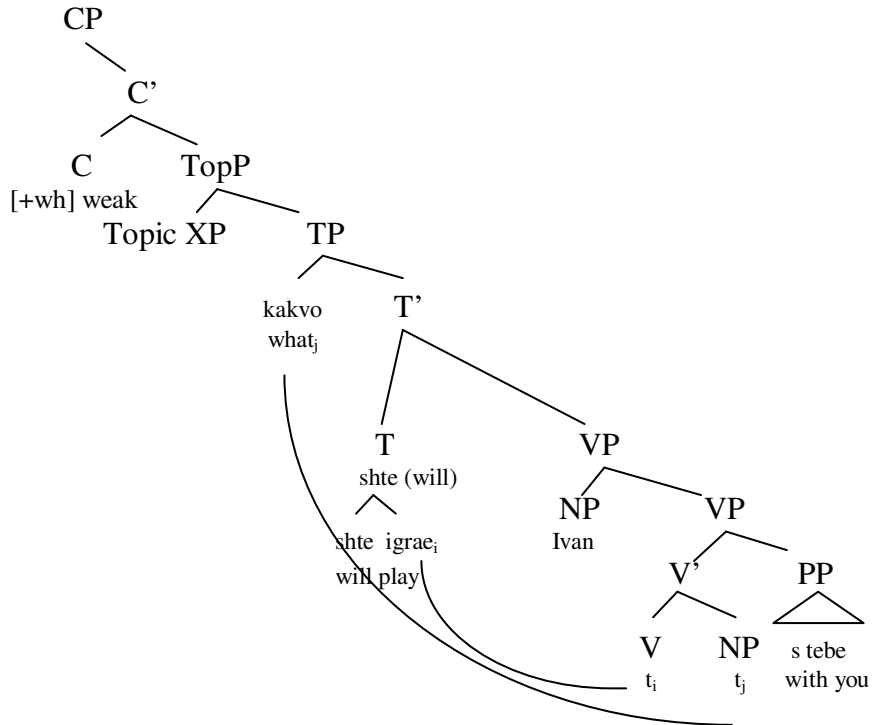
1. *Wh*-movement in Bulgarian questions is driven only by focus in both root and non-root questions, with a weak [+wh] feature in C;
2. There is no T-to-C movement in Bulgarian. The finite verb moves obligatorily to T forming a verbal complex with the auxiliary in T. We assume that the verb does not move any further as the [+focus] feature resides in T.
3. The subject remains VP-internal where it can check Nom Case (Izvorski, 1993; Koopman & Sportiche, 1991). This is the reason for the apparent inversion of the verb.
4. The question particle *li* is the lexical realization of a Q-morpheme inserted in T.

We adopt the structure in (46) for Bulgarian questions, repeated in (47). Examples of *wh*-questions are shown in (48), (49), and (50):

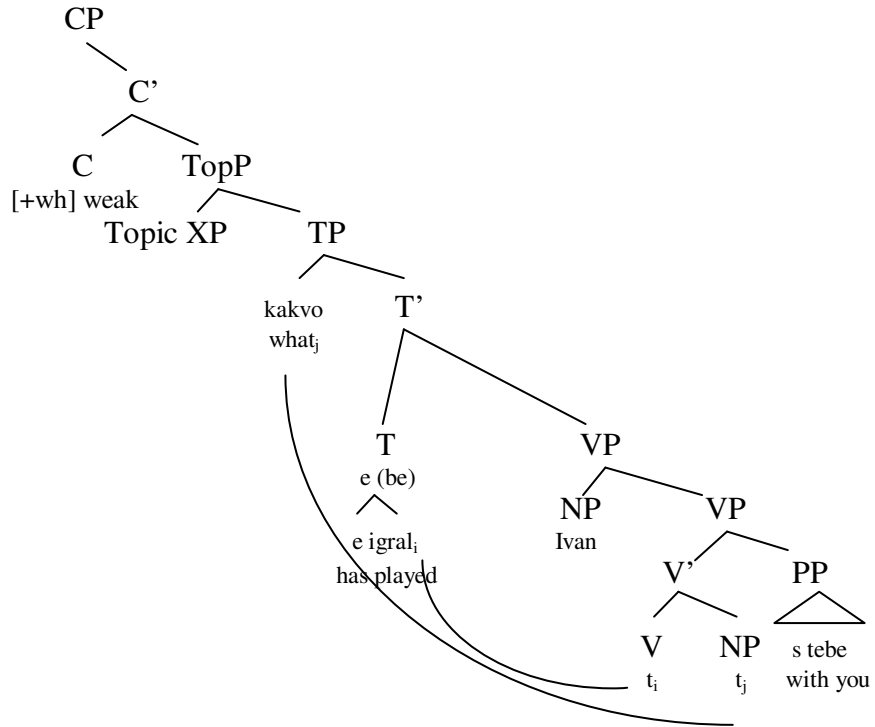
(47)



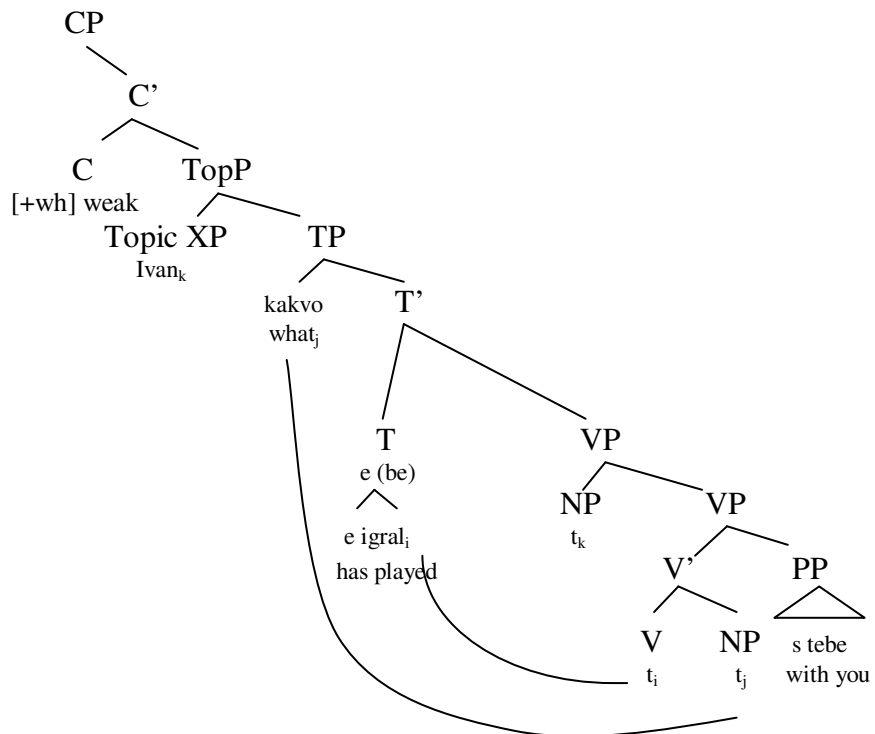
(48) *Kakvo shte igrae Ivan s tebe?*
 What will Ivan play with you?



- (49) *Kakvo e igral Ivan s tebe?*
 What has Ivan played with you?

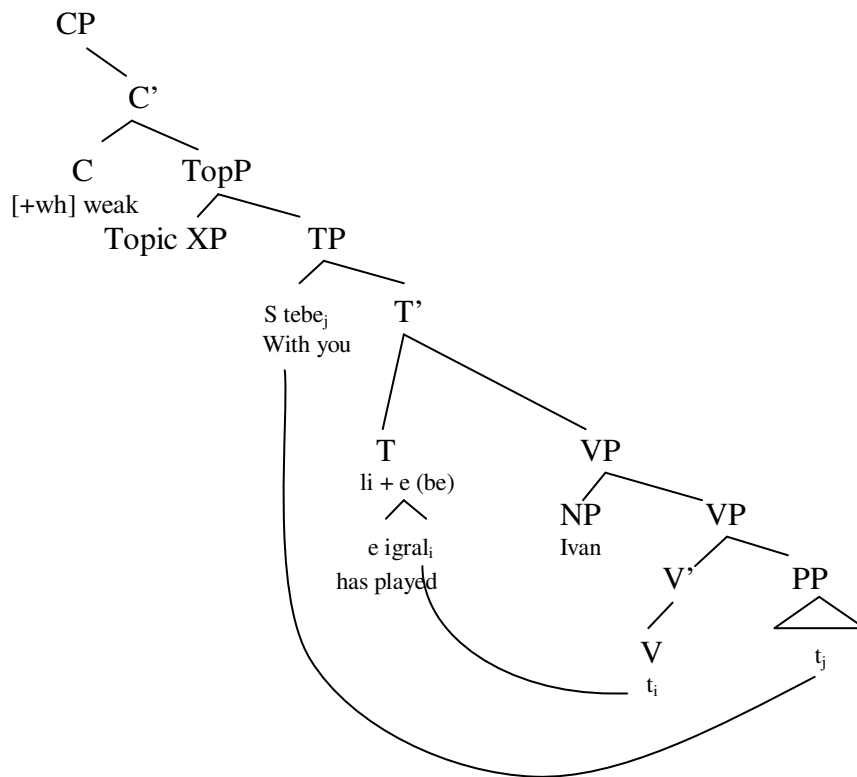


- (50) *Ivan kakvo e igral s tebe?*
 Ivan, what has he played with you?

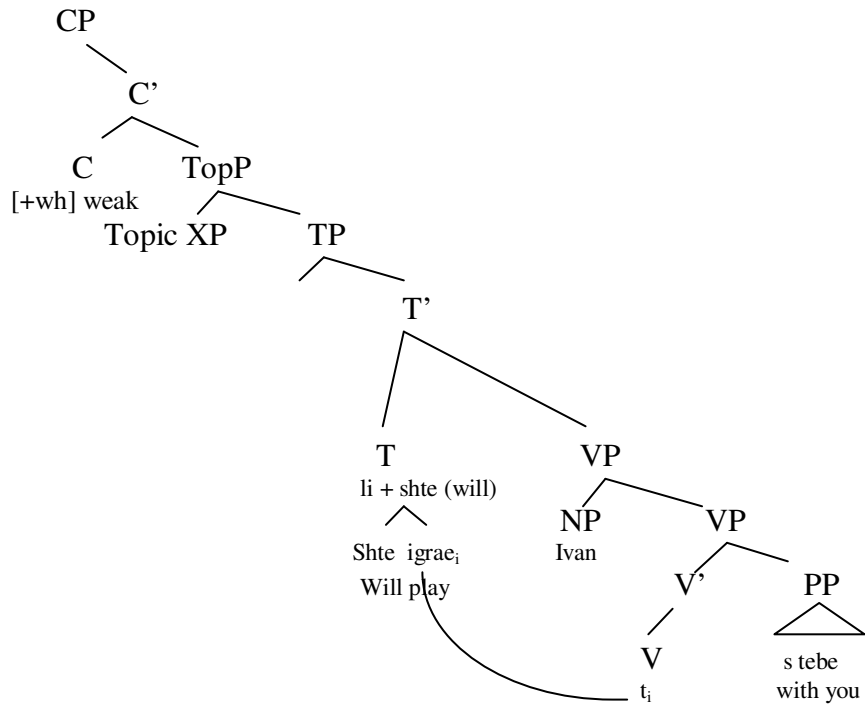


In Bulgarian *yes/no* questions, the T head hosts both the particle *li* (i.e., the lexical realization of the Q marker in T) and the auxiliary (*shite, e*) which marks tense. The finite verb moves to T to check its agreement feature and forms a complex verbal head [*li* [aux +V]]. As discussed earlier in the chapter, the question particle *li* is a clitic and requires a host to its left. The host of *li* could be a focused XP element in [SpecTP] as shown in (51) below. When there is no focused XP to host *li* as in (52), the clitic attaches to the right edge of the prosodic word to its right, i.e., the verbal complex, via Prosodic Inversion. The auxiliary *shite* forms a prosodic word with the following lexical verb and thus the clitic *li* attaches to the right of that verb. The structural illustration of prosodic inversion is repeated in (53) below.

- (51) *S tebe li e igral Ivan?*
 Has Ivan played with YOU?



- (52) *Shte igrae li Ivan s tebe?*
 Will Ivan play with you?



(53) *li [shte igrae]* → *shte igrae li*

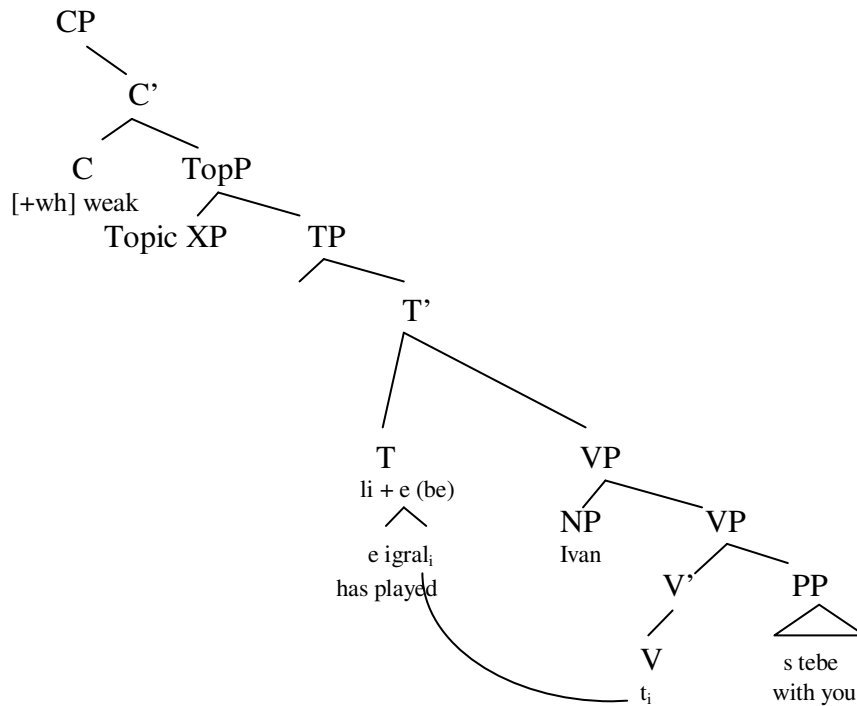
Q aux-will play → aux-will play Q

In cases where the verbal complex contains an auxiliary clitic, prosodic inversion of *li* leaves the 3rd person auxiliary clitic *e* in initial position violating its prosodic requirements. As a result, an extra operation of prosodic inversion of the aux clitic takes place to ensure it also has a host to its left. The operation is shown in (54) and the entire structure in (55):

(54) *li [e igrál]* → *[e [igrál li]]* → *igrál li e*

Q Aux-3p.sg. played → Aux-3p.sg. played Q → Played Q aux-3p.sg.

(55) *Iigral li e Ivan s tebe?*
 Has Ivan played with you?



2.5.2 English questions

With respect to *wh*-movement, we adopt the analysis outlined in Den Dikken (2003). Under this analysis, all English questions have a Q-operator in C that is related to a [+wh] feature in the same head or a focus operator in [SpecFocP]. *Wh*-movement both in root and non-root non-highest-subject *wh*-questions is initiated by the need to check a strong [+focus] feature of the *wh*-phrase. In embedded questions, however, *wh*-movement continues further in order to check the strong [+wh] feature in C. That is why *wh*-movement in English root non-highest-subject questions targets [SpecFocP] and [SpecCP] in embedded questions.

Based on Chomsky (1995) and Den Dikken (2003), we interpret the lack of *wh*-movement to [SpecCP] in root non-highest-subject questions as a consequence of covert checking of the

strong [+wh] feature in the root CP when there is no further structure above CP to force overt feature checking. The embedded CP, however, is dominated by higher projections and thus the strong [+wh] feature needs to be checked via overt *wh*-movement to [SpecCP].

Wh-movement in root non-highest-subject questions has been associated with obligatory subject-auxiliary inversion. Traditional accounts view this as a T-to-C movement (Adger, 2001; Chomsky, 1995; Ginsburg, 2009; Pesetsky & Torrego, 2000; Radford, 2004) or, more recently, as a T-to-F movement (Den Dikken, 2003). As discussed earlier in this chapter, many of these accounts run into problems with regard to explaining the root/non-root asymmetry in auxiliary inversion in English. In most cases, stipulations are used to account for the lack of inversion in embedded questions. Den Dikken (2003) brings up the question of what prevents auxiliary inversion in embedded *wh*-questions, and whether its lack suggests that a *wh*-phrase raises to [SpecCP] without going through [SpecFocP].

An alternative would be to assume that subject-auxiliary inversion is a PF phenomenon triggered only when the specifier of the head that the auxiliary moves into is filled (e.g., [SpecFocP]) at S-structure. In other words, inversion takes place late in the derivation, after all movement operations have been performed, at PF. Auxiliary inversion at PF is a language-specific property and does not necessarily predict that in all languages the operation has to take place at PF. Some languages (Hungarian) may feature earlier (i.e., syntactic) movement of the auxiliary.

Chomsky (1995, Chapter 4) first mentions the idea that head-movement in general takes place at PF. In particular, Chomsky suggests that when Move F involves overt movement of

features the whole category may be ‘pied-piped’ to allow convergence at PF. Thus, it is the properties of the phonological component that force anything beyond features to move.

The idea of head movement at PF has also been discussed within the Distributed Morphology framework as an instantiation of Morphological Merger (Embick & Noyer, 2001; Embick, 2003; Marantz, 1984). According to Embick & Noyer (2001), a number of independent operations occur at the PF level. For example, if syntax does not provide a host for a clitic, PF performs a movement operation to satisfy a clitic dependency (Marantz 1984, 1988, Halpern 1992, Schutze 1994, Embick and Izvorski 1995).

We now return to our discussion of auxiliary inversion in English questions. In English root questions the auxiliary head is attracted to Foc by the filled specifier of FocP. In root non-highest-subject *wh*-questions it is the fronted *wh*-phrase and in *yes/no* questions it is a null but physically filled operator in [SpecFocP]. Evidence for the presence of such an operator is *whether* in [SpecCP] in embedded *yes/no* questions, which is derived from *wh*- and *either*.

In embedded *wh*- and *yes/no* questions, the strong [+wh] feature in C must be checked by overt movement of the *wh*-phrase and the overt operator *whether* to [SpecCP]. As a result, the specifier of FocP only contains the trace of the moved *wh*-element and therefore cannot trigger auxiliary inversion at PF. In *yes/no* questions with the complementizer *if* the specifier position in FocP is also empty and does not attract an auxiliary at PF.

Note, however, that not all head-movement happens at PF in English. For instance, Den Dikken (2006a) shows that head movement extends the phase and thus facilitates phrasal movement in predicate inversion, object shift (see also Fox & Pesetsky, 2005 for arguments on Object shift), and incorporation phenomena. Since syntactic phrasal movement is established,

phase-extending head movement can also be syntactic. Roberts (2011) points out that VP-ellipsis of non-verbal predicates in English requires obligatory *be*-raising to T (56). The ungrammaticality of the example without *be* (57) suggests that V-to-T movement in English has to take place before VP-ellipsis and therefore is part of the syntax (see Roberts, 2011, p.12). In line with this conclusion, we are assuming that only T-to-F head-movement is at PF. That is compatible with our analysis of Bulgarian questions: V-to-T movement is syntactic and is obligatory, and there is NO T-to-C movement.

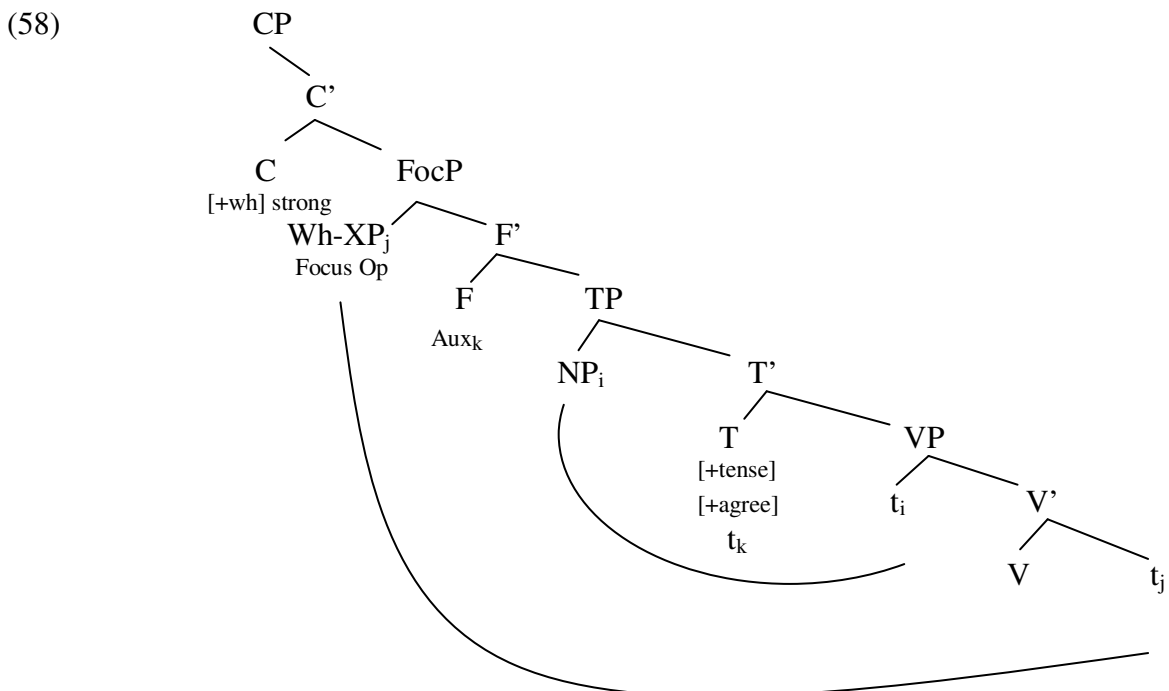
(56) Although he isn't fond of pizza, he is (fond) of pasta.

(57) *Although he isn't fond of pizza, he (fond) of pasta.

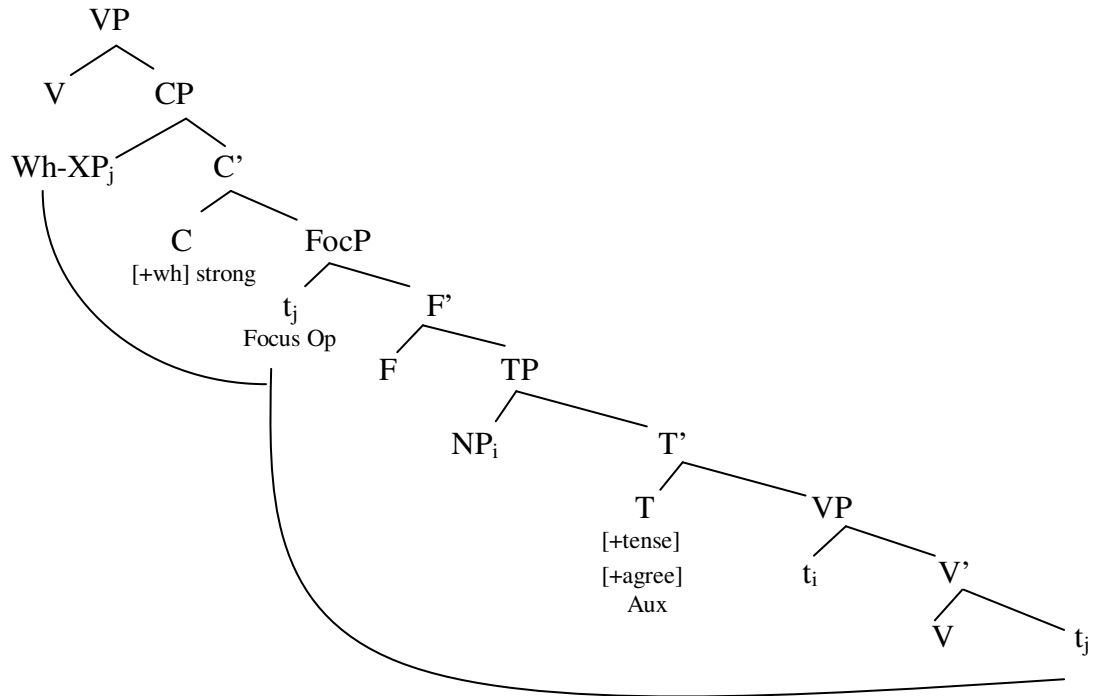
What are the implications of a PF auxiliary inversion analysis with respect to the subject-non-subject asymmetries in English *wh*-questions? Den Dikken (2006b) suggests that highest-subject *wh*-phrases do not occupy the [SpecFocP] position but rather [SpecTP] and for this reason do not trigger aux inversion. In particular, Den Dikken (2006b) argues for a strong version of Chomsky's Vacuous Movement Hypothesis (Chomsky, 1986) where movement that does not cross phonologically or semantically visible material is prohibited. From this hypothesis it follows that highest-subject *wh*-elements stay in-situ, in [SpecTP]. The prohibition on *wh*-movement then results in lack of subject-auxiliary inversion. Note that this strong prohibition on vacuous movement holds only for non-focused *wh*-elements. The question is what happens when a focused highest subject *wh*- is forced to move to [SpecFocP]. Why does subject-auxiliary inversion not apply in those cases? One answer to this question can be found in Pesetsky & Torrego's (2000) analysis, namely, that the nominative *wh*-phrase, which we assume is in [SpecTP] (Den Dikken, 2006) and checks the uninterpretable [T] feature in T⁰ and no T-to-F movement takes place. An alternative explanation is to assume that T-to-Foc movement does

happen, even in cases of movement of the local subject to SpecFocP, but that it does not give rise to *do*-support because *do*-support is a last-resort mechanism that is used only in cases of linear non-adjacency. Since the raised T and its trace are linearly adjacent in the case of movement of the local subject to SpecFocP (the trace in SpecTP is PF-invisible), no *do*-support is required. According to Bobaljik (1995), *do*-support is triggered by a PF adjacency requirement between the morphology in INFL and the verb. Given this approach, *do*-support is not applicable in highest-subject *wh*-questions because nothing blocks PF adjacency between the morphology in the functional head and the verb.

The general structure of English root and non-root non-highest-subject *wh*-questions adopted here is given in (58) and (59). Here we assume that the focus operator is hosted in a separate projection (FocP) rather than in TP as it is in Bulgarian. The reason is that English subjects are not VP-internal and they must move to [SpecTP] for Case marking. As a result, the [SpecTP] position is not available for *wh*-movement.

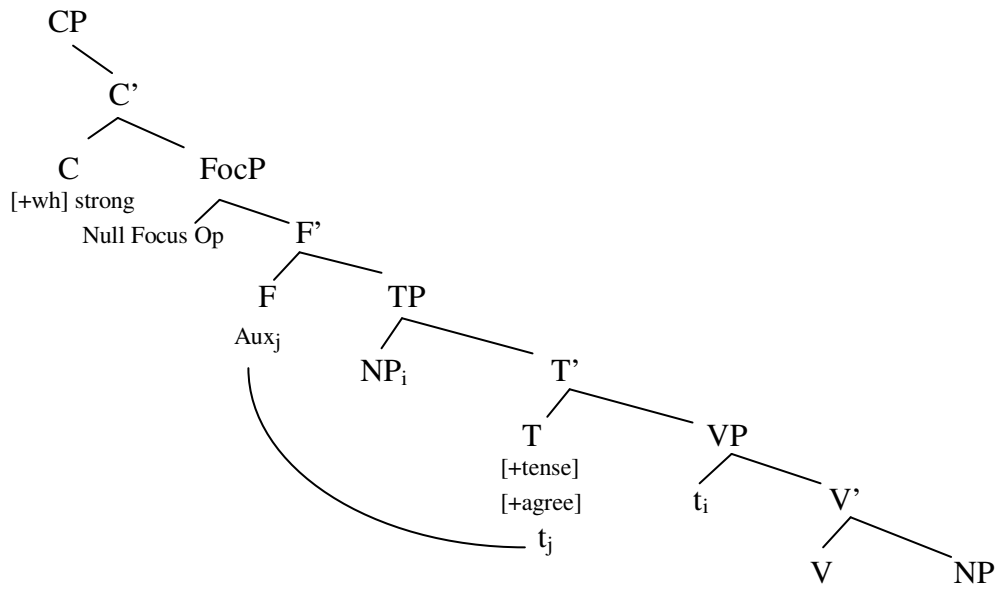


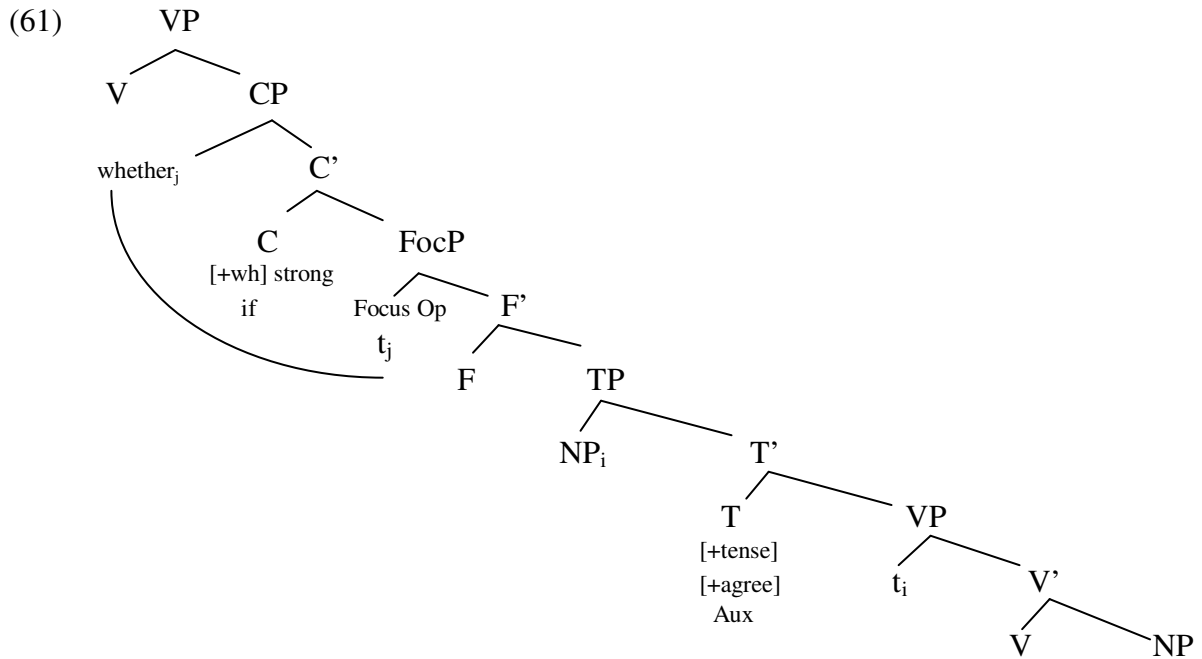
(59)



The corresponding structures of *yes/no* questions is given in (60) and (61)

(60)





2.6 Summary and implications for language acquisition

On our analysis, the strength of the [+wh] feature in C determines whether *wh*-movement is exclusively focus-driven always ending at the projection hosting focus (e.g., [SpecTP] for Bulgarian) or starts as focus movement and proceeds beyond the focus projection in certain contexts in order to check a strong [+wh] feature in C (e.g., [SpecFocP] for English). As a result, *wh*-phrases move to [SpecTP] in Bulgarian root and non-root *wh*-questions, and to [SpecFocP] in English root *wh*-questions. The separate focus projection in English questions is necessary due to the VP-external position of the subject. In English embedded questions *wh*-movement continues to [SpecCP] to check the strong [+wh] feature in C.

Bulgarian and features syntactic V-to-T movement in questions but because of the VP-internal subject in Bulgarian the surface structure looks like there has been subject-auxiliary

and/or subject-verb inversion. Furthermore, we suggest that Bulgarian has no T-to-C movement. We assume that the verb does not move any further as the [+focus] feature resides in T. The finite verb moves to T to form a verbal complex with the auxiliary in T. The Bulgarian question particle *li* used in *yes/no* questions is the lexical realization of a Q-morpheme and is also inserted in T. In Bulgarian *yes/no* and *wh*-questions, the apparent auxiliary and/or verb inversion is a consequence of the VP-internal subject.

English questions, however, feature auxiliary movement to Foc at PF in questions. This PF movement is a non-syntactic operation, occurring late in the derivation after all syntactic movement has taken place. Movement to Foc depends on whether the specifier of FocP is filled. The result is consistent auxiliary inversion in root *wh*- and *yes/no* questions but no inversion in embedded questions.

The difference between Bulgarian and English auxiliary inversion in questions comes down to:

- a. The lack of the extra verb movement in Bulgarian
- b. The strength of the [+wh] feature in C that regulates *wh*-movement in embedded clauses and, consequently, the nature of the material in the specifier of the focus projection (i.e. an overt *wh*-element or a trace)

We now turn to the implications of these differences with respect to language acquisition. Let us suppose that children start with a null hypothesis assuming that all reorderings in the language happen in the syntax. Bulgarian children will not have any difficulties as they will correctly assume that V-to-T movement is syntactic and will apply it when triggered. English-speaking children, however, would run into problems because they would try to apply T-to-F movement in the syntax and the derivation would fail until they learn that inversion is a PF

phenomenon in their target language. If this reasoning is correct, then we would expect English-speaking children to undergeneralize the requirement for auxiliary inversion. If they assume that subject-auxiliary inversion is triggered by *wh*-movement to [SpecFocP], they would not invert with *why* because it is different from other *wh*-elements and is inserted directly into [SpecFocP] (see Ginsburg, 2009; Ko, 1995; Rizzi, 2002 for proposals on the structural position of *why*) rather than move from a TP-internal base-generation position. In the adult language, the PF operation of auxiliary inversion is not triggered by movement but by the filled specifier of FocP. That guarantees that there will be aux inversion with *why*-questions.

Our analysis also predicts that English-speaking children will overgeneralize subject-auxiliary inversion in certain contexts. An elicited imitation study suggests that English-speaking children apply auxiliary inversion in embedded *wh*-questions even though the adult language prohibits it (Pozzan et al., 2010). This overgeneralization is expected if children assume that once the *wh*-phrase moves to [SpecFocP] it will trigger subject-auxiliary inversion in the syntax.

In the following sections we will show that this analysis is supported by our experimental data and that 1) children start with the null hypothesis that reordering in most languages happens in the syntax, 2) that subject-auxiliary inversion in English is a PF phenomenon creating problems for learning; 3) that syntax is active in language acquisition.

Chapter 3: The Hypothesis Testing Model of language acquisition

3.1 The role of abstract linguistic knowledge

As discussed in a previous chapter, there has been an ongoing debate over the initial state of language acquisition. In particular, contrasting views differ with respect to their assumptions about children's earliest linguistic representations and whether they include abstract syntactic categories. Constructivist approaches (also known as empiricist) argue that children's early grammar does not have categories such as *Verb* (Olguin & Tomasello, 1993; Theakston, Lieven, Pine, & Rowland, 2001; Tomasello, 1992) or *Determiner* (Pine & Lieven, 1997; Pine & Martindale, 1996). The child instead starts with concrete item-based knowledge that is the result of accumulation of individual words and lexically-specific templates encountered in the linguistic environment (Abbot-Smith & Tomasello, 2006; Tomasello, 2000, 2003, 2006). Based on experience, the child extracts smaller units from lexical frames in her input and constructs more abstract syntactic categories. Thus, the development of abstract syntactic categories relies exclusively on general cognitive learning mechanisms.

However, there is plenty of evidence from both observational and experimental data that children start language acquisition equipped with abstract knowledge of the organization of language. A series of cross-sectional and longitudinal studies of spontaneous speech suggests that children's early grammars contain the abstract syntactic categories *Verb, Noun, Adjective, Preposition, and Determiner* (Abu-Akel, Bailey & Thum, 2004; Ihns & Leonard, 1988; Valian, 1986; Valian, Solt, & Stewart, 2009).

Young children's abstract representations of syntactic categories and sentence-level relations have also been documented experimentally through elicited imitation tasks (Gerken, Landau & Remez, 1990; Valian, 2006), comprehension studies (Gelman & Taylor, 1984; Katz, Baker & Macnamara, 1974), and syntactic priming (Bencini & Valian, 2008). Gerken, Landau & Remez (1990) found that determiners, unlike nonsense words, help English-speaking 2-year-old children segment speech and identify nouns. Comprehension studies (Gelman & Taylor, 1984; Katz, Baker & Macnamara, 1974) suggest that children use their knowledge of determiners to distinguish between proper and common nouns. Valian (2006) shows that even 2-year-old children distinguish between copular *is/was* and auxiliaries *did/will*, and thus represent tense syntactically and independently from aspect. Valian (2006) argues that if children have abstract representation of tense they must represent the syntactic category *Verb* since tense is inflection on the verb. The data in Valian (2006) suggest that children's early knowledge is not lexically or semantically based.

Bencini & Valian (2008) use syntactic priming to test 3-year-old children's production of passive constructions. They argue that the presence of a syntactic priming effect indicates early abstract sentence-level representations and that children represent the relation between syntactic positions in the sentence (e.g., subject, object) and semantic roles (e.g., agent, patient).

A number of infant studies suggest that real determiners help children parse language (Gerken & McIntosh, 1993; van Heugten, 2006; Kedar, Casasola, & Lust, 2006; Zangl & Fernald, 2007), segment monosyllabic nouns and differentiate between familiar and unfamiliar nouns (Hallé, Durand, & de Boysson-Bardies, 2008), and distinguish between noun and non-noun contexts (Höhle, Weissenborn, Kiefer, Schulz, & Schmitz, 2004; Waxman & Booth, 2001). Infants produce filler syllables in determiner positions suggesting that children have a category

Determiner in their grammar (Veneziano & Sinclair, 2000; Tremblay, 2005; Bottari, Cipriani, & Chilosi, 1993).

In summary, a wide range of data from different domains of grammar demonstrate that children represent various abstract syntactic categories very early in acquisition, by 2 years of age, and that it is unlikely that their knowledge is purely item-based. Given the presented empirical data, the nativist approach is more convincing than its constructivist rival and is the framework adopted here. The next section introduces the major terms to be used in our language learning model in the light of the relevant differences of question formation in English and Bulgarian. Next, we present the hypothesis testing model of acquisition.

3.2 The notions of contrast, syntactic context, and input consistency

We begin with a definition of the term *input* to be used throughout this thesis. In our language learning model, *input* is a function of the unique properties of the target language. Thus, the *input* is the same within a target language (i.e., all English-speaking children receive more or less the same input) and differs across languages. We **do not** use the term *input* to represent individual characteristics of parental speech, e.g., high frequency of verb use, high frequency of questions vs. declaratives, or variety of syntactic structures. Although we acknowledge that individual features of parental speech may play a role in children's language development (e.g., vocabulary size), studies have failed to show consistent relationship between any of those features and speed of acquisition of syntax, including auxiliary inversion in questions (Newport, Gleitman & Gleitman, 1977; Furrow, Nelson & Benedict, 1979; Barnes, Gutfreund, Satterly & Wells, 1983; Gleitman, Newport & Gleitman, 1984; Hoff-Ginsberg, 1986; Scarborough & Wyckoff, 1986; Richards, 1990; Richards & Robinson, 1993).

Next, we introduce the notion of input consistency, or uniformity, that is central to our language learning model. On our analysis, input consistency is a relative notion; it is associated with the lack of any relevant contrasts or distinctions with respect to a certain syntactic requirement. To illustrate what we mean by relevant contrast let us consider the syntactic requirement for auxiliary inclusion in English and Bulgarian. An example of a contrast with respect to auxiliary inclusion in Bulgarian is the variable inclusion requirement for aux *sum* (be) in third person singular and plural. The auxiliary must be included in declaratives (1) and interrogatives (2, 3) marking perfect aspect.

- (1) Ivan e igrat s nego na dvora.
 Ivan be-3p.sg.pres. play-participle with him in yard-the
 Ivan has played with him in the yard.
- (2) Igrat li e Ivan s nego na dvora?
 Play-participle li-Q be-3p.sg.pres. Ivan with him in yard-the
 Has Ivan played with him in the yard?
- (3) Kude e igrat Ivan s tebe?
 Where be-3p.sg.pres. play-participle Ivan with you
 Where has Ivan played with you?

The examples in (1-3) contrast with utterances conveying reported mood, as (4-6) show, where the third person auxiliary cannot be included:

- (4) Ivan igrat s nego na dvora.
 Ivan play-participle with him in yard-the
 Ivan (reportedly) played with him in the yard.
- (5) Igrat li Ivan s nego na dvora?
 Play-participle li-Q Ivan with him in yard-the
 Did Ivan (reportedly) play with him in the yard?
- (6) Kude igrat Ivan s nego?
 Where play-participle Ivan with him
 Where (reportedly) did Ivan play with him?

English presents a different contrast with respect to auxiliary inclusion, variable tense marking in declarative vs. interrogative sentences. Tense can be marked on an auxiliary or a main verb in English declarative sentences (7a-b) as the verb can move to T to get tense marking. In questions, however, tense can only be marked on the auxiliary (8-9) since interrogatives require an additional T-to-F movement (recall that on our analysis auxiliary inversion is the result of movement to a focus head F rather than to C, see Syntax chapter for details). Syntactically, this is due to the fact that English lexical verbs do not move beyond TP in interrogative structures and a dummy *do* auxiliary is inserted to carry tense in the higher focus head. Tensed elements in (7-9) are in bold face.

- (7) a. Mary **could** go to the party.
b. Mary **went** to the party.

- (8) a. Where **could** Mary go?
b. Where **did** Mary go?

- (9) a. **Could** Mary go to the party?
b. **Did** Mary go to the party?

Thus, a relevant contrast is the presence of a syntactic context where the requirement (e.g., auxiliary inclusion) does not apply. In other words, a contrast implies an exception to the requirement. For auxiliary inclusion in Bulgarian, such an exception is a context where the utterance expresses reported mood and the 3rd person auxiliary is not included, both in declarative and interrogative sentences. For auxiliary inclusion in English, the exception is a context where tense can be marked on the main verb and inclusion of an auxiliary is not necessary, i.e., declarative sentences such as (7b).

To further illustrate the terms *relevant contrast* and *syntactic context*, let us consider another syntactic requirement, T-to-F movement in questions. We will describe the relevant properties

of English question formation first. There are three contrasts that are relevant to this requirement in English. The first two contrasts will be in the foundation of our proposal; the third contrast is included here for completeness. First, English auxiliary verbs and main verbs behave differently (the importance of which was noted by Guasti, 2000). While both auxiliaries and main verbs can occupy the T position in a structure (and indeed that is what we see in English declarative sentences, see discussion above), only auxiliaries can and must move beyond T in questions. English main verbs do not undergo T-to-F movement. Thus, in interrogatives, auxiliaries must invert with the subject (10a-c, 11b) while main verbs cannot (10c-d) and (11a-c).

(10a) Daddy will read a book.

(10b) What will daddy read?

(10c) *What daddy will read?

(10d) *What will read daddy?

(11a) Daddy goes to work.

(11b) Where does daddy go?

(11c) *Where goes daddy?

So, in English, there is a syntactic context in which T-to-F movement (i.e., inversion with the subject) does not apply – main Verbs do not undergo such a movement. Thus, main verbs present an exception to the syntactic requirement for T-to-F movement in English interrogatives.

Another contrast relevant to T-to-F movement (i.e., auxiliary inversion) in English interrogatives concerns an asymmetry between main questions, which require auxiliary inversion as in examples (12a-13a), and embedded questions, which prohibit inversion (13b-13b).

Embedded questions present another syntactic context in which the requirement for T-to-F movement does not apply.

(12a) Could Mary go to the party?

(12b) I want to ask if/whether Mary could go to the party.

(13a) Where could Mary *could go?

(13b) I want to ask [where *could Mary could go].

A third contrast pertaining to T-to-F movement in English is related to the fact that most interrogative *wh*-pronouns, except *what*, are morphologically identical to their relative-pronoun counterparts (14-17). This creates a contrast with respect to auxiliary inversion; interrogative *wh*-pronouns require inversion (14, 16) while relative *wh*-pronouns do not (15, 17). Thus, since English *wh*-relative pronouns are not morphologically distinct from interrogative *wh*-words, they provide a context in which the requirement for T-to-F movement does not apply; they are an exception to that syntactic requirement.

(14) When will he pay for it?

(15) I asked him when he would pay for it.

(16) Where does she live?

(17) Maria loves the city where she lives.

Up to this point we have been discussing cases where there is one or more contexts in which a certain syntactic requirement (e.g., inversion with the subject) does not apply. In those cases, the target language supports a relevant contrast(s) with respect to that requirement. On our analysis, a language supporting at least one such contrast provides inconsistent input for the language learner.

Now let us describe a situation where there is no context in which inversion does not apply. That would be a language with no contrasts regarding inversion. Bulgarian is a very good

example because question formation in this language lacks all the contrasts that we outlined for English interrogatives. Specifically, inversion applies to both main verbs and auxiliaries in Bulgarian questions (18-19). Note that auxiliary/verb inversion in Bulgarian questions is not the result of T-to-F movement but is rather a consequence of a VP-internal syntactic subject (see discussion in Syntax chapter). Nevertheless, the auxiliary and/or the main verb precede the subject in questions, and follow it in declaratives (20).

(18a) Kude shte iade kuklata dnes?
Where will eat doll-the today
Where will the doll eat today?

(18b) Kude iade kuklata dnes?
Where eats doll-the today
Where does the doll eat today?

(19a) Shte iade li kuklata dnes?
Will eat li-Q doll-the today
Will the doll eat today?

(19b) Iade li kuklata dnes?
Eat li-Q doll-the today
Does the doll eat today?

(20) Kuklata shte iade v kushti dnes.
Doll-the will eat at home today
The doll will eat at home today.

Similarly, Bulgarian does not make a distinction between main vs. embedded questions regarding auxiliary/main verb inversion; inversion is required in both syntactic contexts (21a-b).

(21a) Kakvo e igral s tebe Ivan?
What has played with you Ivan
What has Ivan played with you?

(21b) Kazi kakvo e igral s tebe Ivan.
Tell (me) what has played with you Ivan
Tell me what Ivan has played with you.

Finally, in Bulgarian all interrogative *wh*-pronouns (e.g., *kude* = *where*) are morphologically distinct from relative *wh*-pronouns (e.g., *kudeto* = *where*). Given this difference, Bulgarian relative *wh*-pronouns do not qualify as a syntactic context in which inversion does not apply (22a-b). In other words, the interrogative vs. relative pronoun contrast is not relevant with respect to inversion.

(22a) *Kude zivee Maria?*
Where lives Maria
Where does Maria live?

(22b) *Maria obicha grada, kudeto tia zivee.*
Maria loves city-the where she lives
Maria loves the city where she lives.

We now return to the notion of input consistency. If input consistency is construed as the lack of contexts which restrict the presence of a category or the operation of movement, then Bulgarian represents an example of a language with consistent input; Bulgarian supports no relevant contrasts for auxiliary inversion. English, on the other hand, supports three contrasts relevant to auxiliary inversion and thus represents an example of a language with inconsistent input.

3.3 The Hypothesis Testing Model of language acquisition

We propose a hypothesis-testing model of language acquisition based on the model developed by Valian (1999), which emphasizes the interaction of linguistic input and the principles of Universal Grammar (UG). The set of possible hypotheses to be tested is constrained by the principles of Universal Grammar such that a child would not generate or consider a hypothesis that is incompatible with those principles. In line with Westergaard's

(2003, 2008, 2009) and Lightfoot's (1999, 2006) cue-based model of acquisition, we assume that children use their input to map specific information to their abstract linguistic knowledge, i.e., what words make up certain categories and how they interact in language structure. In addition, children are sensitive to syntactic regularities in the target linguistic input, not just lexical regularities. Importantly, these regularities are viewed not as pure surface strings of word combinations but pieces of hierarchical structure that make references to relevant syntactic distinctions. In our view, it is not enough to just track lexical information; children also need to follow what lexical information combines with certain syntactic categories in their language. This is a point where our model differs from data-driven models (Abbot-Smith & Tomasello, 2006; Olguin & Tomasello, 1993; Pine & Lieven, 1997; Pine & Martindale, 1996; Theakston, Lieven, Pine, & Rowland, 2001; Tomasello, 1992, 2000, 2003, 2006) in which learning relies solely on lexical information to construct abstract linguistic categories and relations.

Another feature of our model that draws on previous proposals is the assumption that children favor uniformity when generating the initial hypothesis. In particular, Henry (1995) and Henry & Tangnay (1999) link learners' general preference for consistency with their selection of the simplest (or least marked) grammar available within Universal Grammar as a starting point. Thus, we assume that children start with a null hypothesis that assumes a target language with consistent properties. The null hypothesis is that a certain requirement (e.g., auxiliary inversion in non-subject questions) holds for all relevant contexts, i.e., there are no contrasts in the target language. From a learner's point of view, a hypothesis assuming uniformity is the shortest and most economical way to reach the target grammar. Starting with a hypothesis assuming a contrast with respect to a syntactic requirement is dispreferred as it could lead to unnecessary testing of multiple hypotheses when a single one could yield the same result.

If all children start with the same linguistic knowledge and the same null hypothesis (i.e., one assuming consistency) then what defines differences in acquisition is the nature of the input, i.e., the unique characteristics of the specific language they are learning. In particular, the question we ask is what features of these unique properties determine various language acquisition patterns. Similar to the probabilistic variational learning model (Legate & Yang, 2007; Yang, 1999, 2002, 2004), we propose that the level of consistency in the input is a key factor affecting differences in acquisition and it comprises the core component of our language learning model.

Although the variational model was originally designed in a parameter-setting framework, it is applicable in a hypothesis testing approach. On this analysis, every subsequent piece of evidence in the input incrementally increases or decreases the probability of each parameter value until the target value is established as dominant and the competitor value is rejected. The probability of each parameter becoming dominant depends on the abundance and consistency of the relevant evidence in the input. In other words, the more consistent and abundant the evidence, the faster the probability of the target parameter value will grow and the competitor value will decrease to reach the final target setting of the parameter. In our hypothesis testing framework, consistent input will increase the probability of confirming the null hypothesis, and will decrease the probability of generating an alternative hypothesis.

Thus, the unique combination of language-specific properties of the target language determines the range of hypotheses to be considered and how long it would take for a child to go through each hypothesis in the entire range to reach the final state of the adult grammar. Languages with uniform properties facilitate the hypothesis-testing process by providing a narrow range of hypotheses to be considered. The initial null hypothesis is compatible with the input and that results in early target-like performance. Languages with non-uniform properties

prolong acquisition by providing a broad range of hypotheses to be tested, some of which will be incorrect. In those languages, the starting null hypothesis is rejected based on the mixed input and new hypotheses will be generated to fit the input data. Until the learner reaches a hypothesis that is confirmed by the input, his/her performance will be non-target-like.

Our hypothesis-testing model is best illustrated by young children's auxiliary use and inversion in Bulgarian and English *wh-* and *yes-no* questions. Since the English input is inconsistent with respect to both aux inclusion and inversion, we want to compare children's performance to peers learning a language whose input is similar in one respect but different in another. Thus, we chose to investigate and compare a language pair that demonstrates both similarities and differences in the range of hypotheses supported. Bulgarian is a good test because its properties are inconsistent with respect to auxiliary inclusion and it supports a wide range of hypotheses to be considered. In that respect, Bulgarian is similar to English. Bulgarian, however, is different from English because for auxiliary inversion its properties are very consistent and thus it supports a narrow range of hypotheses to be considered.

To sum up, we argue that the level of input consistency or lack of consistency with respect to the requirement for auxiliary inclusion and auxiliary inversion in questions impacts the speed of children's acquisition of those syntactic requirements. Target specific properties of the language determine the types of errors and how difficult they are to correct. The more contrasts the language supports, the greater the number of incorrect hypotheses the child can entertain, and hence the longer it takes for children to acquire the target. Thus, cross-linguistic variation in language acquisition is determined by differences in the amount of relevant contrasts supported in various target grammars. The next section presents the main predictions of the Hypothesis

testing model with respect to the acquisition of auxiliary inclusion and inversion in English and Bulgarian questions.

3.4 Predictions of the Hypothesis Testing Model

3.4.1 Auxiliary inclusion

English and Bulgarian are both inconsistent with respect to auxiliary inclusion; they both disconfirm the null hypothesis that auxiliaries are always (or never) required and thus support a hypothesis in which they are optional. Note that the contrasts concern different language-specific properties and for each contrast one language in the pair is consistent while the other is not. For example, English requires the inclusion of an auxiliary in all contexts in interrogative sentences while Bulgarian requires it for expressing perfect aspect but not reported mood. Similarly, Bulgarian marks tense on the verb or auxiliary in all contexts while English marks tense on the verb or auxiliary in declaratives but not in questions where tense *must* be marked on an auxiliary. This complementary distribution of consistency vs. inconsistency is illustrated in Figure 1 where the relevant contrasts are in dark boxes.

Figure 1. Contrasts for auxiliary inclusion in Bulgarian and English

Bulgarian	English
Aux Be Inclusion (3p.)	
Include in perfect aspect; Do NOT include in reported mood	Include in all contexts
Tense realization	
On Aux or Verb in all contexts	On Aux or Verb in declaratives; On Aux only in questions

What is important for our model is that both target languages support a contrast that makes them inconsistent; learners of these languages are predicted to have similar acquisition patterns albeit for different reasons. In particular, the initial null hypothesis, i.e., always include an auxiliary, is incompatible with the input. The English learner will have to gain more sophisticated knowledge about the conditions of tense marking in his/her target language in declarative vs. interrogative sentences, about language-specific properties such as the lack of lexical verb movement out of TP and the compensating mechanism of *do*-support to carry tense in questions. The Bulgarian learner will need to distinguish between the semantic nuances expressed through present perfect aspect and reported mood constructions.

In the process of accumulating evidence from their input, children in both languages will generate the additional hypothesis 'Include an auxiliary optionally in questions'. English-speaking children will adopt this hypothesis because they treat declarative and interrogative sentences uniformly regarding auxiliary inclusion. Bulgarian-speaking children adopt the 'optional' hypothesis because they treat questions in present perfect aspect and reported mood the same. Until children in both languages receive enough evidence to disconfirm this hypothesis for questions, they are expected to show similar, non-target-like performance on aux inclusion in questions.

3.4.2 Auxiliary inversion

Now let us consider auxiliary inversion in *wh*- and *yes-no* questions, a situation where English makes contrasts that Bulgarian does not. The inconsistent properties of question formation in English define a wide range of hypotheses to be considered with respect to auxiliary inversion. The wide range of hypotheses is supported by three main contrasts in the target

language. Two main distinctions are required for English-speaking children to identify and use to narrow down the hypothesis range for both *wh*- and *yes-no* questions: 1) the auxiliary – main verb dissociation, 2) matrix vs. embedded clause differences. A third contrast specific to *wh*-questions is related to the distinction between relative and interrogative *wh*-pronouns, and more generally, between root questions and relative clauses. With respect to hypothesis-testing, the contrast can only be relevant if children are not able to distinguish the two structures in (23) and (24) to recognize that relative clauses like (24) are not in fact examples of non-inversion in *wh*-questions.

(23) Kude zivee Maria?
Where lives Maria
Where does Maria live?

(24) Maria obicha grada, kudeto tia zivee.
Maria loves city-the where she lives
Maria loves the city where she lives.

However, since the distinction between root questions and relative clauses is presumably acquired fairly early, this contrast will not be included in the hypothesis testing model.

The distribution of contrasts and consistency regarding auxiliary inversion in English and Bulgarian questions are summarized in Figure 2. Relevant contrasts are in dark boxes. Next, we go through the predictions for each relevant contrast.

Figure 2. Contrasts for auxiliary inversion in Bulgarian and English

Bulgarian	English
Aux vs. Lexical Verbs	
Invert all verbs (aux and lexical)	Invert Aux; Do NOT invert lexical verbs
Matrix vs. Embedded Questions	
Invert in all questions	Invert in matrix Qs; Do NOT invert in embedded Qs

Auxiliary-verb dissociation

If children’s null hypothesis assumes uniformity with respect to inversion, they will treat auxiliary and main verbs similarly, leading to two possible hypotheses A1) invert all verbs (whether main or auxiliary) with the subject; A2) do not invert any (main or auxiliary) verbs with the subject. If both A1) and A2) are incompatible with the input, as in English questions, a third hypothesis will be generated A3) optionally invert auxiliaries with the subject. A schematic description of the three hypotheses regarding the auxiliary vs. main verb contrast in inversion is given in Table 7.

Table 7. Hypotheses for inversion of auxiliaries and verbs

Hypothesis	English Confirmed?	Bulgarian Confirmed?
A1) Invert all verbs	No	Yes
A2) Invert no verbs	No	Not generated
A3) Invert auxes optionally	Yes, temporarily	Not generated

Hypotheses A1) and A2) are incorrect for English questions: the first hypothesis will be immediately disconfirmed by very consistent evidence that English main verbs (except for

copula *be*) do not invert with the subject in any context. No errors of main verb inversion have ever been reported for English-speaking children. The second hypothesis will also be disconfirmed quickly as the input clearly suggests that some verbs (copula *be*, auxiliary *be* and *have*, modals) do invert with the subject. In keeping with that children never consistently fail to invert the auxiliary (A2).

The English-speaking child thus generates the simplest alternative hypothesis to accommodate the data: A3) optionally invert auxiliaries with the subject. Children who see some verbs undergo inversion and others not will opt for A3), since it is the most general one that fits the facts. Note that in English *yes/no* questions, the auxiliary can stay in its original position (25b, 26b) providing evidence for hypothesis A3). As discussed in a previous chapter, such constructions have interrogative illocutionary force (i.e., the intention of the speaker to ask a question) and declarative-clause word order, and are not considered true syntactic questions. Bulgarian also allows such *yes/no* questions. Although the lack of inversion in these constructions may well influence children's hypothesis testing process for questions in general, it will do so to the same extent both for English and Bulgarian. In that respect, the input of the two languages is similar and the possibility of no inversion in *yes/no* questions is not expected to cause differences in inversion performance between the two language groups.

(25a) Does daddy go to work?

(25b) Daddy goes to work?

(26a) Will daddy read a book?

(26b) Daddy will read a book?

Now we return to the discussion of hypothesis A3). It is incorrect for English *wh*-questions. In order to reject it, children have to learn which verbs belong to the equivalence class of auxiliaries and separate them from main verbs. Only then can they consider a hypothesis like ‘invert only auxiliary verbs; do not invert main verbs’.

Bulgarian does not make a distinction between main verbs and auxiliaries with respect to inversion. The Bulgarian learner would also start with hypotheses A1) and A2). In her case, A1) is immediately compatible with the facts, because Bulgarian does not differentiate between auxiliaries and main verbs. There is no need to consider the alternative hypothesis A3) and learning is complete.

Root vs. non-root questions

If children’s initial null hypothesis assumes uniformity of auxiliary inversion across clause types, it will be either B1) invert in all non-subject questions or B2) do not invert in non-subject questions, or if neither B1) or B2) are supported, a third hypothesis will be generated and considered, B3) optionally invert in non-subject questions. Table 8 presents the three hypotheses for auxiliary inversion in main and embedded questions.

Table 8. Hypotheses for auxiliary inversion in root and non-root questions

Hypothesis	English confirmed?	Bulgarian confirmed?
B1) Invert in all non-subject questions	No	Yes
B2) Do not invert in non-subject questions	No	Not generated
B3) optionally invert in non-subject questions	Yes, temporarily	Not generated

Since the English input does not support B1) or B2), a third hypothesis B3) optionally invert in non-subject questions is generated. However, B3) is not correct for English questions.

Children have to be able to distinguish between root and embedded questions and accept B1) for root questions and B2) for embedded questions. Before learning the difference between the two types of structures, a child who sees that inversion occurs sometimes but not always should opt for B3). In this case hypothesis B1) is not immediately rejected (unlike hypothesis A1) invert all verbs) because the evidence for inversion in all non-subject questions is not consistent across all contexts. Thus, errors of overgeneralization of inversion to contexts where it is disallowed are expected. Pozzan et al. (2010) report that English-speaking children invert auxiliaries even in embedded *wh*-questions where inversion is prohibited. This supports the idea that children start out with a consistency-based null hypothesis of inversion and only subsequently learn that inversion is not allowed in embedded questions.

One may ask why children overgeneralize inversion from main to embedded questions rather than the reverse. In our view, this is due to the overwhelmingly higher frequency of main questions than embedded questions in child-directed speech (Pozzan et al, 2010).

The Bulgarian learner also starts with a null hypothesis like B1) or B2), but Bulgarian treats main and embedded questions the same way, requiring inversion in both. Thus, Bulgarian supports only the first hypothesis: ‘invert all verbs in all non-highest subject questions’. No additional hypotheses are tested

Since Bulgarian features no contrasts regarding inversion, i.e., it supports the initial null hypothesis of consistency, we predict that Bulgarian-speaking children a) will master inversion in *wh*-questions earlier than their English-speaking peers, b) will correctly invert auxiliaries when present, c) will invert the verb and the subject at a high rate. English-speaking children are expected to show slower acquisition of inversion than Bulgarian-speaking children

To summarize, intra-linguistic and cross-linguistic variation can be thought of as differences in the range of possible hypotheses that can be considered. It is these differences that account for different patterns of acquisition. We predict that in a language like Bulgarian, which makes none of the three distinctions described for English, learning of auxiliary inversion in *wh*-questions will be faster even though the English learner and the Bulgarian learner start with the same null hypothesis.

Now let us consider different scenarios in which our model would be wrong and would not predict a difference in auxiliary inclusion performance in English and Bulgarian questions. One possibility is that auxiliary inclusion performance is driven by the nature rather than by the number of the contrast(s) in the target language. In English, auxiliary inclusion is related to conditions on tense marking in declaratives and interrogatives. Thus, the contrast refers to a morphosyntactic phenomenon and, specifically, to the prohibition on main verb movement out of TP. In Bulgarian questions, the contrast concerns the pragmatics of the utterance, i.e., whether the question expresses present perfect aspect or reported mood. If the nature of the contrast alone accounts for children's performance, then we would expect better auxiliary inclusion rates in English than in Bulgarian for two reasons. First, syntactic phenomena are presumably acquired earlier and faster than semantic and pragmatic phenomena (see Karmiloff-Smith, 1979; Kemp, Lieven & Tomasello, 2005; Maratsos, 1976; Matthewson & Schaeffer, 2000 for late acquisition of the pragmatics of determiners *a* and *the*). In particular, the contrast between present perfect aspect and reported mood in Bulgarian requires children to have the cognitive ability to make a subtle distinction between the roles of the speaker involved in the situations described by the two constructions (witness present perfect aspect and non-witness in reported mood). There is evidence that children acquire aspectual information (i.e., can reliably

distinguish perfective and imperfective aspect) between the ages of three and four years (Weist, Atanassova, Wysocka, & Pawlak, 1999; Wagner, 2002, 2009). Since our participants were younger (aged between 2 and 3 years), it is plausible to assume that their knowledge of aspectual information was incomplete. Second, the syntactic contrast in English is more robust in the input than the semantic distinction in Bulgarian; English-speaking children never hear a question that lacks an auxiliary since that is ungrammatical in the target language. Bulgarian-speaking parents, on the other hand, frequently produce questions without an auxiliary to express reported mood. Our data, as we will show in the next chapter, do not support this line of reasoning as children in both language groups show similar auxiliary inclusion rates.

Another possibility is that the size of the auxiliary equivalence class rather than specific contrasts in the target language determines children's performance on auxiliary inclusion. The English auxiliary equivalence class is larger than the Bulgarian equivalence class, which includes only two members, aux *sum* (be) and aux *will* (shte). Thus, English-speaking children are expected to have more difficulties including an auxiliary in questions than their Bulgarian-speaking peers. However, we will demonstrate that children in both language groups perform similarly on auxiliary inclusion. Although we acknowledge that the large equivalence class in English may have a role in children's difficulties with auxiliaries, it is unlikely that it is the only reason for their low auxiliary inclusion rates.

Now let us look at alternative explanations for auxiliary inversion. Our hypothesis testing model would be disconfirmed if English-speaking children show equal or higher auxiliary inversion rates than their Bulgarian-speaking peers. A usage-based approach to acquisition, for example, would predict better auxiliary inversion performance for English-speaking children than for Bulgarian-speaking children. In the case of *wh*-questions, collocations such as *Wh +*

Aux are far more frequent in the English input than they are in the Bulgarian input. As discussed earlier, all English root questions, with the exception of *Who + Verb* highest-subject questions (e.g., *Who moved my bag?*), require an auxiliary and feature the *Wh + Aux* collocation. Note that embedded questions in English do not allow inversion and the collocation would not be present; since these constructions are relatively rare in the input, they are not expected to have a significant effect on children's generalization for auxiliary inversion. In Bulgarian, however, not all *wh*-questions contain an auxiliary; some questions are formed by inverting the main verb and they would have a collocation such as *Wh + Verb*. Since verbs are an open class, the input frequency of any given *Wh + Verb* collocation will be much lower than those that include members of the closed auxiliary class. The great concentration of high-frequency *Wh + Aux* collocations in the English input predicts that English-speaking children will reach a generalization for auxiliary inversion faster and will perform better on auxiliary inversion than Bulgarian-speaking children whose input is much more evenly distributed between *Wh + Aux* and *Wh + Verb* collocations.

In the case of *yes/no* questions, English questions feature collocations of the type *Aux + X*, where *X* is a bare noun, determiner + noun, pronoun, or a proper noun. Assuming that the young child has already constructed the category *X* from evidence in the input and knows what lexical items belong in it, the collocation *Aux + X* will easily lead to the correct generalization for auxiliary inversion in *yes/no* questions. The situation in Bulgarian *yes/no* questions is more complicated since they involve a specialized interrogative particle *li* whose position relative to the auxiliary and the verb varies. For example, *li* can attach to a focused element *F* and thus precedes the auxiliary and/or verb (e.g., *F li (Aux) Verb*). In the absence of a focused phrase *li* attaches to the verbal complex creating several different collocations: *Verb + li + Subject*, *Shte*

Verb + *li* + Subject; Verb + *li* + *Sum* + Subject. Note that the two auxiliaries *shite* and *sum* occupy different positions relative to *li* (see discussion of Prosodic Inversion in Bulgarian *yes/no* questions, Chapter 2). Since English *yes/no* questions involve only one type of collocation frame and Bulgarian *yes/no* questions support at least four, a usage-based approach to acquisition predicts better performance on auxiliary inversion in English than in Bulgarian *yes/no* questions. However, we will show that this prediction is not supported by our experimental data.

Chapter 4: Experiments I – IV

4.1 Rationale for controlled elicited imitation experimentation

The selection of the elicited imitation paradigm was motivated by two main factors. First, the thesis investigates the acquisition of specific linguistic structures, namely, *wh-* and *yes/no* questions in English and Bulgarian. Elicited imitation allows systematic manipulation of the variables of interest (e.g., *wh-* words and auxiliaries) that are not always equally represented in spontaneous speech (Lust, Flynn, & Foley, 1996). Elicited imitation is an especially powerful method in the study of syntactic components or structures that may not be part of the spontaneous speech inventory of young children. Second, our choice of the elicited imitation task was determined by the young age of our targeted participants (2-3 years). Unlike elicited production, which is most effective in children at age 3 and older (Thornton, 1996), elicited imitation is not too demanding for 2-year-olds and it requires little training. Another advantage of elicited imitation over elicited production is that the former is suitable for use with very young children because it provides a syntactic model for production that increases the chance of receiving a target response. Thus, elicited imitation allows for better control over the output syntactic structure which is crucial in investigations with young children. Furthermore, elicited imitation tests both comprehension and production of a specific target structure while elicited production provides information primarily on production.

Elicited imitation is also preferable to a grammaticality judgment task which is not age-appropriate for this investigation. Generally, the grammaticality judgment paradigm is not reliable when used with children younger than 3 as they are not meta-linguistically aware (McDaniel & Cairns, 1996). Further, unlike the grammaticality judgment task, imitation allows

for analysis of children's productivity with the target structures and their elements and a more in-depth investigation of errors.

An important question is what kind of information correct imitation provides about children's linguistic competence. While quantitative data on correct imitation alone do not necessarily reflect what children know about their grammar, they are examined in conjunction with qualitative analysis of children's spontaneous conversions of the target items. Previous research suggests that imitation requires analysis and interpretation of the target structure and thus reflects linguistic competence rather than mere verbatim reproduction (Lust, Flynn, & Foley, 1996; Valian, Prasada, & Scarpa, 2006). Evidence for the analytic nature of children's imitations is their well-documented correct substitution of various components of the target syntactic structures while preserving the meaning of the sentences (Slobin & Welsh, 1973; Lust, 1977, from Lust et al. 1996). Our data from Bulgarian- and English-speaking children also provide evidence that children structurally analyze the stimuli while imitating them. We come back to this point in the discussion of the results.

Four elicited imitation experiments were conducted to investigate 2-year-old children's acquisition of *wh*- and *yes/no* questions. All four examine subject-verb inversion (SVI) and subject-auxiliary inversion (SAI) in Bulgarian and English questions: experiments I and II investigate *wh*- questions; experiments III and IV investigate *yes/no* questions.

Experiments I and II test the hypothesis that Bulgarian-speaking children learn auxiliary and verb inversion in *wh*-questions earlier than their English peers.

Experiments III and IV have two goals. First, within language groups, they test whether children show any difficulty with inversion in Bulgarian and English *yes/no* questions, and

whether their performance differs from that on *wh*-questions. Such a direct comparison of English-speaking children's performance on *wh*- and *yes/no* questions has not previously been done. Second, the experiments test the hypothesis that Bulgarian-speaking children will show higher (i.e., better) inversion rates than English-speaking participants. This parallel investigation of *wh*- and *yes/no* questions will enable us to provide a unified account of children's acquisition of questions in general, one that is not specific to *wh*- or *yes/no* questions. Experiment III also tests the assumption that children understand Focus and understand that the interrogative particle *li* is a clitic in the head of a focus phrase (FocP) and needs a host. We predict that children will correctly place the question marker *li* in the different word order permutations that result from the host requirement.

4.2 Procedures common to all experiments on auxiliary use and inversion

4.2.1 Participants

All participants were monolingual speakers of English or Bulgarian and were recruited through day care centers, nursery schools, and personal contacts. The children had no known history of language or other delays. Participants were included in the analysis if a) their overall imitation rate in the experiment was no more than 95 % correct; b) they had at least 12 (or 50 %) scorable imitations, and c) at least 10 % of the utterances requiring an auxiliary contained one. An utterance was considered scorable if it contained at least one intelligible word from the target question. The 95 % correct cut-off was used to filter out children who were performing at ceiling and would skew the results.

The target age range for our participants was 2;4 to 3;4. As discussed in a previous chapter, the existing data on English-speaking children's acquisition of *wh*-questions are greatly variable, in part due to the wide age ranges used by some studies (e.g., Ambridge et al., 2006; Bellugi, 1971; Guasti, 2000; Kuczaj & Brannick, 1979; Labov & Labov, 1971; Rowland, 2007; Stromswold, 1990). Here, this issue is addressed by choosing a relatively narrow age range to reduce the variance due to language and cognitive development. Our target age range is also slightly lower than other elicited studies of questions. The motivation was to examine children's performance at an age when errors related to inversion and auxiliary omission are most common and prominent. Interestingly, the studies that found low auxiliary omission and inversion error rates were the ones that used elicited production with higher age ranges (e.g., Ambridge et al. 2006; Kuczaj & Brannick, 1979).

4.2.2 Task

All experiments consisted of one approximately 60-minute session administered at a daycare center or the child's home. The entire session was audio-recorded. At the beginning of the session, the experimenter brought out a children's book to develop a conversation with the child and gather spontaneous speech. Approximately 20 – 25 minutes of spontaneous speech were collected. In the second segment, the researcher introduced the elicited imitation task as a game in which the child was to say what the experimenter said. Each target sentence was accompanied by a picture of the agent (subject). The child was asked to repeat the question to a character – Freddy the frog. The prop toy was used to facilitate children's engagement in the task. A child could hear a sentence a maximum of two times.

4.2.3 Materials

The trial lists in all experiments consisted of four practice and 24 experimental items. All target questions were grammatical. The 24 target questions ensured enough trials for each contrast and a list short enough for 2-year-old children to be able to imitate with ease. A similar study of English-speaking children's imitation of *wh*-questions (Valian & Casey, 2003) indicates that 2-year-old children are capable of imitating 24 experimental sentences without losing interest in the task.

All stimuli contained an optionally transitive lexical verb that can occur both with *what* and *where*, e.g., *eat*, *play*. Items in each trial list were arranged such that a given child heard any given verb only once. All verbs were matched for number of syllables.

The lists were arranged so that the first 12 items exhausted all possible contrast combinations. Experimental items were pseudo-randomized such that no more than two consecutive sentences shared any of the features relevant to the investigation (e.g., lack or presence of aux, clitic *si*, *wh*-type, neutral/focused reading, etc.). Finally, we controlled for order-of-presentation effects by switching the first 12 and last 12 sentences in each trial list so that each trial list was presented in 2 different orders across subjects. For example, in order A sentences 1-12 were presented first and in order B sentences 13-24 were presented first.

4.2.4 Scoring, coding, and dependent measures

Inclusion Measures. All responses were scored for inclusion of each of the question components, i.e., *wh*-word, question particle *li*, auxiliary, verb, subject, and adjunct. In order to address the issue of productivity in children's imitations, we did not require children to imitate the target words in the specific order they were presented (i.e., word order changes were

allowed) and used both strict and lax scoring. Strict inclusion scoring credits responses only if they contain the target word. Strict scoring of inclusion was labeled *target* inclusion (e.g., the strict measure of auxiliary inclusion is *target auxiliary inclusion*). Lax inclusion scoring gives credit for inclusion of a target component in a different form (e.g., *are* instead of *is*) or a word that is different than the target (i.e., is non-target) if it is a word of the same category (e.g., *is* instead of *will*). Thus, lax scoring takes into account children's licit word order rearrangements and substitutions of a *wh*-word, an auxiliary, or a main verb.

Substitution Measure. In the cases when overall auxiliary inclusion and target auxiliary inclusion differ we calculated a substitution measure dividing the percentage of target auxiliary inclusion by the percentage of utterances that contained an auxiliary (i.e., the percentage of overall auxiliary inclusion).

Inversion Measures. All responses were also scored for correct auxiliary and verb inversion. Here we had two versions of the inversion measures. **Inversion+Aux/Verb** calculates correct auxiliary/verb placement in those utterances that contained an auxiliary and/or verb and an overt subject in a base position. Note that the presence of an overt subject is necessary to determine whether inversion has taken place. Some utterances in Experiment I (Bulgarian *wh*-questions) contain a topicalized subject which precedes the *wh*-word. Since auxiliary inversion could not be scored in these utterances they were not included in the analyses of inversion. They were considered in the aux inclusion analyses only.

Inversion±Aux/Verb calculates aux/verb inversion as computed out of all scorable questions, regardless of aux/verb inclusion. In other words, this measure combines inversion errors and auxiliary omission errors. In English, we scored '0' for inversion if the aux was not

inverted or was missing. In Bulgarian, we scored '0' if both the auxiliary and the verb were missing, if both were not inverted, or if one was missing and the other was not inverted. As with the **Inversion+Aux/Verb** measure, in order to score for **Inversion±Aux/Verb** an overt subject had to be present in its base position.

Overall Correct Imitation Measure. The data were also coded for overall percent correct imitation, which was calculated by dividing the number of completely correctly repeated words by the total words in any given target question. Substitutions were not allowed. This score provides a measure of overall imitation rate.

4.2.5 Analyses

For each of the four experiments we conducted within-subjects repeated measures analyses to determine whether children's performance varied as a function of each of the dependent variables. We also compared the data across experiments where language group (Bulgarian vs. English) and question type group (*wh-* vs. *yes/no*) were the between-subjects variables.

4.3 Experiments on *wh*-questions

4.3.1 Experiment I – Bulgarian *wh*-questions

Participants

The participants were 17 monolingual Bulgarian-speaking children aged between 2;2 and 3;3, with mean age 2;8. A total of 48 Bulgarian-speaking children were seen for this experiment, nine of whom performed at ceiling (i.e., had higher than 95 % correct overall imitation) and were

not included in the data analyses. Another 22 children did not understand the task, failed to finish the experiment, or did not provide enough scorable utterances to be included in the analyses. The inclusion criteria were as described in the general participants section. Participants' age, number of imitated items (target sentences), and mean overall imitation rate across all attempted imitations in percent are shown in Table 9.

Table 9. Experiment I: Participants summary

Child	Age (in months)	N imitations	Mean overall imitation (%)
32A	26	15	33
34B	35	17	42
43B	30	24	79
24A	35	24	69
21B	34	24	53
32B	29	21	52
46A	34	20	66
42B	32	20	85
33B	31	23	64
31B	34	24	81
36A	29	17	90
22A	29	23	52
35A	31	23	86
26A	34	24	57
34A	34	23	89
42A	35	23	82
24B	39	13	89
Mean (S.D.)	32 (3)	21 (4)	69 (18)

Materials

In this experiment, we used two within-subjects variables: 1) presence vs. absence of an auxiliary and 2) type of *wh*-word. As previously discussed, Bulgarian *wh*-questions do not require an auxiliary unless the question is in perfect aspect or future tense. We manipulated auxiliary presence or absence to examine its effects on children's subject-verb inversion rates. There were three levels of this variable: a) sentences with an auxiliary (+Aux), b) sentences without an auxiliary (-Aux), and c) sentences with no auxiliary and with the clitic *si* (-Aux

+Clitic). The third level was introduced to control for length in questions without an auxiliary. In the –Aux+Clitic condition, we used the same targets as in the –Aux condition, and added the reflexive clitic *si*. The choice of this clitic was motivated by two main factors: a) its similar syntactic behavior to the auxiliary clitics *sum* ('be') and *shte* ('will') and c) minimal semantic/pragmatic and syntactic contribution to the target sentence. Like the two auxiliaries, the clitic *si* is monosyllabic and precedes the verb. In the +Aux condition we used the two (and only) Bulgarian auxiliaries *sum* (be/have) and *shte* (will).

The second within-subjects variable was type of *wh*-question with two levels, i.e., argument (*what*) or adjunct (*where*). This variable was used to determine whether the syntactic argument/adjunct distinction influences children's inversion rates as suggested in previous accounts of inversion errors (Erreich, 1984; Klee, 1985; Kuczaj & Brannick, 1979; Labov & Labov, 1978; Plunkett, 1991; Rowland & Pine, 2000; Stromswold, 1990; de Villiers, 1991).

Thus, there were three aux presence conditions (+Aux, –Aux, and –Aux+Clitic), and two *wh*-type conditions (*what* vs. *where*), for a total of six contrasts. Table 10 illustrates one of the six stimulus sets we used to construct six experimental lists that were presented to the participants.

Conditions were counterbalanced within each stimulus set and across experimental lists (i.e., across subjects). Half of the sentences in each set and list were *wh*-argument questions (e.g., *what*), half were *wh*-adjunct questions (e.g., *where*). One-third (eight items) contained an auxiliary plus main verb (+Aux), one-third contained only a main verb (–Aux), and one-third had a main verb and the clitic *si* and no auxiliary (–Aux+Clitic). Each cell of contrast contained four experimental items, two with a feminine verb and two with a masculine verb. Thus, half of the verbs in the stimulus set were masculine, half were feminine. All lexical verbs were in third

person singular and could occur with both *what* and *where*, e.g., *eat, play*. Each verb appeared six times across all lists, once in each of the six contrasts. Verbs occurred in three different temporal forms: present, past progressive, and past participle. Each of the target *wh*-questions contained a *wh*-word, an auxiliary, if applicable, a main verb, a lexical subject, and an adjunct which was either adverbial (e.g., *tomorrow, again, here*) or a prepositional phrase (e.g., *with us, for lunch, etc.*)

Table 10. Sample stimulus set for Experiment I

Aux	No Aux	No Aux + Cl
What		
Kakvo e shiela kaka snoshti? <i>What has sewn big-sister last night?</i>	Kakvo shieshe kaka snoshti? <i>What sewed big-sister last night?</i>	Kakvo si shieshe kaka snoshti? <i>What refl. sewed big-sister last night?</i>
Kakvo e kopal taino diado? <i>What has dug secretly grandpa?</i>	Kakvo kopa taino diado? <i>What dug secretly grandpa?</i>	Kakvo si kopa taino diado? <i>What refl. dug secretly grandpa?</i>
Kakvo shte iade kuklata dnes? <i>What will eat doll-the today?</i>	Kakvo iade kuklata dnes? <i>What eats doll-the today?</i>	Kakvo si iade kuklata dnes? <i>What refl. ate doll-the today?</i>
Kakvo shte chete s nas tatko? <i>What will read with us daddy?</i>	Kakvo chete s nas tatko? <i>What reads with us daddy?</i>	Kakvo si chete s nas tatko? <i>What refl. reads with us daddy?</i>
Where		
Kude e shiela kaka snoshti? <i>Where has sewn sister last night?</i>	Kude shieshe kaka snoshti? <i>Where sewed sister last night?</i>	Kude si shieshe kaka snoshti? <i>Where refl. sewed sister last night?</i>
Kude e kopal taino diado? <i>Where has dug secretly grandpa?</i>	Kude kopa taino diado? <i>Where dug secretly grandpa?</i>	Kude si kopa taino diado? <i>Where refl. dug secretly grandpa?</i>
Kude shte iade kuklata dnes? <i>Where will eat doll-the today?</i>	Kude iade kuklata dnes? <i>Where eats doll-the today?</i>	Kude si iade kuklata dnes? <i>Where refl. eats doll-the today?</i>
Kude shte chete s nas tatko? <i>Where will read with us daddy?</i>	Kude chete s nas tatko? <i>Where reads with us daddy?</i>	Kude si chete s nas tatko? <i>Where refl. reads with us daddy?</i>

The mean number of words per target sentence was 4.88. Since Bulgarian word order is not fixed, the adjunct was either preceding or following the subject. Thus, the syntactic frame for each target item was:

Wh-word – (Aux) – Verb – (Adjunct) – Subject – (Adjunct)

Scoring and Coding

Scoring and coding procedures were as described above in the general section.

Results

Inclusion. Bulgarian-speaking children's mean overall correct imitation was 69 %, ranging from 33 % to 93 %. Overall auxiliary inclusion (56 %) and target auxiliary (54 %) rates were similar, suggesting that learners did not rely on substitutions. Overall verb inclusion was 92 % and target verb inclusion was 72 %. Out of all included verbs, 20 % were substitutions. Children included lexical subjects 95 % percent of the time. The clitic *si* and adjuncts were included at 53 % and 59 %, respectively. Table 11 shows individual means per inclusion variable.

Table 11. Bulgarian *wh*-questions: Individual inclusion means (and S.D.) in percent correct

Child	Age (months)	Mean Overall Imitation	Overall Aux	Target Aux	Aux <i>Be</i>	Aux <i>Will</i>	Verb	Target Verb	Subject	Clitic <i>Si</i>	Adjunct
32A	26	33	43	14	33	50	60	13	80	20	13
34B	29	52	14	14	0	33	90	62	100	14	38
43B	29	90	83	83	75	100	100	76	100	80	82
24A	29	52	44	44	60	25	100	43	100	17	30
21B	30	79	75	75	100	67	83	83	88	50	71
32B	31	64	50	50	0	100	96	61	100	25	52
46A	31	66	75	75	75	75	100	96	96	63	74
42B	32	85	29	29	50	0	95	95	100	100	90
33B	34	53	88	88	75	100	88	67	70	88	83
31B	34	66	29	29	50	0	90	90	100	43	25
36A	34	81	88	88	75	100	96	79	100	50	83
22A	34	57	13	13	0	25	100	67	100	50	33
35A	34	93	63	63	25	100	100	91	100	88	91
26A	35	42	43	43	25	67	82	47	94	20	65
34A	35	69	67	67	60	75	83	58	92	71	42
42A	35	82	75	75	50	100	100	92	96	88	42
24B	39	89	75	75	50	100	100	100	100	40	85
Mean (S.D)	32 (3)	69 (18)	56 (25)	54 (27)	47 (30)	66 (37)	92 (11)	72 (23)	95 (9)	53 (29)	59 (26)

Note: Since inclusion of overall aux and target aux was practically the same, we are not including separate columns for Target Aux *Be* and Target Aux *Will*.

A repeated measures analysis of variance (ANOVA) showed a tendency for children to include an auxiliary when the target was *will* more frequently (66 %) than when the target was *be* (47 %) ($F(1,16) = 3.313, p = .087$). Auxiliary type had no effect on any other measure. *Wh*-word type had no effect on any inclusion measure. Overall and target auxiliary inclusion rates did not correlate with overall and target verb inclusion rates. To examine whether age had any influence on children's inclusion rates, we performed a separate analysis of variance in which participants were divided into two sub-groups: *young* (26 – 32 months, $n = 8$) and *old* (34-39 months, $n = 9$). We found no significant differences for any inclusion measure.

Inversion. As predicted, children showed very high inversion rates. On the Inversion+Aux measure, all children showed overall auxiliary inversion of 100 %. Children also showed high Inversion+Verb rates for Bulgarian lexical verbs (94 %). High auxiliary and verb inversion rates were stable across conditions and did not vary with respect to aux type (*be* vs. *will*), presence or absence of an auxiliary, verb form (present vs. past), or *wh*-word (*what* vs. *where*). This provides evidence for the robustness of the effect in our findings. On the Inversion±Aux/Verb measure, Bulgarian-speaking children inverted the auxiliary or the verb 88 % of the time, which is significantly lower than the Inversion+Verb inversion rate of 94 %, ($t(16) = 2.229, p = .04$). The difference is mainly due to the fact that Inversion±Aux/Verb correlated with verb inclusion ($r = .77, p < .05$) but not with aux inclusion. Due to the absence of variance in the auxiliary inversion variable (all children had 100 % aux inversion rates) a *t*-test was not a viable option for comparing Inversion+Aux and Inversion±Aux means. For that reason, we use the Inversion+Verb variable instead of the auxiliary inversion measure. Inversion±Aux was 91 % with aux *be* and 95 % with aux *will*. The Inversion±Aux/Verb measure depends on inclusion of overall aux and target aux; since they were practically the same we are not including separate

columns for Target Aux *be* inversion and Target Aux *will* inversion. Individual inversion means are shown in Table 12.

Table 12. Bulgarian *wh*-questions: Individual inversion means per variable in percent correct

Child	Age (months)	Inversion+Aux/Verb Measures		Inversion±Aux/Verb Measures		
		Overall Aux	Overall Verb	Overall Aux/Verb	Aux <i>Be</i>	Aux <i>Will</i>
32A	26	100	100	56	100	67
34B	29	100	74	70	50	100
43B	29	100	100	100	100	100
24A	29	100	88	86	100	50
21B	30	100	94	94	100	100
32B	31	100	95	91	100	100
46A	31	100	95	95	100	100
42B	32	100	100	95	100	100
33B	34	100	100	100	100	100
31B	34	100	82	74	25	100
36A	34	100	90	86	75	100
22A	34	100	96	96	100	100
35A	34	100	100	100	100	100
26A	35	100	91	79	100	100
34A	35	100	100	81	100	100
42A	35	100	92	92	100	100
24B	39	100	100	100	100	100
Mean	32	100	94	88	91	95
(S.D.)	(3)	(0)	(7)	(13)	(22)	(14)

*Note: Since overall Inversion+Aux inversion was 100% across all subjects, separate columns for Target Aux, Aux *Be* and Aux *Will* are not included. Inversion+Verb (target) was the same as Inversion+overall verb and is not included in the table.

Discussion

Inclusion. As predicted by our hypothesis-testing model, Bulgarian-speaking children included auxiliaries inconsistently (56 %). We interpret that inconsistency as due to a combination of two important characteristics of the target language. First, Bulgarian has a contrast with respect to the inclusion requirements for auxiliary *sum* (be) in third person singular; aux *sum* has to be included in perfect aspect (1) and it cannot be included in reported mood (2). Since both perfect aspect and reported mood are common in child-directed speech as well as children’s literature, learners’ exposure to the input inconsistency is reflected in their low

inclusion rates for auxiliary *sum* (47%).

- (1) Kude e igral Ivan s tebe?
Where be-3p.sg. played Ivan with you
Where has Ivan played with you?
- (2) Kude igral Ivan s tebe?
Where has Ivan (reportedly) played with you?

Second, auxiliary *shte* (will) requires a lexical verb in present form to express future tense. As a result, the only difference between a future tense (3) and a present tense (4) form of a sentence is the occurrence of auxiliary *shte* in (3). Although, generally, inclusion of aux *shte* in all persons and numbers indicates future tense, omission of the auxiliary does not necessarily change the meaning of the sentence. As we mentioned earlier, simple present can also indicate futurity in which case omission of the aux preserves both the meaning and grammaticality of the sentence. Thus, the result of omitting aux *shte* is a completely grammatical and acceptable utterance. This language-specific property is reflected in children's higher but still non-target-like inclusion rates of aux *shte* (66%).

- (3) Kude shte igrae Ivan s tebe?
Where will play-3p.sg.pres. Ivan with you
Where will Ivan play with you?
- (4) Kude igrae Ivan s tebe?
Where play-3p.sg.pres. Ivan with you
Where does Ivan play with you?

In both cases described above, the learner rejects the initial null hypothesis (i.e., that an auxiliary is always included) as it is incompatible with the input and generates alternative hypotheses, namely, that auxiliary inclusion is optional. Evidence that children treat auxiliaries as optional components is the fact that the auxiliary inclusion rate is similar to the inclusion rates of other optional sentence elements, such as the clitic *si* (53 %) and the adjuncts (59 %), and

much lower than the inclusion rate for obligatory elements such as lexical verbs (94 %). Note that although overt subjects are also optional (Bulgarian is a *pro* drop language) children showed high inclusion rates for lexical subjects (95 %). This high rate, however, is attributed to the task design in which each experimental item was accompanied by a drawing depicting the subject, thus making it very prominent and salient.

An interesting piece of evidence in support of our hypothesis-testing model is that children were more likely to include an auxiliary when the target was *will* than when it was *be*. This difference suggests that children are not just sensitive to the general possibility of not including an auxiliary (i.e., both aux *sum* and aux *will*) but also to the presence of a specific contrast that governs the requirements for aux inclusion in different syntactic contexts (i.e., aux *sum* only). As predicted by our model, specific input inconsistencies result in greater deviation from the target than general inconsistencies. Thus, the lower inclusion rate with *sum* than with *will* is determined by the level of specificity of the inconsistency in the input.

Overall and target auxiliary inclusion rates were practically identical suggesting that children consistently supplied the target auxiliary and did not need to substitute for it. This result indicates that at this age, Bulgarian-speaking children have a good grasp of the auxiliary category and its members. However, other components of the target questions such as the *wh*-word, the lexical verb, subjects, and adjuncts were frequently replaced with a different form or word from the same category. Children also varied the position of some of these elements (e.g., topicalized a subject or changed the position of an adverb). These productive changes support the idea that children analyze structurally the elicited imitation stimuli.

Inversion. The inversion results also strongly support our hypothesis-testing model. We

hypothesized that if the properties of question formation are compatible with the null hypotheses that all learners start with (e.g., invert all verbs, invert in all questions, etc.), the hypothesis search space will be exhausted quickly and auxiliary and verb inversion in *wh*-questions will be learned easily. The high verb inversion rates together with consistently perfect auxiliary inversion rates across all participants in the experiment suggest that indeed Bulgarian 2-to-3-year old children have a full command of auxiliary and verb inversion in *wh*-questions.

4.3.2 Experiment II – English *wh*-questions

Participants

Participants' age, number of imitated items, and mean overall imitation rate across all attempted target questions (in percent) are shown in Table 13.

Table 13. Experiment II: Participants summary

Child	Age (in months)	N imitations	Mean overall imitation (%)
55A	28	14	58
64A	30	23	66
62B	30	24	62
54A	31	24	77
54B	32	24	73
55B	33	16	86
51B	33	15	89
62A	34	23	69
65B	36	24	61
51A	38	24	94
Mean (S.D.)	33 (3)	21 (4)	74 (12)

The participants were 10 monolingual English-speaking children aged between 2;4 and 3;2, with mean age 2;9. A total of 18 English-speaking children were seen for this experiment. None of the children performed at ceiling. There were eight children who did not understand the task,

failed to finish the experiment, or did not provide enough scorable utterances to be included in the analyses. Inclusion criteria were as described in the general participants section.

Materials

English experimental *wh*-questions were translated from the stimuli in Experiment I, with slight modifications where the direct translation did not result in a well-formed and natural-sounding sentence. The target *wh*-questions for the English experiment were directly comparable to those in Experiment I.

There were three within-subjects variables in this experiment: 1) auxiliary type, 2) *wh*-word type, and 3) length. Since all English questions require an inverted auxiliary, we manipulated type of auxiliary rather than presence/absence of an auxiliary. There were two levels of this variable. In one level, corresponding to the +Aux condition in Bulgarian, we used the past third person singular form of auxiliary *be*, *was*, and auxiliary *will*. In the other level, corresponding to the –Aux condition in Bulgarian, we used the past and present third person singular forms of auxiliary *do*, i.e., *did* and *does*.

The rationale for using the past forms of *be* and *do* was to control for the influence of the independent factor *time of action* in Experiment I. In Bulgarian, the auxiliary *be* is used with a past participle of the verb to express an action in the past (perfect aspect). The corresponding verb form in the –Aux and –Aux+Clitic condition is past progressive. As a result, half of the Bulgarian stimuli feature verbs referring to past actions, see Table 10 for examples. Thus, using the past forms *was* and *did* ensures that English-speaking children will also be exposed to the present vs. past tense distinction in the experimental materials. As in Experiment I, the second within-subjects variable, *wh*-question type, has two levels, argument (e.g., *what*) and adjunct

(e.g., *where*). It tests whether the argument vs. adjunct distinction has any influence on children's performance on auxiliary inclusion and inversion.

The third within-subjects variable is length, with two levels: a) short and b) long. Although the English experimental *wh*-questions were adapted from the Bulgarian stimuli for Experiment I, they were significantly longer due to two main factors: 1) English *wh*-questions always require an auxiliary while Bulgarian questions do not, 2) English determiners, (e.g., *the*, *a*) are separate words and Bulgarian determiners are inflections on the noun and do not count as separate words. We address this issue by introducing a length variable, to control for the number of words in the experimental questions. Each target item had a short and long version, with an adjunct (an adverbial phrase or a prepositional phrase) in the long version. Each sentence can only appear in either the long or short version (but not both) in any given trial list.

Thus, the experiment has a 2 (aux type: *was/will* vs. *did/does*) X 2 (*what* vs. *where*) X 2 (*short* vs. *long*) design. There are a total of four stimulus sets used to construct eight trial lists. Each stimulus set contains four major contrasts with six trials, equally divided between the two auxiliary forms in each of the auxiliary pairs *was/will* and *did/does*. Table 14 provides a sample stimulus set. Conditions were counterbalanced within stimulus sets and across subjects. Half of the sentences in each set and list used the *wh*-word *what* and half used the *wh*-word *where*. Half of the target questions contained *was/will* and half *did/does*. In each list, half of the sentences were short (i.e., do not include adjuncts) and half were long. All lexical verbs were optionally transitive and could occur with both *what* and *where*, e.g., *eat*, *play*. Each verb appeared four times across all lists, once in each of the four contrasts. Verbs occurred in two grammatical forms: present and the progressive *-ing* form. Each of the target *wh*- questions contained a *wh*-word, an auxiliary, a main verb, a lexical subject, and an adjunct which was either adverbial (e.g.,

tomorrow, again, here) or a prepositional phrase (e.g., with us, for lunch, etc.). The overall mean number of words per target sentence in the stimuli sets was 5.42, with a mean of 4.50 for the short condition and a mean of 6.34 in the long condition.

Table 14. Sample stimulus set for Experiment II*

Was/Will	Does/Did
What	
What was the sister coloring (last night)?	What did the sister color (last night)?
What was grandpa digging (with a shovel)?	What did grandpa dig (with a shovel)?
What was John playing (with you)?	What did John play (with you)?
What will the doll eat (today)?	What does the doll eat (today)?
What will daddy read (quietly)?	What does daddy read (quietly)?
What will Mike build (tonight)?	What does Mike build (tonight)?
Where	
Where was the sister coloring (last night)?	Where did the sister color (last night)?
Where was grandpa digging (with a shovel)?	Where did grandpa dig (with a shovel)?
Where was John playing (with you)?	Where did John play (with you)?
Where will the doll eat (today)?	Where does the doll eat (today)?
Where will daddy read (quietly)?	Where does daddy read (quietly)?
Where will Mike build (tonight)?	Where does Mike build (tonight)?

*Material in parentheses indicates long version of item

Scoring and Coding

Scoring and coding procedures were identical to Experiment I (Bulgarian *wh*-questions). Utterances containing the contracted present form of auxiliary *be*, -'s, received credit for non-target aux inclusion and inversion but not for target aux inclusion. The substitution was not counted in the overall correct imitation measure.

Results

Inclusion. Table 15 provides the individual mean percent inclusion rates for the auxiliary measures. Overall auxiliary inclusion rate for English-speaking children was 56 % and for target auxiliary inclusion it was 28 %, or 50 % of the utterances that contained an auxiliary (i.e., $(28/56) \times 100 = 50\%$). In the remaining 50 % children substituted a different auxiliary for the

target. Children’s overall inclusion of auxiliary *will* was somewhat lower (47 %) than their inclusion rates of aux *was* (66 %), *does* (60 %), and *did* (57 %). Although the difference did not reach significance, this trend supports previous findings (Tornyova & Valian, in prep; Valian & Casey, 2003) of lower inclusion rate for modal verb *will* (42 %) than for *can* (66 %), *be* (65 %), and *do* (54 %).

Comparing overall inclusion and target inclusion rates by auxiliary type (Figure 3) shows that children had the most difficulty with *does*, supplying the target in only 21 % of all trials (or in $(21/60) \times 100 = 35\%$ of the trials with an included aux). This low target aux inclusion rate translates into a 65 % substitution rate, i.e., in 65 % of the time when the target was *does* children used a different auxiliary. Children had the least difficulty with *did*, including the target in 65 % of the utterances that contained an aux (i.e., $(37/57) \times 100 = 65\%$) and substituting in the remaining 35 %. Substitution rates with *was* and *will* were 53 % and 49 %, respectively.

Table 15. English *wh*-questions: Individual aux inclusion means in percent correct

Child	Age (months)	Overall Aux	Target Aux	Was	Target Was	Will	Target Will	Does	Target Does	Did	Target Did
55A	28	21	7	0	0	50	0	0	0	33	33
64A	30	70	13	60	0	67	33	83	0	67	17
62B	30	13	8	0	0	33	33	17	0	0	0
54A	31	13	13	83	33	17	17	0	0	0	0
54B	32	71	0	100	0	33	0	100	0	50	0
55B	33	81	56	60	60	67	33	100	25	100	100
51B	33	73	73	100	100	40	40	67	67	100	100
62A	34	91	0	100	0	67	0	100	0	100	0
65B	36	25	17	55	33	0	0	33	17	17	17
51A	38	100	91	100	80	100	83	100	100	100	100
Mean (S.D.)	33 (3)	56 (34)	28 (33)	66 (39)	31 (38)	47 (29)	24 (27)	60 (43)	21 (35)	57 (42)	37 (45)

Figure 3. English *wh*-questions - Overall aux and Target aux inclusion by aux type

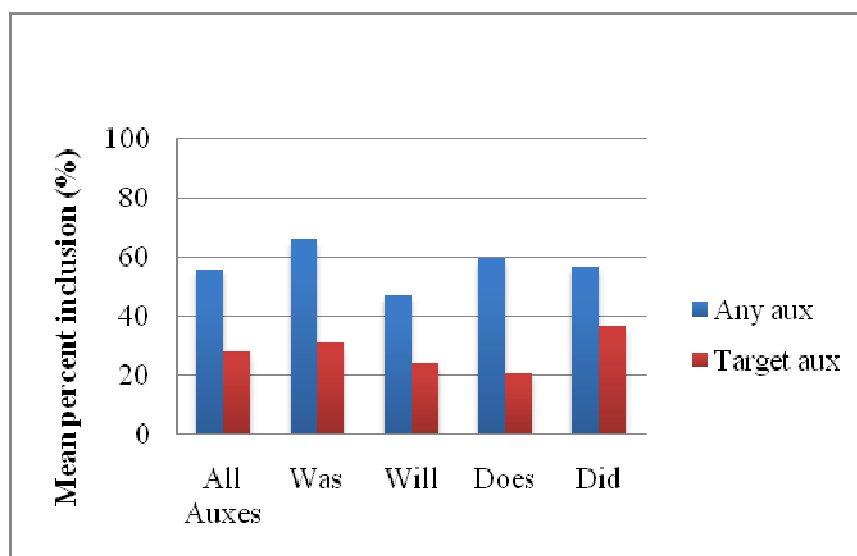


Table 16 presents inclusion means for the non-auxiliary measures. Mean overall correct imitation was 74 %, ranging from 58 % to 94 %. Overall verb inclusion was 93 % and target verb inclusion was 87 %, indicating a 6 % rate of verb substitution. Children included lexical subjects and adjuncts 94 % and 84 % of the time, respectively. As in the previous experiments, the high subject inclusion rate is attributed to the task design.

Table 16. English *wh*-questions: Individual inclusion means in percent correct

Child	Age (months)	Overall Imitation	Verb	Target Verb	Subj	Adj
55A	28	58	86	79	64	83
64A	30	66	65	65	83	83
62B	30	62	88	79	92	67
54A	31	77	100	100	100	100
54B	32	73	100	92	100	90
55B	33	66	100	88	100	75
51B	33	89	93	87	100	78
62A	34	69	100	91	100	73
65B	36	61	96	91	100	100
51A	38	94	100	96	100	92
Mean (S.D.)	33 (3)	74 (12)	93 (11)	87 (10)	94 (12)	84 (12)

A repeated measures test revealed that only overall inclusion rates varied as a function of sentence length ($F(1, 9) = 9.917, p = .012$). Sentence length had no effect on any other measure. Children's performance did not vary as a function of a *wh*-word (i.e., *what* vs. *where*) or aux type (i.e., *was/will/does/did*).

Inversion. On the Inversion+Aux measure, six out of ten children showed overall auxiliary inversion of 100 %. Inversion rates for all auxiliaries were in the 90 % – 100 % range. The difference in inversion rates between overall aux and target aux was solely due to aux *will*; children showed lower inversion rates when using target aux *will* (83 % vs. 94 % when using any auxiliary). Overall aux and target aux inversion rates did not differ for the rest of the auxiliaries. Statistical analyses were not conducted to determine significance, because at least four out of ten children had 0 % target inclusion for one or more of the auxiliaries and thus target inversion for those auxiliaries could not be calculated. For that reason, Table 17 only includes overall aux inversion rates.

Table 17. English *wh*-questions: Individual inversion means in percent correct

Child	Age (mo)	Inversion+Aux Inversion Measure						Inversion±Aux Measure				
		Overall Aux	Target Aux	Was	Will	Does	Did	Overall Aux	Was	Will	Does	Did
55A	28	100	100	n/a	100	n/a	100	21	0	50	0	33
64A	30	87	0	100	50	100	100	60	60	33	83	60
62B	30	100	100	n/a	100	100	n/a	13	0	33	17	0
54A	31	100	100	100	100	n/a	n/a	13	33	17	0	0
54B	32	100	n/a	100	100	100	100	71	100	33	100	50
55B	33	88	83	50	100	100	100	75	40	67	100	100
51B	33	100	100	100	100	100	100	73	100	40	67	100
62A	34	91	n/a	100	100	100	100	91	100	67	100	100
65B	36	83	100	67	n/a	100	100	21	33	0	33	17
51A	38	100	100	100	100	100	100	100	100	100	100	100
Mean (S.D.)	33 (3)	95 (7)	85 (35)	90 (20)	94 (17)	100 (0)	100 (0)	54 (34)	57 (41)	44 (28)	60 (43)	56 (42)

Auxiliary inversion rates were stable across conditions and did not vary with respect to

length, aux type or *wh*-word (*what* vs. *where*). On the **Inversion±Aux** measure, English-speaking children inverted the auxiliary 54 % of the time, a rate significantly lower than the Inversion+Aux rate of 95 % ($t(9) = - 3.373, p < .01$). The individual inversion means per variable are shown in Table 18. Note: inversion rates by target auxiliary form are not reported here because of the very low overall inversion rate for target auxiliaries (33 %), making the data difficult to interpret.

Discussion

Inclusion. As predicted by our hypothesis-testing model, although auxiliaries are required in all English questions, children included them inconsistently (56 %). There are several factors that interact and contribute to this low auxiliary inclusion rate.

The variable requirements on tense marking (on aux or a verb in declaratives and embedded questions; on aux only in matrix questions) in the target language allow for the incorrect hypothesis that tense can be marked either on an auxiliary or a main verb in both questions and declaratives, and therefore auxiliary inclusion is optional in these contexts. In fact, this broad hypothesis is supported by the greatest part of the input, with the exception of matrix questions and negated structures, which restrict tense marking to auxiliaries. Thus, children need to be able to distinguish between matrix and embedded questions in order to reconsider and correct their broad hypothesis to reflect the relevant restrictions on tense marking and auxiliary inclusion.

Another factor responsible for the low auxiliary inclusion rate is the complexity and heterogeneity of the English auxiliary equivalence class, which includes members from several categories with different morpho-syntactic behaviors. The big difference between overall and

target auxiliary inclusion rates (56 % and 28 %, respectively) indicates a high (50 %) substitution rate. This result is consistent with our analyses on children's productivity with auxiliaries based on data from Valian & Casey (2003). Children's auxiliary substitutions reveal general knowledge of the equivalence class of auxiliaries and present a strategy to compensate for difficulties with certain members of that class. Evidence for the latter comes from the much lower substitution rates for lexical verbs (6 %), which we assume to be the baseline substitution rate for these children. As in Experiment I, the auxiliary substitution rates along with productive changes of other elements of the target questions suggest that children indeed process the stimuli in the imitation task.

Inversion. The results show that although English-speaking two-year-olds exhibit relatively high overall inversion rates in *wh*-questions (95 %), only six out of ten participants showed perfect inversion rates. This suggests that while English-speaking children are, as a group, doing fairly well, a significant part of the group still makes errors of non-inversion that are due to the difficulties associated with the complex hypothesis testing process. Since the properties of English question formation are not immediately compatible with the general starting hypotheses of inversion, further hypothesis-testing is required until all restrictions on auxiliary inversion are learned.

Note that overall Inversion+Aux was higher (94 %) than the one found in the Valian & Casey 2003 dataset (81%) (Tornyova & Valian, 2009). One possible reason for the difference is that the Valian & Casey study examined inversion in a different set of auxiliaries, i.e. copula *be*, aux *do*, and the modal auxiliaries *will* and *can*. Previous analyses have shown that children experience problems inverting both with aux *will* and aux *can*, especially when they provide the target auxiliary; that may have brought down the overall aux inversion rate (Tornyova & Valian,

in prep). Such an explanation is supported by an independent samples *t*-test that showed no significant difference between the overall inversion rates with auxiliary *will* in the Valian & Casey dataset and this study. Thus, the difference in overall Inversion+Aux auxiliary inversion is likely due to the different sets of auxiliaries tested in the two studies.

4.3.3 Comparison between Bulgarian and English *wh*-questions

Results

Inclusion. The results of our elicited imitation experiments on children's production of *wh*-questions reveal that both Bulgarian- and English-speaking children omit auxiliaries in *wh*-questions. Bulgarian-speaking children performed significantly better on providing the target auxiliary than English-speaking children do. A one-way ANOVA comparing means for all inclusion measures between English and Bulgarian *wh*-questions revealed a significant effect for target aux inclusion ($F(1, 25) = 5.236, p = .031$) and for target *will* inclusion ($F(1, 25) = 6.357, p = .018$). Overall, Bulgarian-speaking children included a target aux at a higher rate (54 %) than English-speaking children did (28 %). They also included target aux *will* at a higher rate (63 %) than their English-speaking peers (26 %).

Inversion. On the Inversion+Aux/Verb measure, both English- and Bulgarian-speaking children showed high rates of inversion. However, the use of parametric tests (e.g., ANOVA or *t*-tests) of the equality of means is not appropriate for auxiliary inversion due to the absence of variance on this measure in the Bulgarian group (recall that all children in this group inverted the auxiliary 100 % of the time). We thus instead used the nonparametric Fisher Exact Test with a 2 (Bulgarian vs. English group) x 2 (number of children with 100% inversion rate vs. number of children with less than 100 % inversion rate) contingency table (Table 18). The test revealed a

significant difference in auxiliary inversion ($p = .01$, 2-tailed). Bulgarian-speaking children performed better at auxiliary inversion than their English-speaking peers.

Table 18. Fisher Exact Test 2 x 2 contingency table

Language	BG	EN	Totals
Children w/ 100% Inversion	17	6	23
Children w/ < 100% Inversion	0	4	4
Totals	17	10	27

The **Inversion±Aux/Verb** measure provides an alternative way of looking at those results and avoids the issue of no variance in the Bulgarian group. The *Levene* statistic was significant at the .02 level, indicating that equal variances could not be assumed for inversion. We address this issue by using the *Welch* test of variance, a more robust statistic that does not assume equal variance. It revealed that Bulgarian-speaking children inverted at a significantly higher rate (84 %) than English-speaking participants (54 %), $F(1, 18.960) = 6.936$, $p = .02$. Since the **Inversion±Aux/Verb** measure collapses together inversion and omission errors, the effect size here is amplified by group differences with respect to auxiliary omission.

Discussion of comparison between English and Bulgarian *wh*-questions

The comparison of auxiliary inclusion in Bulgarian and English *wh*-questions supports our hypothesis testing model in which the presence of unique language-specific restrictions on auxiliary use determines the range of hypotheses to be considered in the process of learning. Bulgarian- and English-speaking children showed similar performance on overall auxiliary

inclusion (54 % and 56 %, respectively) confirming our prediction based on the fact that both target languages feature properties allowing for the incorrect hypothesis that auxiliary inclusion is optional in *wh*-questions. The inconsistency in auxiliary inclusion in English was related to variable tense marking in declarative and interrogative structures; in Bulgarian it was related to non-uniform auxiliary inclusion requirements for different forms of aux *be* as well as to the fact that omission of aux *shte* changes the tense of the utterance but does not change its grammaticality status.

The significant difference in target aux inclusion and the lack of a difference in overall aux inclusion suggests that English-speaking children substitute for the target auxiliary 50% of the time on average while their Bulgarian-speaking peers do not. English-speaking children use substitution as a strategy to compensate for difficulties with the target auxiliary system while Bulgarian-speaking children show a full command of theirs.

The comparison of auxiliary inversion in Bulgarian and English *wh*-questions also supports our hypothesis testing model. The difficulty of aligning the properties of English input with the hypotheses specified in the hypothesis space makes English *wh*-questions hard to learn. The ease of aligning the Bulgarian input with the hypotheses makes Bulgarian *wh*-questions easy to acquire. Differences between English and Bulgarian regarding two distinctions account for the differences in children's performance on inversion. In both cases, Bulgarian provides evidence for a small set of hypotheses and English for a larger set.

First, English auxiliary verbs and main verbs behave differently (the importance of which was noted by Guasti, 2000). Auxiliaries must invert with the subject while main verbs (except for copula *be*) cannot. This input is not compatible with a null hypothesis such as 'invert all

auxiliary and main verbs' or 'do not invert any verbs'. Thus, children need to go through a series of hypotheses until they learn the difference between the two types of verbs and adopt the correct hypothesis 'invert only auxiliary verbs; do not invert main verbs'. Bulgarian auxiliaries and lexical verbs behave similarly and thus the input is compatible with the general hypothesis 'invert with all verbs'. English-speaking children thus face a challenge their Bulgarian peers do not: distinguishing auxiliaries and verbs.

Second, English embedded *wh*-questions prohibit auxiliary inversion even though matrix *wh*-questions require it. These properties of question formation, again, require extensive hypothesis-testing beyond the initial null hypothesis. Bulgarian, in contrast, requires inversion in both matrix and embedded *wh*-questions, providing consistent evidence for obligatory inversion in *wh*-questions and supports the null hypothesis of inversion.

4.4 Experiments on *yes/no* questions

4.4.1 Experiment III – Bulgarian *yes/no* questions

Participants

The participants were 10 monolingual Bulgarian-speaking children aged between 2;4 and 3;1, with mean age 2;9. A total of 21 Bulgarian-speaking children were seen for this experiment. None of the children performed at ceiling. Table 19 summarizes participants' age, number of imitated items, and overall imitation rate (in percent). There were 11 children who did not understand the task, failed to finish the experiment or did not provide enough scorable utterances to be included in the analyses. The inclusion criteria were as described above.

Table 19. Experiment III: Participants summary

Child	Age (in months)	N imitations	Overall imitation (%)
1002B	28	21	60
1004B	29	24	68
1001A	33	13	77
1001B	33	21	82
1003A	33	23	79
2006A	33	24	86
1003B	34	24	93
1006A	34	24	87
1002A	35	22	88
1006B	37	24	89
Mean (S.D)	33 (3)	22 (3)	81 (10)

Materials

A sample stimulus set for this experiment is shown in Table 20. The materials were based on the *wh*-questions from Experiment I. There were two within-subjects variables: 1) aux presence vs. absence (as in Experiment I) and 2) question reading. The three levels of the Aux presence vs. absence variable (+Aux, -Aux, -Aux +Clitic) were identical to those in Experiment I.

The second within-subjects variable, reading, had two levels: a) neutral and focused. The neutral vs. focused distinction replaced the *wh*-type contrast from Experiment I. In that variable, the question particle *li* is attached either to the finite verbal complex, in which the sentence has a neutral reading, or to a focused adverbial phrase in which case the sentence has a focused reading. The rationale for this manipulation was to test children's performance on inversion in two different syntactic environments where auxiliary and verb inversion is visible in the surface word order (e.g., focused reading) or is not visible due to additional prosodic operations (e.g., neutral reading). Another reason for using the contrast was to examine children's understanding of focus and requirements such as cliticization, i.e., children's ability to correctly place the question particle *li* to the right of the verbal complex when there is no focused phrase.

Table 20. Sample stimulus set for Experiment III*

Aux	No Aux	No Aux + Cl
VP		
Shiela li e kaka snoshti? <i>Sewn li has big-sister last night?</i> <i>Has big-sister sewn last night?</i>	Shieshe li kaka snoshti? <i>Sewed li big-sister last night?</i> <i>Was big-sister sewing last night?</i>	Shieshe li si kaka snoshti? <i>Sewed li refl. big-sister last night?</i> <i>Was big-sister sewing last night?</i>
Kopal li e taino diado? <i>Dug li has secretly grandpa?</i> <i>Has grandpa dug secretly?</i>	Kopa li taino diado? <i>Dug li secretly grandpa?</i> <i>Did grandpa dig secretly?</i>	Kopa li si taino diado? <i>Dug li refl. secretly grandpa?</i> <i>Did grandpa dig secretly?</i>
Shte iade li kuklata dnes? <i>Will eat li doll-the today?</i> <i>Will the doll eat today?</i>	Iade li kuklata dnes? <i>Eats li doll-the today?</i> <i>Does the doll eat today?</i>	Iade li si kuklata dnes? <i>Eats li refl. doll-the today?</i> <i>Does the doll eat today?</i>
Shte chete li s nas tatko? <i>Will read li with us daddy?</i> <i>Will daddy read with us?</i>	Chete li s nas tatko? <i>Reads li with us daddy?</i> <i>Does daddy read with us?</i>	Chete li si s nas tatko? <i>Reads li refl. with us daddy?</i> <i>Does daddy read with us?</i>
XP		
Snoshti li e shiela kaka? <i>Last night li has sewn sister?</i> <i>Has big-sister sewn last night?</i>	Snoshti li shieshe kaka? <i>Last night li sewed big-sister?</i> <i>Was big-sister sewing last night?</i>	Snoshti li si shieshe kaka? <i>Last night li refl. sewed sister?</i> <i>Was big-sister sewing last night?</i>
Taino li e kopal diado? <i>Secretely li has dug grandpa?</i> <i>Has grandpa dug secretly?</i>	Taino li kopa diado? <i>Secretely li dug grandpa?</i> <i>Did grandpa dig secretly?</i>	Taino li si kopa diado? <i>Secretely li refl. dug grandpa?</i> <i>Did grandpa dig secretly?</i>
Dnes li shte iade kuklata? <i>Today li will eat doll-the?</i> <i>Will the doll eat today?</i>	Dnes li iade kuklata? <i>Today li eats doll-the?</i> <i>Does the doll eat today?</i>	Dnes li si iade kuklata? <i>Today li refl. eats doll-the?</i> <i>Does the doll eat today?</i>
S nas li shte chete tatko? <i>With us li will read daddy?</i> <i>Will daddy read with us?</i>	S nas li chete tatko? <i>With us li reads daddy?</i> <i>Does daddy read with us?</i>	S nas li si chete tatko? <i>With us li refl. reads daddy?</i> <i>Does daddy read with us?</i>

*Focused elements are shown in **bold face**

Thus, the experiment had a 3 (aux presence: +Aux, –Aux, –Aux +Clitic) x 2 (reading: neutral vs. focused) factorial design with six stimulus sets used to construct six trial lists. Conditions were counterbalanced within each stimulus set and across subjects. Half of the sentences in each set and list had neutral reading, half had focused reading. One-third (eight items) contained an auxiliary plus main verb (+Aux), one-third only contained a main verb (–Aux), and one-third had a main verb and the clitic *si* and no auxiliary (–Aux +Clitic). Each cell of contrast contained four experimental items. Half of the verbs in the stimulus set were masculine, half were feminine.

All lexical verbs were in third person singular and could occur with both *what* and *where*, e.g., *eat*, *play*. Each verb appeared six times across all lists, once in each of the six contrasts. Verbs occurred in three different temporal forms: present, past progressive, and past participle. Each of the target *yes/no* questions contained the question particle *li*, an auxiliary, if applicable, a main verb, a lexical subject, and an adjunct which was either adverbial (e.g. *tomorrow*, *again*, *here*) or a prepositional phrase (e.g., *with us*, *for lunch*, etc.). The mean number of words per target sentence was 4.91.

Coding

As in Experiment I, all responses were scored for inclusion of each of the questions components, i.e., particle *li*, auxiliary, verb, subject, and adjunct. Both lax and strict (also termed as non-target and target) scoring was recorded for auxiliary and main verb inclusion.

Results

Inclusion. Bulgarian-speaking children showed overall imitation rate of 81 %, ranging from 60 % to 93 %. Overall and target auxiliary inclusion rates were the same (66 %). Overall verb inclusion was 96 % and target verb inclusion was 89 %, indicating a 7 % rate of verb substitution. Children included the specialized question particle *li* 68 % of the time and placed it correctly, i.e., attached it to the finite verbal phrase to express a neutral reading or to the fronted adjunct (i.e., XP) to express focused reading. The clitic *si* was included 60 % of the time. Lexical subjects and adjuncts were included at 100 % and 84 %, respectively. The individual means per inclusion variable are shown in Table 21. A repeated measures test showed that auxiliary type (*be* vs. *will*) significantly affected aux inclusion and target aux inclusion to the

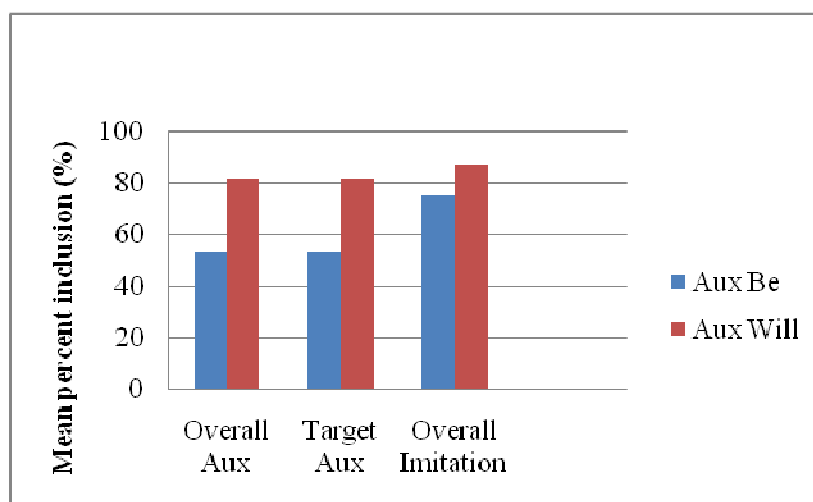
same extent ($F(1,9) = 5.872, p = .038$), and overall inclusion rates ($F(1,9) = 7.786, p = .021$), see Figure 4.

Table 21. Bulgarian *yes/no* questions: Individual inclusion means in percent correct

Child	Age (months)	Overall Imitation	Overall Aux	Target Aux	Aux Be	Aux Will	Verb	Target Verb	Q-marker <i>Li</i>	Clitic <i>Si</i>	Subj	Adj
1002B	28	60	33	33	25	50	81	76	33	14	95	48
1004B	29	68	25	25	0	50	96	96	21	25	100	83
1001A	33	77	60	60	33	100	100	92	46	60	100	85
1001B	33	82	43	43	50	33	100	100	86	57	100	81
1003A	33	79	50	50	0	100	100	96	74	71	100	83
2006A	33	86	88	88	75	100	100	88	92	50	100	79
1003B	34	93	88	88	75	100	96	88	88	88	100	96
1006A	34	87	75	75	75	75	100	96	58	88	100	92
1002A	35	88	100	100	100	100	95	77	95	67	100	100
1006B	37	89	100	100	100	100	92	79	83	75	100	96
Mean (S.D.)	33 (3)	81 (10)	66 (28)	66 (28)	53 (38)	81 (27)	96 (6)	89 (9)	68 (26)	60 (25)	100 (2)	84 (15)

As in Experiment I, children supplied an auxiliary when the target was *will* more frequently (81%) than when the target was *be* (53 %). This result is consistent with the inclusion characteristics of these auxiliaries in the Bulgarian input. The test also showed that children's inclusion rates on any measure did not vary as a function of question reading, i.e., focused (XP) vs. neutral (VP). Aux presence (+Aux vs. -Aux vs. -Aux+Clitic) also had no effect on children's performance on inclusion.

Figure 4. Aux type effect on auxiliary inclusion and overall imitation rate in Bulgarian *yes/no* questions



Inversion. In line with our previous findings for *wh*-questions, overall **Inversion+Aux** in *yes/no* questions was 100 % for all children. Inversion rate for verbs was also 100 %, slightly higher than the corresponding rate for *wh*-questions (94 %). The absence of variance by definition shows that inversion rates were stable across conditions and did not vary with respect to auxiliary type (*be* vs. *will*), *wh*-word (*what* vs. *where*), or focused (XP) vs. neutral (VP) reading. The latter indicates that even in the absence of phrasal focus movement children recognize that the question particle *li* carries focus. On the **Inversion±Aux/Verb** measure, children showed overall inversion rate of 95 %, higher than the 88 % in *wh*-questions. This greater difference is due to the higher aux inclusion rate in *yes/no* (66 %) than in *wh*-questions (56 %). **Inversion±Aux/Verb** with aux *be* was 95 % and with aux *will* it was 100 %. The individual inversion means are shown in Table 22.

Table 22. Bulgarian *yes/no* questions: Individual inversion means per variable in percent correct**

Child	Age (months)	Inversion+Aux/Verb Inversion Measures		Inversion±Aux/Verb Measures		
		Overall Aux	Overall V	Overall Aux/V	Aux Be	Aux Will
1002B	28	100	100	80	75	100
1004B	29	100	100	96	100	100
1001A	33	100	100	100	100	100
1001B	33	100	100	95	75	100
1003A	33	100	100	100	100	100
2006A	33	100	100	100	100	100
1003B	34	100	100	96	100	100
1006A	34	100	100	100	100	100
1002A	35	100	100	95	100	100
1006B	37	100	100	96	100	100
Mean	33 (3)	100 (0)	100 (0)	96 (6)	95 (11)	100 (0)

**Note: As in Table 12, separate columns for Inversion+Aux for aux *be* and aux *will* were not included as all participants inverted all auxiliaries at 100 %.

Discussion

Inclusion. The results from the experiment on Bulgarian *yes/no* questions are consistent with our findings on *wh*-questions and provide further support for the hypothesis-testing model. As predicted, Bulgarian-speaking children included auxiliaries inconsistently (66 %) in *yes/no* questions. We attribute this result to children considering the incorrect hypothesis that auxiliary inclusion is optional based on inconsistent input with respect to aux inclusion requirements in the target language. The fact that auxiliaries were included at similar rates as other optional sentence elements, such as the clitic *si* (60 %), and at much lower rates than obligatory elements, such as lexical verbs (96 %), suggests that children indeed treat auxiliaries as optional components.

As with *wh*-questions, children were more likely to include an auxiliary when the target was *will* than when it was *be*. This difference reflects the language-specific properties of Bulgarian input. Auxiliary *sum* (be) in the third person singular is obligatory in certain syntax contexts and prohibited in others; auxiliary *shite* (will) is obligatory in some contexts to express future tense but in others, where simple present can indicate futurity, it can be omitted. In both cases,

omission of auxiliary *shite* does not result in an ungrammatical utterance.

Overall and target auxiliary inclusion rates were identical suggesting that children consistently supplied the target auxiliary. This confirms that, at this age, Bulgarian-speaking children have learned the properties of the auxiliary category and its members.

The specialized focused interrogative particle *li* was included at 68 %. This rate reflects a property of the target language. Bulgarian *yes/no* questions, like in English, can be formed with a declarative word order and an interrogative intonation. In those cases, the particle *li* can be omitted.

The consistent correct placement of *li* in the sentence as well as the lack of an effect of neutral vs. focused reading on the inclusion of *li* suggests children know that even in the absence of phrasal focus movement the question particle *li* carries focus and sits in the highest structural projection, Focus Phrase (FocP).

The high inclusion rates for lexical subjects remained high (100 %) as in the *wh*-questions experiment due to the task design, in which each experimental item was accompanied by a drawing depicting the subject. The adjunct inclusion rates increased (from 59 % in *wh*-questions to 84 % in *yes/no* questions) because adjuncts were in sentence-initial focused position in half of the trials to manipulate focused reading of the *yes/no* question.

As in Experiment I, children often changed the word order or some of the words in the target questions suggesting again that they process them in a structural manner. For example, children varied the position of the interrogative particle *li* and consistently placed it correctly immediately following a focused element or after the verbal complex in sentences with neutral reading.

Inversion. The inversion results from this experiment are consistent with our findings for

wh-questions and add further support for the hypothesis-testing model. All children showed perfect inversion rates with both auxiliaries and lexical verbs. This suggests unequivocally that learning of auxiliary and verb inversion in *yes/no* questions is complete for Bulgarian-speaking children at this age. The relative ease of the learning process results from a straightforward hypothesis-testing process in which the target properties of question formation are immediately compatible with the initial null hypotheses that all learners start with (e.g. invert all verbs, invert in all questions, etc.). Thus, as predicted, the range of hypotheses to be considered is narrow and auxiliary and verb inversion in *wh*-questions is learned quickly.

4.4.2 Comparison of Bulgarian *wh*- and *yes/no* questions

Although the data from Experiment III (Bulgarian *yes/no* questions) are consistent with the main predictions for Bulgarian-speaking children's auxiliary use and inversion, the *yes/no* group performed better than their peers in the *wh*-group on a number of measures, including target verb inclusion, subject inclusion, adjunct inclusion, **Inversion±Aux/Verb**, and overall correct inclusion. Table 23 summarizes the statistical analyses. The second and third columns show the mean percent correct responses for each variable in *wh*- and *yes/no* questions, respectively. The third column represents the *Welch* statistic which was used instead of the standard *F* value due to a violated assumption of homogeneity of variances. The last two columns in the table represent degrees of freedom (df) and significance (Sign.) at the .05 alpha level, respectively. We attribute these differences to the fact that the *wh*-group demonstrated greater variance with respect to overall correct imitation (rates ranged between 33 % and 93 %). In the *yes/no* group and the English-speaking *wh*-group, children's overall correct imitation ranged between 58 % and 94 %.

Table 23. ANOVA results: Bulgarian *wh*- and *yes/no* questions

<i>Variable</i>	<i>WH Mean % N=17</i>	<i>Y/N Mean % N=10</i>	<i>Welch F</i>	<i>Df</i>	<i>Sign.</i>
<i>Target Verb Inclusion</i>	72	89	7.403	1, 22.387	.012
<i>Subject Inclusion</i>	95	100	4.365	1, 17.821	.05
<i>Adjunct Inclusion</i>	59	84	10.771	1, 24.998	.003
<i>Inv Aux/V</i>	87	96	5.359	1, 23.981	.029
<i>Overall Inclusion</i>	69	81	4.652	1, 24.980	.041

To verify whether the variance in overall correct imitation was responsible for the differences we performed an ANOVA in which we excluded six subjects from the Bulgarian *wh*-group who had overall inclusion rates lower than 58 % (i.e., we equalized the group variances) . If the differences are not due to the variance, then they should persist after the data manipulation. The ANOVA test showed no significant effects for any of the variables, confirming our hypothesis that the variance in overall correct imitation in the Bulgarian *wh*-group was indeed responsible for the initial differences. Furthermore, we re-ran all ANOVAs that compared English and Bulgarian *wh*-questions to confirm that the data exclusion did not influence any of the effects. All significant differences persisted.

4.4.3 Experiment IV – English *yes/no* questions

Participants

The participants were 10 monolingual English-speaking children aged between 2;5 and 3;1, with mean age 2;9. A total of 15 English-speaking children were seen for this experiment. None performed at ceiling. There were five children who did not understand the task, failed to finish the experiment or did not provide enough scorable utterances to be included in the analyses. The same inclusion criteria were used as in the previous experiments. Participants' age, number of imitated items, and overall imitation rate (in percent) are shown in Table 24.

Table 24. Experiment IV: Participants summary

Child	Age (in months)	N imitations	Overall imitation (%)
5002B	29	22	66
5004B	29	24	82
6003A	30	14	48
5001B	30	23	93
5003A	32	24	82
5001A	33	22	62
5004A	35	23	95
5002A	36	24	68
6001A	36	23	69
5003B	37	24	81
Mean (S.D)	33 (3)	22 (3)	75 (15)

Materials

The English experimental *yes/no* questions are based on the English control *wh*-questions. To preserve the average number of words per target and across stimuli we added a direct object or a goal of the action (e.g., *read stories*, *drive home*) to compensate for the missing *wh*-word. To avoid the use of a determiner which would add another word to the total we used bare plural nouns (e.g., toys, books).

There were two within-subjects variables in this experiment: 1) auxiliary type and 2) length. As in Experiment II, there were two levels of the auxiliary type variable. One level used the past third person singular form of auxiliary *be*, *was*, and auxiliary *will* and the other the past and present third person singular forms of auxiliary *do*, e.g., *did* and *does*. See materials section of Experiment II for motivation of this choice.

The second within-subjects variable was length, and it had two levels: long and short. As in the *wh*-questions control, the English target *yes/no* questions were significantly longer than the Bulgarian versions because of the presence of required auxiliaries and determiners. As discussed earlier, the length variable was used to address this issue by controlling for the number of words

in the stimuli. Each experimental item could only appear in either its short or long version (but not both) in any given trial list. The long form had an additional adjunct (an adverbial phrase or a prepositional phrase).

The experiment had a 2 (aux type: *was/will* vs. *did/does*) X 2 (*short* vs. *long*) design with a total of four lists. Conditions were counterbalanced within stimulus sets and across subjects. In each list, half of the sentences were short (i.e., do not include adjuncts) and half were long. Each stimulus set contained two major contrasts with 12 trials each, equally divided between the two forms in each of the auxiliary pairs *was/will* and *did/does*. Each verb appeared two times across all lists, once in each of the two contrasts. Verbs occurred in two grammatical forms: present and the progressive *-ing* form. Each of the target *wh-* questions contained a *wh-*word, an auxiliary, a main verb, a lexical subject, and an adjunct which was either adverbial (e.g., *tomorrow, again, here*) or a prepositional phrase (e.g., *with us, for lunch, etc.*). The overall mean number of words per target sentence in the stimuli sets was 5.42, with a mean of 4.50 for the short condition and a mean of 6.34 in the long condition. A sample stimulus set is given in Table 25.

Table 25. Sample stimulus set for Experiment IV

Was/Will	Does/Did
Was the sister coloring books (last night)? Was grandpa digging holes (with a shovel)? Was John playing ball (with you)? Will the doll eat soup (today)? Will daddy read stories (quietly)? Will Mike build castles (tonight)?	Did the sister color books (last night)? Did grandpa dig holes (with a shovel)? Did John play ball (with you)? Does the doll eat soup (today)? Does daddy read stories (quietly)? Does Mike build castles (tonight)?
Was the brother washing apples (yesterday)? Was the mouse hiding food (from you)? Was Mary rocking chairs (in the afternoon)? Will the Bunny paint pictures (all day)? Will auntie write letters (often)? Will Kate draw circles (this morning)?	Did the brother wash apples (yesterday)? Did the mouse hide food (from you)? Did Mary rock chairs (in the afternoon)? Does the Bunny paint pictures (all day)? Does auntie write letters (often)? Does Kate draw circles (this morning)?

Coding

Scoring and coding procedures were identical to Experiment II (Bulgarian *yes/no* questions). Responses containing *wh*-questions instead of the intended target *yes/no* question were included in the data analyses. Utterances containing the contracted form of auxiliary *be*, -'s , as in (5a-b), received credit for non-target aux inclusion and inversion but not for target aux inclusion. The substitution was not counted in the overall correct imitation measure.

(5) a. Will the doll eat soup today? (Target)

b. What's the doll eating? (Response)

Results

Inclusion. Table 26 provides the individual mean percent inclusion rates for the auxiliary measures. As in the English *wh*-questions experiment, overall auxiliary inclusion rate was higher (69 %) than for target auxiliary inclusion (49 %), indicating a 29 % substitution rate.

Table 26. English *yes/no* questions: Individual inclusion means in percent correct

Child	Age (months)	Overall Aux	Target Aux	Was	Target Was	Will	Target Will	Does	Target Does	Did	Target Did
5002B	29	33	33	20	20	80	75	20	20	17	17
5004B	29	79	50	100	100	67	50	83	17	67	33
6003A	30	50	29	100	75	75	25	0	0	33	0
5001B	30	100	74	100	17	100	100	100	83	100	100
5003A	32	67	63	67	67	83	83	50	33	67	67
5001A	33	45	45	80	80	80	80	0	0	33	33
5004A	35	100	91	100	67	100	100	100	100	100	100
5002A	36	83	13	67	0	83	0	83	17	100	33
6001A	36	65	30	50	33	83	50	60	40	67	0
5003B	37	67	58	67	50	83	83	50	33	67	67
Mean (S.D.)	32 (3)	69 (24)	49 (25)	75 (27)	51 (32)	81 (15)	65 (33)	55 (38)	34 (33)	65 (30)	45 (37)

Children’s overall inclusion of auxiliaries was (75 %) and *will* (81 %) was higher than their inclusion rates of aux *does* (55 %) and *did* (65 %).

Figure 5. Aux inclusion in English *yes/no* questions

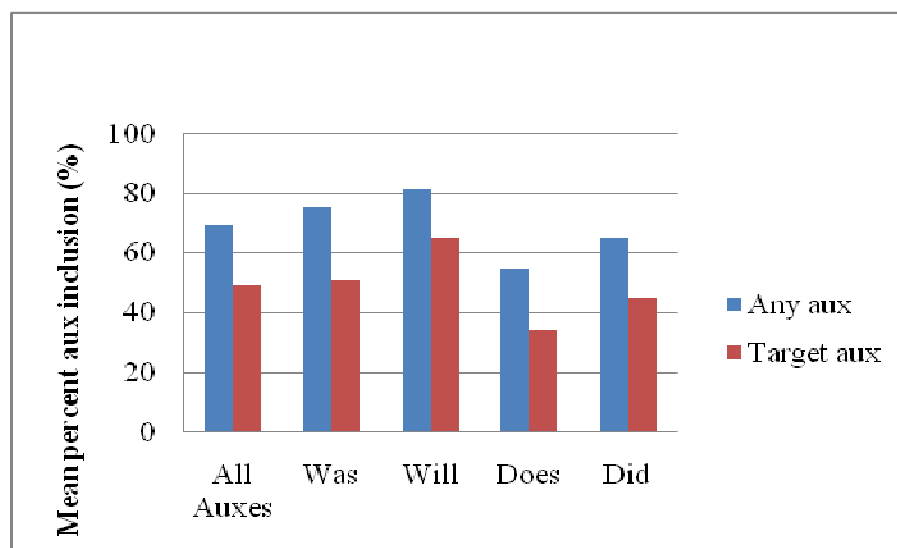


Figure 5 shows that, as with *wh*-questions, children experienced difficulties supplying the target for all auxiliary types. They had the most difficulty with *does*, supplying the target in only 34 % of all trials (or in $(34/55) \times 100 = 62$ % of the trials with an included aux). Thus, 38 % of the time when the target was *does* children used a different auxiliary. Children had the least difficulty with *will*, including the target in 80 % of the utterances that contained an aux (i.e., $(65/81) \times 100 = 80$ %) and substituting in the remaining 20 %. Substitution rates with *was* and *did* were 32 % and 31 %, respectively.

Table 27 presents inclusion means for the non-auxiliary measures. English-speaking children showed overall imitation rate of 75 %, ranging from 48 % to 95 %. Overall verb inclusion was 87 % and target verb inclusion was 80 %, indicating an 8 % rate of verb substitution. Lexical subjects and objects were included at the same rate (86 %) and adjunct inclusion rate was 71 %.

Table 27. English *yes/no* questions: Individual inclusion means in percent correct, non-auxiliary measures

Child	Age (months)	Overall Imitation	Verb	Target Verb	Subject	Object	Adjective
5002B	29	66	74	74	95	76	70
5004B	29	82	96	88	83	96	100
6003A	30	48	64	57	64	62	0
5001B	30	93	100	91	100	91	90
5003A	32	82	83	79	92	96	83
5001A	33	62	86	68	68	82	54
5004A	35	95	100	100	100	96	92
5002A	36	68	92	79	92	83	67
6001A	36	69	87	83	78	78	73
5003B	37	81	83	79	92	96	83
Mean (S.D.)	33 (3)	75 (15)	87 (12)	80 (13)	86 (13)	86 (12)	71 (30)

Inversion. On the Inversion+Aux measure, nine out of 10 children showed overall auxiliary inversion of 100 %. Inversion rates for all auxiliaries ranged between 89 % and 100 %. There was no difference in inversion rates between overall aux and target aux. For this reason, Table 28 only includes overall aux inversion rates. Auxiliary inversion rates were stable across conditions and did not vary with respect to length or aux type. On the Inversion±Aux measure, English-speaking children inverted the auxiliary 68 % of the time, a rate significantly lower than the Inversion+Aux inversion rate 92 %. The individual inversion means per variable are shown in Table 28.

Table 28. English *yes/no* questions: Individual inversion means in percent correct

Child	Age (mo)	Inversion+Aux Measure						Inversion±Aux Measure				
		Overall Aux	Target Aux	Was	Will	Does	Did	Overall Aux	Was	Will	Does	Did
5002B	28	100	100	100	100	100	100	33	17	80	20	20
5004B	30	100	100	100	100	100	100	80	100	75	80	60
6003A	30	100	100	100	100	n/a	n/a	56	100	67	0	0
5001B	31	100	100	100	100	100	100	100	100	100	100	100
5003A	32	100	100	100	100	100	100	68	67	83	60	60
5001A	33	20	20	33	0	n/a	0	7	25	0	0	0
5004A	33	100	100	100	100	100	100	100	100	100	100	100
5002A	34	100	100	100	100	100	100	86	80	83	83	100
6001A	36	100	100	100	100	100	100	78	100	83	60	80
5003B	38	100	100	100	100	100	100	68	67	83	60	60
Mean (S.D.)	33 (3)	92 (27)	92 (27)	93 (22)	90 (33)	100 (0)	89 (35)	68 (31)	76 (34)	75 (30)	56 (40)	58 (42)

Note: Inversion rates by target auxiliary form are not reported here because of the low overall inversion rate for target auxiliaries (48 %) making the data difficult to interpret.

Discussion

Inclusion: The results from the experiment on English *yes/no* questions extend our findings for *wh*-questions and provide further support for the hypothesis-testing model. As anticipated, children included auxiliaries at a relatively low rate (69 %) despite the fact that auxiliaries are required in all English main questions. The reason for this low inclusion rate is that a large part of the input (i.e., all declaratives and embedded questions) allows tense marking on an auxiliary or a matrix verb and thus supports the hypothesis that auxiliary inclusion is optional in both declarative and interrogative sentences. In order to reconsider and refine their broad hypothesis to reflect the requirement for auxiliary inclusion in matrix questions, children need to learn the relevant distinction between matrix and embedded questions.

As in English *wh*-questions, children had difficulty supplying the target auxiliary, as indicated by a large difference between overall and target auxiliary inclusion rates (69 % and 49 %, respectively). Children tend to substitute for the target auxiliary in order to compensate for difficulties with certain members of the complex auxiliary equivalence class. Thus, overall low auxiliary inclusion rate is also affected by the different nature and syntactic behavior of the members of that class. Substitutions, though in lower rates, were present for subjects, adjuncts, and lexical verbs, reflecting children's linguistic productivity during the imitation task.

Inversion. English-speaking two-year-olds showed high overall inversion rates in *yes/no* questions (92 %), and nine out of 10 participants showed perfect inversion rates. While this may

suggest that children have gained better knowledge of auxiliary inversion in general, the results should be interpreted with caution. The high auxiliary inclusion and substitution rates are likely to inflate overall inversion and make the Inversion+Aux measure of inversion unreliable. An alternative and possibly better marker of children’s knowledge of auxiliary inversion is the **Inversion±Aux** measure (this issue is discussed in greater detail in the section that compares Bulgarian and English *yes/no* questions).

4.4.4 Comparison of English *wh*- and *yes/no* questions

Children performed better on *yes/no* questions than on *wh*-questions on all auxiliary inclusion measures (Table 29). Overall auxiliary inclusion increased from 56 % in *wh*-questions to 69 % in *yes/no* questions and was due mostly to improvement with auxiliary *will* (from 47 % to 81 %). Overall inclusion of auxiliaries *was*, *does*, and *did* was similar in *wh*- and *yes/no* questions. Target auxiliary inclusion increased from 28 % to 49 % and it improved the most for auxiliaries *was* (from 31 % to 51 %) and *will* (from 24 % to 65 %), and marginally for *does* (from 21 % to 34 %) and *did* (from 37 % to 45 %).

Table 29. Auxiliary Inclusion in English *wh*- and *yes/no* questions (in percent)

<i>Measure</i>	Overall		Target	
<i>Question</i>	WH	Y/N	WH	Y/N
<i>Aux Inclusion</i>	56	69	28	49
<i>Was</i>	66	75	31	51
<i>Will</i>	47	81	24	65
<i>Does</i>	60	55	21	34
<i>Did</i>	57	65	37	45
Inversion±Aux	54	68	n/a	n/a

Another measure of children’s improvement on auxiliary use in *yes/no* questions is the extent to which they provided the target aux or replaced it with a different aux, relatively to their overall

auxiliary use for any given target. Table 30 below shows that children’s performance on all auxiliaries except aux *did* improved in *yes/no* questions, as indicated by increased target inclusion rates and lowered substitution rates. Children showed the most difficulty supplying the target for aux *does* in both *wh*- and *yes/no* questions but their performance improved in *yes/no* questions. A dramatic improvement with *will* target inclusion caused this auxiliary to replace *did* as the least difficult auxiliary in *yes/no* questions.

Table 30. Target auxiliary inclusion and substitution in English *wh*- and *yes/no* questions (in percent)

Question	English WH		English YN	
	Subst	Target	Subst	Target
<i>Was</i>	53	47	32	68
<i>Will</i>	49	51	20	80
<i>Does</i>	65	35	38	62
<i>Did</i>	35	65	31	69

Discussion of comparison between English *wh*- and *yes/no* questions

The overall better performance on auxiliary inclusion in *yes/no* compared to *wh*-questions is primarily due to auxiliary *will*, as Table 30 shows. One factor that influences this difference is the fact that the auxiliary *will* has independent semantic meaning that contributes to the interpretation of a *yes/no* question. For instance, *will* may refer to the intention, the potentiality, or futurity of the proposition that is being questioned. In *wh*-questions, the semantic role of auxiliary *will* is only subsidiary as the main focus of the question is carried by the *wh*-word.

Another factor that contributes to the overall better performance in *yes/no* compared to *wh*-questions is the sentence-initial position of auxiliaries, which makes them more salient than the auxiliary in a *wh*-question. Children tend to include auxiliaries more in *yes/no* than in *wh*-questions and they tend to invert them more. The sentence-initial position of the auxiliary is also

responsible for the higher auxiliary inversion in English *yes/no* questions than in *wh*-questions, where nine out of the 10 participants showed perfect inversion.

It is important to note that this difference in performance is question-type specific and does not reflect general language development or improvement with auxiliary use and inversion. While children seemed to perform better on all measures of inclusion and inversion in *yes/no* compared to *wh*-questions, their patterns of inclusion remained the same. Children continued to have problems supplying the target auxiliary and to substitute to compensate for the difficulty.

4.4.5 Comparison of Bulgarian and English *yes/no* questions

Inclusion. As predicted, English-speaking children's overall auxiliary inclusion in *yes/no* questions was similar to Bulgarian-speaking children (69 % and 66 %, respectively). Again, Bulgarian-speaking children included the target aux at a higher rate (66 %) than English-speaking children did (49 %). They also included target aux *will* at a higher rate (81 %) than their English-speaking peers (65 %). The large difference in target auxiliary inclusion in *yes/no* questions is consistent with the results on *wh*-questions indicating that English-speaking children substitute for the target auxiliary significantly more than their Bulgarian-speaking peers.

Inversion. Previous research on English questions suggests that children tend to invert correctly when they include the target or a substitute auxiliary (Tornyova & Valian, in prep). Children also tend to replace difficult target auxiliaries with auxiliaries they know how to invert (e.g., aux *be*). This implies that the Inversion+Aux/Verb measure based on utterances with present auxiliaries is likely to be inflated when aux inclusion is high (i.e., English *yes/no* questions). The Inversion+Aux/Verb measure is not necessarily representative of children's knowledge of inversion with the particular targets as it also reflects inversion with the substituted

auxiliaries. In such cases, the Inversion \pm Aux/Verb measure based on all utterances, regardless of presence vs. absence of an auxiliary is a better indicator of children's linguistic competence. English-speaking children inverted 54 % in *wh*-questions and 68 % in *yes/no* questions, which is significantly lower than Bulgarian-speaking children's inversion rates in both question types (88 % and 96 %, respectively). This outcome confirms our hypothesis that language-specific differences in question formation determine different hypothesis testing routes leading to different patterns of acquisition of Bulgarian and English questions.

Chapter 5: General discussion and conclusions

We propose a Hypothesis testing model of language acquisition in which children start with a null hypothesis assuming consistent input, i.e., input that features no relevant contrasts with respect to a given syntactic requirement. The level of input consistency in the target language, which is closely related to the presence or absence of relevant contrasts, determines the range of hypotheses to be considered and how long it would take for a child to go through each hypothesis in the range to reach the final state of the adult grammar. Languages with uniform properties (i.e., no contrasts) facilitate the hypothesis-testing process by providing a narrow range of hypotheses to be considered. The initial null hypothesis is compatible with the input and that results in early target-like performance. Languages with non-uniform properties (i.e., with contrasts) prolong acquisition by providing a broad range of hypotheses to be tested, some of which will be incorrect. In those languages, the starting null hypothesis is rejected based on mixed input and new hypotheses will be generated to fit the input data. Until the learner reaches a hypothesis that is confirmed by the input, his/her performance will be non-target-like.

We argue that the level of input consistency or lack of consistency with respect to the requirement for auxiliary inclusion and auxiliary inversion in questions impacts the speed of children's acquisition of those syntactic requirements. English and Bulgarian both support relevant contrasts with respect to auxiliary inclusion and this makes the input in both languages inconsistent. As a result, in both languages the initial null hypothesis will be disconfirmed by the input and will necessitate the generation of the additional hypothesis 'Include an auxiliary optionally in questions'. English-speaking children will temporarily adopt this hypothesis because they treat declarative and interrogative sentences uniformly regarding auxiliary

inclusion. Bulgarian-speaking children will consider the ‘optional’ hypothesis because they treat questions in present perfect aspect and reported mood the same. Until children in both languages receive enough evidence to disconfirm this incorrect hypothesis for questions, they are expected to show similar, non-target-like performance on auxiliary inclusion in questions.

In the case of auxiliary inversion, Bulgarian is consistent and English is not. English supports two main contrasts with respect to auxiliary inversion in questions: 1) the auxiliary – main verb dissociation, and 2) matrix vs. embedded clause differences. We predict that in a language like Bulgarian, which makes none of the three distinctions described for English, learning of auxiliary inversion in questions will be faster even though the English learner and the Bulgarian learner start with the same null hypothesis. Since Bulgarian input supports the initial null hypothesis of consistency, we predict that Bulgarian-speaking children a) will master inversion in questions earlier than their English-speaking peers, b) will correctly invert auxiliaries when present, c) will invert the verb and the subject at a high rate. English-speaking children are expected to show slower acquisition of inversion than Bulgarian-speaking children.

To test the proposed hypothesis testing model and its predictions we conducted four elicited imitation experiments investigating 2-year-old children’s acquisition of *wh-* and *yes/no* questions. All experiments examine subject-verb inversion and subject-auxiliary inversion in Bulgarian and English questions: experiments I and II investigate *wh-* questions; experiments III and IV investigate *yes/no* questions.

The comparison of auxiliary inclusion in Bulgarian and English *wh-* and *yes/no* questions supports our hypothesis testing model in which the presence of unique language-specific restrictions on auxiliary use determines the range of hypotheses to be considered in the process

of learning. Bulgarian- and English-speaking children showed similar performance on overall auxiliary inclusion both in *wh*-questions (54 % and 56 %, respectively) and *yes/no* questions (69 % and 66 %, respectively), confirming our prediction based on the fact that both target languages have properties that are inconsistent with respect to auxiliary inclusion requirements. English and Bulgarian both support relevant contrasts allowing for the incorrect hypothesis that auxiliary inclusion is optional in questions. The inconsistency in auxiliary inclusion in English is related to variable tense marking in declarative and interrogative structures; in Bulgarian it is related to non-uniform auxiliary inclusion requirements for different forms of aux *sum* as well as to the fact that omission of aux *shte* changes the tense of the utterance but does not change its grammaticality status.

The investigation of auxiliary inversion in Bulgarian and English questions also supports our hypothesis testing model. As predicted, Bulgarian-speaking participants showed better performance on auxiliary inversion in both question types than English-speaking children. None of the 17 Bulgarian-speaking children in the *wh*- and *yes/no* question groups made errors of auxiliary inversion in the utterances that contained one while 5 out of the 20 English-speaking children showed at least one error of auxiliary inversion in the two question types. On our stricter measure of auxiliary inversion, which took into account attempted imitations that contained an auxiliary **and** those that did not, Bulgarian-speaking children's inversion rates were 88 % in *wh*-questions and 96 % in *yes/no* questions, significantly higher than English-speaking children's rates : 54 % in *wh*-questions and 68 % in *yes/no* questions. This outcome confirms our hypothesis that language-specific differences in question formation determine different hypothesis testing routes leading to different patterns of acquisition of Bulgarian and English questions. We attribute the significantly higher performance on inversion in Bulgarian than in

English questions to the lack of relevant contrasts with respect to auxiliary inversion in Bulgarian and the presence of three such relevant contrasts in English. The difficulty of aligning the properties of English input with the initial null hypothesis makes English questions hard to learn. The ease of aligning the Bulgarian input with the starting null hypothesis makes Bulgarian questions easy to acquire. We continue with a discussion of the hypothesis testing model in the context of previous nativist accounts of auxiliary omission and auxiliary inversion errors in English questions.

A number of proposals attribute auxiliary omission and auxiliary inversion errors in English-speaking children's questions to an underlying optional component in the child grammar, whether it is an optional auxiliary in root questions (e.g., the Null Aux Hypothesis of Guasti & Rizzi, 1996; Guasti, 2000; see also Boser, 1997; Boser et al., 1992; and Josefsson, 1999 for similar analyses), an optional auxiliary inversion rule (Valian et al, 1992), or an optional tense/agreement realization (Plunkett, 1991; Valian et al. 1992).

Our hypothesis testing model shares some common features with those proposals. It is possible that in the process of analyzing their input children entertain an optional null aux hypothesis (Guasti & Rizzi, 1996; Guasti, 2000), or the hypothesis that inversion and tense/agreement lexicalization is optional (Plunkett, 1991; Valian et al. 1992). However, our model offers a better explanation for the data presented here. For instance, Guasti (2000, p.117) herself points out that under her analysis a null aux will not be allowed in contexts where T-to-C movement does not apply, i.e., in Bulgarian questions. If the null aux does not move to C (in Bulgarian questions it remains in T), it will not be in the head of the root and will be subject to the principle of clause-internal identification of empty categories. Thus, the Null Aux hypothesis does not account for aux omission in the Bulgarian data. One possibility to solve this issue is to

assume that Bulgarian-speaking children truncate the structure at the TP level such that TP becomes the root. On our analysis, *wh*-phrases are in [SpecTP] and the verbal complex including the auxiliary is in T. In this case, a null aux in T is legitimate because there is no higher projection dominating it and no potential identifier. An open question, however, is how to handle cases of topicalization where TP would be dominated by a topic phrase and will no longer be the root.

The Null Aux hypothesis alone cannot account for English-speaking children's errors of non-inversion of overt auxiliaries. Guasti (2000) addresses this issue by assuming that the child grammar allows for base-generation of the *wh*-word in C and thus does not require checking of the [+wh] feature via auxiliary movement to C. Given our analysis of the structure of Bulgarian questions where no T-to-C movement takes place, this solution is compatible with the lack of uninverted overt auxiliaries in the Bulgarian data.

Our hypothesis testing model also has common features with the optional inversion rule analysis (Valian et al., 1992). The proposal that English-speaking children allow the head of a Question Phrase to optionally lower to C in both *wh*- and *yes/no* questions while the adult grammar restricts it to *yes/no* questions is in line with our idea that children start with a hypothesis assuming uniformity, i.e. that *yes/no* and *wh*-questions behave similarly with respect to the availability of Q lowering to C. However, our model accounts for a wider range of the empirical data than the analysis proposed by Valian et al. (1992). For example, on the latter analysis, both Bulgarian- and English-speaking children should allow optional Q-to-C lowering in all root questions. This is consistent with the results on auxiliary inclusion (both Bulgarian- and English-speaking children omit auxiliaries) but is inconsistent with the aux inversion results. Bulgarian-speaking children do not show errors of non-inversion. Valian et al.'s (1992) optional

analysis also does not capture errors of overgeneralization in which children invert the auxiliary in embedded questions (Pozzan et al, 2010) unless it assumes that children's grammar also allows a QuesP in embedded contexts, which is prohibited in the adult grammar.

A similar proposal that assumes optional tense/agreement realization in the child grammar is presented by Plunkett (1991). On this analysis, English-speaking children have a grammar similar to adult Arabic, which does not require obligatory realization of the +present tense feature and the 3rd person singular agreement feature. This analysis, however, provides only a partial explanation as it predicts no auxiliary/copula omission for forms in past tense or with agreement features other than 3rd person singular. Our data show that English-speaking children fail to include an auxiliary even when the target *wh*-question contains the past form of aux *be*, *was*. Contrary to Plunkett's predictions, the omission rate for *was* (34%) is similar to that for the present tense 3rd person singular form *does* (40%), and omission of *does* is similar to omission of the past form *did* (43%). More interestingly, Plunkett's analysis cannot account for errors of *do*-insertion as in '*Where he goes?*', in which the auxiliary is missing but the verb inflection *-s* is overt. We analyze this type of error in terms of differences in tense realization between declarative and interrogative sentences. On our model, children are expected to make this error if they hypothesize that tense can be marked either on a main verb in both declarative and interrogative sentences.

Another group of analyses attributes children's difficulties with auxiliaries to problems with language-specific properties of the grammar such as main verb *be* raising and *do*-insertion in English (Santelmann et al., 2002; Stromswold, 1990). Although this approach is also in line with our assumptions (e.g., language-specific properties of the target language influence the hypothesis testing process and the course of acquisition), it does not provide a full explanation of

the empirical data presented in this thesis. For example, it correctly predicts better aux inclusion performance with auxiliaries *was* and *will* than with *does* and *did* in *yes/no* questions, but it does not account for the lack of such differences in *wh*-questions.

The adjunction analysis (De Villiers, 1991; Plunkett, 1991; Stromswold, 1990) treats auxiliary inversion errors in English-speaking children's *wh*-questions as a function of landing-site differences between argument (e.g., *what*) and adjunct questions (e.g., *where*). Our hypothesis testing model is not compatible with this account because neither English nor Bulgarian features a contrast between argument and adjunct *wh*-words with respect to auxiliary or verb inversion; both *wh*-types require inversion in root non-highest-subject questions. Thus, the input in both languages is consistent and no difficulties are expected based on this distinction. The data from previous studies as well as from the current experiments on Bulgarian and English *wh*-questions do not show any differences in inversion with respect to argument vs. adjunct questions and thus do not support the adjunction analysis (Ambridge et al., 2006 for *what*, *who* (object), *how*, and *why*; Rowland et al., 2005 for *what* and *where*; Valian & Casey, 2003 for *when* and *where*).

We now turn to a discussion of more recent proposals about the process of language acquisition. As mentioned in a previous chapter, several aspects of our hypothesis testing model draw on previous proposals of language acquisition. For instance, we share Westergaard's (2003, 2008, 2009) and Lightfoot's (1999, 2006) idea that children are sensitive to syntactic regularities in the target linguistic input and use them to map specific information to their abstract linguistic knowledge. On Westergaard's (2003, 2009) micro-cues model children's early grammars include structure and rules, and learners are endowed with the ability to detect fine linguistic distinctions that define variation among adult grammars. Based on observational

data from three Norwegian-speaking children and one English-speaking child (Adam, data set from Rowland & Pine, 2000) Westergaard concludes that children acquire fine linguistics distinctions very early. Our hypothesis testing model differs from this approach in that it suggests that children start with a null hypothesis assuming consistency and learn the relevant distinctions for the target language and their interaction later on based on experience. On our analysis, the extent of input consistency, i.e., the number of relevant distinctions in the target grammar determines how close to the target children's performance will be. In other words, we acknowledge that children are capable of detecting syntactic distinctions, but the number of any such distinctions in the target grammar will determine how fast they will reach error-free target-like performance. To illustrate, English makes three main distinctions with respect to auxiliary inversion: 1) declarative vs. interrogative non-highest-subject sentences, 2) main vs. auxiliary verbs, and 3) main vs. embedded questions. Norwegian makes two distinctions: 1) long vs. short *wh*-words and 2) main vs. embedded questions. Norwegian does not make the declarative vs. interrogative distinction (V2 is required in both declarative and interrogative non-highest-subject sentences) or the main vs. aux verb distinction. In addition, only one of the two Norwegian distinctions extends to *yes/no* questions, the other is specific to *wh*-questions. Finally, Bulgarian only makes one of the above mentioned contrasts: declarative vs. interrogative sentences. The relevant contrasts across the three languages are summarized in Table 31. On our model, the Bulgarian target grammar is the most consistent because it has the fewest contrasts (only one), Norwegian is the second most consistent target grammar with two relevant contrasts, and English is the least consistent grammar because it has the most contrasts. Thus, our model predicts that Bulgarian-speaking children will show highest performance on auxiliary/verb inversion,

followed by Norwegian-speaking children, and English-speaking children's performance will be lowest.

Table 31. Contrasts for auxiliary/verb inversion/V2 in English, Norwegian, and Bulgarian

Contrast	English	Norwegian	Bulgarian
Declaratives vs. Interrogatives	+	-	+
Main vs. Embedded Qs	+	+	-
Main verb vs. Aux	+	-	-
Long vs. short <i>wh</i> -word	-	+	-

A central component of our model is the idea that children start with a null hypothesis assuming a target language with consistent properties. A similar proposal that refers to input consistency as a factor in language acquisition suggests that learners select as a starting point the simplest grammar available within Universal Grammar that is supported by part of the input (Henry, 1995; Henry & Tangnay, 1999). The simplicity of the learner's initial-state grammar is defined by the consistency of feature strength specifications of each functional head; in a simple grammar, the features are consistently weak or strong. For example, a grammar where all verbs invert with the subject (e.g., Bulgarian) or no verbs invert, is simpler than one where some verbs invert and others do not (e.g., English auxiliaries vs. main verbs). On this analysis, learners of both English and Bulgarian start with a simple grammar in which the learner assumes that either all or no verbs invert with the subject. The selection of one of these two options is determined by the target input; the initial grammar has to be at least partially compatible with the input. For Bulgarian, the only possible simple grammar is one in which all verbs invert with the subject. The other option is not supported by the input. This analysis correctly predicts that Bulgarian-speaking children will have no difficulty inverting the auxiliary and the verb in questions, as this

grammar fits perfectly with the input and does not require further specification. For English, however, this analysis does not make clear predictions. First, both simple grammars are supported in the input; some verbs (auxiliaries) have to invert with subject while others (main verbs) cannot invert. Thus, it is not clear on what basis the learner chooses one grammar over the other. It is plausible to assume that for reasons of economy, the learner will prefer the ‘*invert no verbs*’ grammar. However, this assumption is problematic since there is no stage in language acquisition where children consistently fail to invert the auxiliary, as this grammar would predict. Let us suppose that a child starts with the invert-all-verbs grammar. Children are then expected to produce utterances in which main verbs have been inverted with the subject. However, children never make an error of inverting the main verb.

Our model addresses these issues by specifying that children generate and test hypotheses continuously based on the input. Since the input is very consistent with respect to lack of main verb inversion, a child may not even generate a hypothesis that all verbs invert with the subject. Even if a child generates the hypothesis, it will be immediately disconfirmed.

Another proposal that our hypothesis testing model shares a common ground with is the probabilistic variational learning model (Legate & Yang, 2007; Yang, 1999, 2002, 2004), in which the level of consistency in the input is a key factor affecting differences in acquisition. However, the variational model was originally designed in a parameter-setting framework. On this analysis, the child starts with an innate set of syntactic parameters (e.g., +/- Tense, +/- *pro* drop, etc.) specified by UG. Both parameter values (i.e., + and -) are associated with equal initial probabilities that change adaptively in response to the linguistic input. Unlike a triggering model, where a unique grammar changes into another unique grammar based on even one instance of linguistic evidence, the variational model emphasizes a gradual change towards the

target grammar, i.e., the gradual increase of the probability of a parameter value supported by the data in the environment. To illustrate, on the variational model, auxiliary inversion in questions can be viewed as a +/- Inversion parameter. Both Bulgarian and English are +Inversion languages. The data in the Bulgarian input consistently reward the +Inversion value by increasing its probability and reducing the probability of the –Inversion value. Thus, in Bulgarian questions, +Inversion is quickly established as the dominant parameter value. In English, however, the input is less consistent and sometimes it will incorrectly reward the –Inversion value and penalize the +Inversion value (e.g., when encountering no inversion in embedded questions). Note that the case of root vs. non-root asymmetry with respect to inversion in English questions is problematic for the variational approach. In particular, the +Inversion value of the parameter will always be inconsistent with some part of the input, namely, embedded questions where inversion is not allowed. On the variational approach, children do not have a way of learning that inversion is required in some contexts and disallowed in others. Our hypothesis-testing model addresses this issue by making reference to the context to which certain syntactic requirements apply. Thus, on our model, children do not just learn information about the value of a parameter (i.e. +Inversion) in their target language but also the relevant contexts in which this value will be applied. Note, however, that our model does not use a parametric approach to language acquisition.

Although our model and the variational probabilistic model make similar predictions for learning based on the consistency of the input, our analysis makes one further step away from the traditional parameter-setting theory; it assumes a more dynamic relationship between the abstract knowledge of the learner and the linguistic data in his/her environment. In a parameter-setting approach, the child works with a fixed set of parameters specified by UG and uses the input to

set one of two pre-determined values of each parameter. In the hypothesis testing model, except for the initial null hypothesis, the child actively generates hypotheses based on regularities in the input. In our model, UG provides structural and categorical representations but not specific hypotheses or rules of syntactic relationships.

An important component of the hypothesis testing model that sets it apart from the probabilistic variational approach is that cross-linguistic variation is viewed in terms of specified differences in the relevant contexts in which a certain requirement (or parameter value) applies. Thus, our model can be extended to domains of grammar beyond the acquisition of auxiliary use and inversion in questions and it can be tested by looking at the same language pair: English and Bulgarian. For example, the Bulgarian input is inconsistent with respect to the requirement for use of dative pronominal forms. There is a context in which a full pronoun has to be used and another where only the short clitic form is allowed (1-2). Bulgarian-speaking children have to be able to recognize the relevant contrast to reach target-like performance. English, on the other hand, is consistent because it has one pronominal form and uses it in both relevant contexts (3-4).

(1) Dai **mu** (***na nego**) knigata.
Give him book-the

(2) Dai knigata **na nego** (***mu**).
Give book-the to him.

(3) Give **him** the book.

(4) Give the book **to him**.

English-speaking children do not need to distinguish between the two contexts in order to have target-consistent production. Thus, our model predicts that English-speaking children will acquire dative pronominal use faster than Bulgarian-speaking children.

A similar contrast exists in Bulgarian with respect to the full and short form of possessive pronouns (5-6). The full form in (5) takes a definite article and the short (clitic) form (6) cannot. English does not make this distinction and the pronoun itself serves as a determiner (7).

(5) moia-ta kniga
my-the book

(6) Kniga-ta mi
Book-the my

(7) my book

The contrast in Bulgarian is undoubtedly related to the clitic status of the short pronoun but nevertheless, children have to be able to make a distinction between the two forms to appreciate the restriction on word ordering and definite article hosting. English-speaking children do not face such a contrast and are expected to acquire the target faster than their Bulgarian-speaking peers.

The above examples of contrasts between pronominal clitics and full pronouns in Bulgarian have been brought up only to illustrate the potential of the Hypothesis testing model and remain speculative at this point. At a first glance, at least, the domain of pronouns seems to provide an interesting testing ground for the Hypothesis testing model. We leave this for future research.

5.1 Open questions

A major theoretical issue for the Hypothesis testing model as well as all previous accounts arguing for optionality in the child grammar when the adult grammar poses restrictions is at what point the learner stops hypothesis-testing. In other words, how does the learner know that

enough linguistic evidence has been accumulated to construct the adult grammar? A closely related question is what kind of positive evidence can lead a child to abandon the optional hypothesis and when, if at all, does the child become sensitive to indirect negative evidence in the input. The theory, as developed thus far, does not give an answer to these questions.

According to the Subset Principle (Baker, 1979; Pinker, 1979; Dell, 1981; Berwick, 1985; Manzini & Wexler, 1987; Clark, 1992), a learner assumes the most restrictive grammar and adjusts to a larger grammar based on positive evidence in the input. If a learner assumed a grammar that was less restrictive, or larger than the actual target grammar, no evidence in the input would force a change of the grammar, due to the absence of negative evidence (direct or indirect).

In our model, the null hypotheses are not problematic because they operate universally across syntactic contexts and thus only one counterexample is enough to disconfirm them. For example, hypothesis A1) *invert all verbs* is immediately disconfirmed by evidence that main verbs do not invert; similarly, hypothesis A2) *do not invert any verbs* is disconfirmed by positive evidence for inversion with auxiliaries. The optional inversion hypothesis, however, is problematic since children do not receive negative evidence to lead to the more restricted hypothesis '*inversion with auxiliaries is obligatory*'. The optional hypothesis is a case of assuming an incorrect superset grammar when the target is a subset grammar. According to the Subset Principle, children do not have a way to retreat from the incorrect hypothesis for optional inversion. Thus, an important question is whether there is a mechanism other than the Subset Principle that children use to recover from an incorrect assumption of a superset grammar. The search for an alternative solution is also motivated by a recent challenge to the psychological plausibility of the Subset Principle in language acquisition (Fodor & Sakas, 2005) suggesting

that its application requires knowledge of the subset-superset distinction and vast computational resources to compare all possible subset-superset combinations.

Alternatively, if we assume that children have access to indirect negative evidence they could infer the obligatory status of auxiliary inversion from the fact that they do not see any occurrences of non inversion with auxiliaries in questions. In order to be sensitive to this kind of indirect evidence, children have to be able to keep track of more than one contrast with respect to inversion (e.g., declarative vs. interrogative structures in connection with main verbs vs. auxiliaries). It is plausible that young children are limited in the number of distinctions they can consider while generating hypotheses. For instance, it is possible that young learners of English are able to make a number of single distinctions (i.e., declarative vs. interrogative sentences; main vs. aux verbs; main vs. embedded sentences) but experience difficulties when these have to be integrated together in the hypothesis testing process. In particular, the difficulty comes from considering the declarative vs. interrogative contrast in **conjunction** with the main vs. auxiliary verb contrast. The ability to consider more than one linguistic contrast develops as cognitive resources increase with age. Note that this idea is different from the Maturation Hypothesis (Rizzi, 1994b; Wexler, 1994, 1998) which assumes that specific syntactic representations change with development. On our analysis, what changes with development are cognitive resources and abilities necessary to analyze the linguistic input rather than abstract linguistic representations. This line of reasoning remains speculative at this point and we leave it for future research.

5.2 General conclusions and implications

This dissertation set out to shed light on several major empirical and theoretical issues in a long-lasting effort to explain English-speaking children's difficulties with auxiliary use and

inversion in questions. Empirically, existing studies of English question acquisition are inconsistent in their findings due to differences in methods and techniques. A number of proposals about the source of auxiliary omission and inversion errors have been presented but they remain with a limited cross-linguistic scope and cannot explain the data in full. The goal of this dissertation has been to address these issues by investigating the influence of various target-specific properties on children's production of *wh*- and *yes/no* questions.

The parallel analysis of auxiliary use and inversion in Bulgarian and English questions enables us to establish that auxiliary errors in English are determined by language-specific properties of the target. In addition, the comparative study allows us to evaluate the impact of intra- and cross-linguistic variation in language acquisition. Although our model is designed to account for cross-linguistic variation in language acquisition, it also captures variation within languages. For example, in languages, such as Bulgarian, the degree of input consistency varies across constructions and language acquisition patterns differ across the contrasting constructions.

Identifying specific contrasts that are responsible for cross-linguistic differences in auxiliary use and inversion in questions provide a foundation for the central component of our language learning model, level of input consistency in the target language. The hypothesis testing model makes specific predictions about the time-course of cross-linguistic language acquisition and accounts for both auxiliary omission and auxiliary inversion errors. Languages with consistent properties are acquired faster than languages with inconsistent properties.

The proposed Hypothesis Testing model of language acquisition provides a generalized account of auxiliary inclusion and auxiliary inversion errors in the acquisition of *wh*- and *yes/no* questions and is consistent with a Continuity theory of acquisition where children continuously develop their abstract knowledge of the target language based on the input in their environment.

Empirically, our study contributes by providing data on children's auxiliary inversion rates using two measures, reflecting inversion in sentences that contain an auxiliary and inversion regardless of the presence/absence of an auxiliary. Both measures have been used in previous studies but never in parallel for the same data set. Investigating these two aspects of inversion side by side provides a fuller picture of children's knowledge and a better understanding of the complex factors involved in their difficulties with auxiliaries in questions.

References

- Abbot-Smith, K. & Tomasello, M. (2006).** Exemplar-learning and schematization in a usage-based account of syntactic acquisition. *Linguistic Review*, 23, 275 – 90.
- Abu-Akel, A., Bailey, A. L. & Thum, Y-M. (2004).** Describing the acquisition of determiners in English : A growth modeling approach. *Journal of Psycholinguistic Research*, 33, 407 – 424.
- Adger, D. (2001).** *Core syntax: A minimalist approach*. New York: Oxford University Press.
- Ambridge, B., Rowland, C., Theakston, A., & Thomassello, 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, 519 – 557.
- Baker, C. L. (1970).** Notes on the description of English questions: The role of an abstract question morpheme. *Foundations of Language*, 6, 197 – 219.
- Baker, C. L. (1979).** Syntactic theory and the projection problem. *Linguistic Inquiry*, 10, 533 – 581.
- Barnes, S., Gutfreund, M., Satterly, D. & Wells, D. (1983).** Characteristics of adult speech which predict children's language development. *Journal of Child Language*, 10, 65 – 84.
- Bellugi, U. (1965).** The development of interrogative structures in children’s speech. In K. Riegel (ed.), *The development of language functions*. University of Michigan Language Development Program, Report No. 8, 103 – 138.
- Bellugi, U. (1971).** Simplification in children’s language. In R. Huxley & E. Ingram (Eds.), *Language Acquisition: Models and methods*. New York: Academic Press.
- Bencini, G. M. L., & Valian, V. (2008).** Abstract sentence representation in 3-year-olds: Evidence from comprehension and production. *Journal of Memory and Language*, 59, 97 – 113.
- Berwick, R. C. (1985).** *The acquisition of syntactic knowledge*. Cambridge, MA: MIT Press.
- Bobaljik, J. D. (1995).** Morphosyntax: the syntax of verbal inflection. MIT dissertation.
- Boser, K. (1997).** The acquisition of word order knowledge in early child German: interactions between syntax and pragmatics. Unpublished Ph.D. Dissertation, Cornell University, Ithaca.
- Boser, K., Lust, B., Santelmann, L., Whitman, J. (1992).** The syntax of CP and V₂ in early child German: the Strong Continuity Hypothesis. In *Proceedings of NELS 22*, 51 – 66.

- Bošković, Ž. (1998).** Wh-Phrases and Wh-Movement in Slavic. *Position Paper in “Comparative Slavic Morphosyntax”*, Bloomington, Indiana.
- Bošković, Ž. (2001).** *On the Nature of the Syntax-Phonology Interface*. Amsterdam: Elsevier.
- Bošković, Ž. (2002).** Clitics as nonbranching elements and the linear correspondence axiom. *Linguistic Inquiry*, 33 (2), 329 – 340.
- Bošković, Ž. (2003).** On *wh*-islands and obligatory *wh*-movement contexts in South Slavic. In C. Boeckx & K. Grohmann (Eds.), *Multiple Wh-Fronting*. Amsterdam: John Benjamins, 27 – 50.
- Bottari, P., Cipriani, P., & Chilosi, A. (1993).** Protosyntactic devices in the acquisition of Italian free morphology. *Language Acquisition*, 3, 327 – 369.
- Brown, R., Cazden, C. & Bellugi, U. (1969).** The child’s grammar from I to II. In J.P.Hill (Ed.), *Minnesota Symposium on Child Psychology, Vol. 2*, Minneapolis, Minn.: University of Minnesota Press.
- Bybee, J. (1995).** Regular morphology and the lexicon. *Language and Cognitive Processes*, 10(5), 425 – 455.
- Cameron-Faulkner, T., Lieven, E., & Tomasello, M. (2003).** A construction-based analysis of child directed speech. *Cognitive Science*, 27, 843 – 873.
- Ćavar, D. & Wilder, C. (1994).** Long head movement? Verb movement and cliticization in Croatian. *Lingua*, 93, 1 – 58.
- Cheng, L. (1991).** On the typology of *wh*-questions. MIT dissertation.
- Childers, J. & Tomasello, M. (2001).** The role of pronouns in young children’s acquisition of the English transitive construction. *Developmental Psychology*, 37(6), 739 – 748.
- Chomsky, N. (1986).** *Barriers*. Cambridge, MA: MIT Press.
- Chomsky, N. (1989).** Some notes on economy of derivation and representation. In I. Laka (Ed.), *MIT Working Papers in Linguistics, Vol. 10*, 43 – 74.
- Chomsky, N. (1995).** *The Minimalist Program*. Cambridge, MA: MIT Press.
- Chomsky, N. & Lasnik, H. (1993).** The theory of principles and parameters. In J. Jacobs, A. von Stechow, W. Sternefeld, & T. Vennemann (Eds.), *Syntax: An International Handbook of Contemporary Research*. Berlin: de Gruyter.
- Clark, R. (1992).** The selection of syntactic knowledge. *Language Acquisition*, 2, 83 – 149.

- Dąbrowska, E. (2000).** From formula to schema: The acquisition of English questions. *Cognitive Linguistics*, 11-1/2, 83 – 102.
- Dąbrowska, E. (2001).** Discriminating between constructivist and nativist positions: fillers as evidence of generalization. *Journal of Child Language*, 28, 243 – 245.
- Dąbrowska, E., & Lieven, E. (2005).** Towards a lexically specific grammar of children's question constructions. *Cognitive Linguistics*, 16-3, 437 – 474.
- De Villiers, J. (1991).** Why questions? In T. Maxwell & B. Plunkett (Eds.), *Papers in the acquisition of wh: Proceedings of the UMass Roundtable*, May, 1990. Amherst, MA: University of Massachusetts Occasional Papers.
- Dell, F. C. (1981).** On the learnability of optional phonological rules. *Linguistic Inquiry*, 12, 31 – 37.
- Dikken, M. den (2003).** On the morphosyntax of wh-movement. In C. Boeckx and K. Grohmann (Eds.), *Multiple Wh-Fronting*. Amsterdam: John Benjamins. 77 – 98.
- Dikken, M. den. (2006a).** *Relators and linkers: The syntax of predication, Predicate Inversion, and copulas*. Cambridge, MA: MIT Press.
- Dikken, M. den (2006b).** Vacuous movement in focus – On the syntax of highest-subject *wh*-questions and relative clauses. *Paper presented at the 29th GLOW Colloquium*, Barcelona.
- Dikken, M. den & Giannakidou, A. (2002).** From hell to polarity: “Aggressively non-D-linked” *wh*-phrases as polarity items. *Linguistic Inquiry*, 33, 31 – 61.
- Embick, D. (2003).** Linearization and local dislocation: Derivational mechanics and interactions. *Linguistic Analysis*, 33(3 – 4), 303 – 336.
- Embick, D. & Izvorski, R. (1995).** Participle-auxiliary word-orders in Slavic. In W. Browne (Ed.), *Formal Approaches to Slavic Linguistics: The Cornell University Meeting*, Michigan Slavic Publications, Ann Arbor, 210 – 239.
- Embick, D. & Noyer, R. (2001).** Movement operations after syntax. *Linguistic Inquiry*, 32, 555 – 595.
- Erreich, A. (1984).** Learning how to ask: patterns of inversion in yes-no and *wh*-questions. *Journal of Child Language II*, 579 – 592.
- Erreich, A. Valian, V., & Winzemer, J. (1980).** Aspect of a theory of language acquisition. *Journal of Child Language*, 7, 157 – 179.
- Fodor, J. D. & Sakas, W.G. (2005).** The Subset Principle in syntax: Costs of compliance. *Journal of Linguistics*, 41(3), 513 – 569.

- Fox, D. & Pesetsky, D. (2005).** Cyclic linearization of syntactic structure. *Theoretical Linguistics*, 31, 1 – 45.
- Franks, S. (2006).** Another look at *li* placement in Bulgarian. *The Linguistic Review*, 23, 161 – 211.
- Franks, S. (2008).** Clitic placement, prosody and the Bulgarian verbal complex. *Journal of Slavic Linguistics*, 16 (1), 97 – 137.
- Franks, S. & Progovac, L. (1994).** On the placement of Serbo-Croatian clitics. In G. Fowler, H. Cooper, & J. Ludwig (Eds.), *Indiana Slavic Studies 7, Proceedings of the 9th Biennial Conference on Balkan and South Slavic Linguistics, Literature and Folklore*, 69–78. Bloomington, IN.
- Furrow, D., Nelson, K. & Benedict, H. (1979).** Mothers' speech to children and syntactic development: some simple relationships. *Journal of Child Language*, 6, 423 – 442.
- Gelman, S. A. & Taylor, J. (1984).** How two-year-old children interpret proper and common names for unfamiliar objects. *Child Development* 55, 1535 – 40.
- Gerken, L. A., Landau, B. & Remez, R. E. (1990).** Function morphemes in young children' s speech perception and production. *Developmental Psychology* 26, 204 – 216.
- Gerken, L. & MacIntosh, B. (1993).** Interplay of function morphemes and prosody in early language. *Developmental Psychology*, 29, 448 – 457.
- Ginsburg, J. R. (2009).** Interrogative features. Ph.D. Dissertation, University of Arizona.
- Gleitman, L. R., Newport, E. L. & Gleitman, H. (1984).** The current status of the motherese hypothesis. *Journal of Child Language*, 2, 43 – 79.
- Guasti, M.T. (2000).** An excursion into interrogatives in Early English and Italian. In M.A. Friedmann and L. Rizzi, (Eds.), *The Acquisition of Syntax: Studies in Comparative Developmental Linguistics*. 103 – 128. Longman.
- Guasti, M.T. (2000).** An excursion into interrogatives in Early English and Italian. In M.A. Friedmann and L. Rizzi, (Eds.), *The Acquisition of Syntax: Studies in Comparative Developmental Linguistics*. 103 – 128. Longman.
- Guasti, M.T. & Rizzi, L. (1996).** Null aux and the acquisition of residual V₂. In A. Stringfellow, D. Cahana-Amytay, E. Hughes, and A. Zukowski (Eds.), *Proceedings of the 20th Annual Boston Conference on Language Development*. Somerville: Cascadilla Press. 284 – 295.
- Hallé, P., Durand, C., & de Boysson-Bardies, B. (2008).** Do 11-month-old French infants process articles? *Language and Speech*, 51, 23 – 44.

- Halpern, A. (1992).** Topics in the placement and morphology of clitics. Ph.D. Dissertation, Stanford University.
- Henry, A. (1995).** *Belfast English and Standard English: Dialect variation and parameter setting*. New York: Oxford University Press.
- Henry, A. & Tangnay, D. (1999).** Functional categories and parameter setting in the second language acquisition of Irish in early childhood. In M. Degraff (Ed.), *Language Creation and Language Change: Creolization, Diachrony and Development*. 239 – 253 MIT Press.
- Hoff-Ginsberg, E. (1986).** Maternal speech and the child's development of syntax. *Developmental Psychology*, 22, 155 – 63.
- Höhle, B., Weissenborn, J., Kiefer, D., Schulz, A., & Schmitz, M. (2004).** Functional elements in infants' speech processing: The role of determiners in the syntactic categorization of lexical elements. *Infancy*, 5, 341 – 353.
- Ihns, M. & Leonard, L. (1988).** Syntactic categories in early child language: Some additional data. *Journal of Child Language*, 15, 673 – 78.
- Ingram, D. & Tyack, D. (1979).** Inversion of subject NP and Aux in children's questions. *Journal of Psycholinguistics Research*, 4, 333 – 41.
- Iovtcheva, S. (2010).** *Wh-questions in Bulgarian: Evidence for focus movement in a feature based syntactic theory*. M.A. Thesis. Syracuse University.
- Izvorski, R. (1993).** *Preverbal and postverbal subjects*. MS Thesis. University of Pennsylvania.
- Izvorski, R. (1995).** On wh-movement and focus movement in Bulgarian. *Proceedings of the Second Conference of the Student Organization of Linguistics in Europe*, 54 – 67.
- Izvorski, R., King, T., Rudin, C. (1997).** Against li-lowering in Bulgarian. *Lingua* 102, 187 – 194.
- Josefsson, G. (1999).** Non-finite root clauses in Swedish child language. In A. Greenhill, H. Littlefield, & C. Tano (eds.), *Proceedings of the 23rd Annual Boston University Conference on Language Development*, Medford, MA: Cascadilla Press, 312 – 324.
- Karmiloff-Smith, A. (1976).** *A Functional Approach to Child Language: A Study of Determiners and Reference*. Cambridge, England: Cambridge University Press.
- Katz, J. J. and Postal, P. (1964).** *An Integrated Theory of Linguistic Description*. Cambridge, MA: MIT Press.
- Katz, N., Baker, E. & Macnamara, J. (1974).** What's in a name? A study of how children learn common and proper names. *Child Development*, 45, 469 – 473.

- Kedar, Y., Casasola, M., & Lust, B. (2006).** Getting there faster: 18- and 24-month-old infants' use of function words to determine reference. *Child Development*, 77, 325 – 338.
- Kemp, N., Lieven, E., & Tomasello, M. (2005).** Young children's knowledge of the 'Determiner' and 'Adjective' categories. *Journal of Speech, Language, and Hearing Research*, 48 (1), 592 – 609.
- Kiss, K.É. (1993).** *Wh*-movement and specificity. *Natural Language and Linguistic Theory*, 11, 83 – 120.
- Klee, T. (1985).** Role of inversion in children's question development. *Journal of Speech and Hearing Research*, 28, 225 – 232.
- Klima, E. & Bellugi, U. (1966)** Syntactic regularities in the speech of children. In J. Lyons & R. Wales (Eds.), *Psycholinguistic papers*. Edinburgh, Scotland: Edinburgh University Press.
- Ko, H. (2005).** Syntax of why-in-situ: Merge into [Spec,CP] in the overt syntax. *Natural Language & Linguistic Theory*, 23 (4), 867 – 916.
- Koopman, H. (1983).** ECP effects in main clauses. *Linguistic Inquiry*, 14, 346 – 350.
- Koopman, H. & Sportiche, D. (1991).** The position of subjects. *Lingua*, 85, 211.
- Kraskow, T. (1990).** On multiple questions in Slavic. *Paper presented at the Workshop on Scrambling*, Tilburg.
- Kuczaj, S. & Brannick, N. (1979).** Children's use of the *wh*-question modal auxiliary placement rule. *Journal of Experimental Child Psychology*, 28, 43 – 67.
- Labov, W. & Labov, T. (1978).** Learning the syntax of questions. In R. Campbell & P. Smith (Eds.), *Recent advances in the psychology of language*, New York: Plenum Press.
- Lambova, M. (2001).** On A-bar Movements in Bulgarian and their interaction. *The Linguistic Review*, 18(4), 327 – 374.
- Langacker, R. (1987).** *Foundations of Cognitive Grammar*, Vol. 1. Stanford, CA: Stanford University Press.
- Langacker, R. (2000).** A dynamic usage-based model. In M. Barlow, and S. Kemmer, (Eds.), *Usage-Based Models of Language*. Stanford, CA: CSLI Publications, 1 – 63.
- Legate, J. A. & Yang, C. (2007).** Morphosyntactic learning and the development of tense. *Language Acquisition*, 14(3), 315 – 344.
- Lightfoot, D. (1999).** *The development of language: Acquisition, change and evolution*. Malden, MA and Oxford: Blackwell.

- Lightfoot, D. (2006).** *How new languages emerge*. Cambridge: Cambridge University Press.
- Lipták, A. (2001).** *On the syntax of wh-items in Hungarian*. Ph.D. Dissertation. University of Leiden.
- Lust, B. (1977).** Conjunction Reduction in Child Language. *Journal of Child Language*, 4(2), 257 – 297.
- Lust, B., Flynn, S., & Foley, C. (1996).** What Children Know about What They Say: Elicited Imitation as a Research Method for Assessing Children's Syntax. In D. McDaniel, C. McKee, & H. Cairns (Eds.), *Methods for Assessing Children's Syntax*, MIT Press: Cambridge, MA.
- Manzini, M. R. & Wexler, K. (1987).** Parameters, binding theory, and learnability. *Linguistic Inquiry*, 18, 413 – 444.
- Marantz, A. (1984).** *On the nature of grammatical relations*. MIT Press, Cambridge.
- Marantz, A. (1988).** Clitics, morphological merger, and the mapping to phonological structure. In Michael Hammond and Michael Noonan, (Eds.), *Theoretical Morphology: Approaches in Modern Linguistics*. Academic Press, San Diego, 253 – 270.
- Maratsos, M. (1976).** *The Use of Definite and Indefinite Reference in Young Children*. Cambridge, England: Cambridge University Press.
- Maratsos, M. (1984).** Some current issues in the study of the acquisition of grammar. In J. Flavell & E. Markman (Eds.), *Handbook of child psychology, fourth edition. Vol. 3: Cognitive development*.
- Matthewson, L. & Schaeffer, J. (2000).** Grammar and pragmatics in the acquisition of article systems. In J. Gilkerson, M. Becker, & N. Hyams (Eds.), *UCLA Working Papers in Linguistics: Language Development and Breakdown*, 1, 1 – 39.
- McDaniel, D. & Cairns, H. S. (1996).** Eliciting judgments of grammaticality and reference. In D. McDaniel, C. McKee, & H. S. Cairns (Eds.), *Methods for Assessing Children's Syntax*. Cambridge, MA: MIT Press, 233 – 254.
- Motapanyane, V. (1997).** Evidence for focus features. In Alexandrova, G. & Arnaudova, O. (Eds.), *The Minimalist Parameter*, 249 – 260.
- Newport, E., Gleitman, L. R. & Gleitman, H. (1977).** Mother, I'd rather do it myself: some effects and non-effects of maternal speech style. In C. E. Snow & C. A. Ferguson (Eds.), *Talking to children: Language input and acquisition*. NY: Cambridge University Press.
- Olguin, R., & Tomasello, M. (1993).** Twenty-five-month-old children do not have a grammatical category of verb. *Cognitive Development*, 8, 245 – 272.

- Pesetsky, D. & Torrego, E. (2000).** T-to-C Movement: Causes and Consequences. In M. Kenstowicz (Ed.), *Ken Hale: A Life in Language*. Cambridge, Mass.: MIT Press.
- Pine, J. & Lieven, E. (1993).** Reanalyzing rote-learned phrases: individual differences in the transition to multi-word speech. *Journal of Child Language*, 20(3), 551 – 571.
- Pine, J. M. & Lieven, E. V. M. (1997).** Slot and frame patterns and the development of the determiner category. *Applied Psycholinguistics*, 18, 123 – 38.
- Pine, J. M. & Martindale, H. (1996).** Syntactic categories in the speech of young children: The case of the determiner. *Journal of Child Language*, 23, 369 – 95.
- Pinker, S. (1979).** Formal models of language learning. *Cognition*, 7, 217 – 283.
- Plunkett, B. (1991).** Inversion and early *wh*-questions. In T. Maxwell & B. Plunkett (Eds.), *Papers in the acquisition of wh: Proceedings of the UMass Roundtable*, May, 1990. Amherst, MA: University of Massachusetts Occasional Papers.
- Pozzan, L., Bencini, G., Quirk, E., Eng, N., & Valian, V. (2010).** The acquisition of English main and embedded questions in child and adult SLA: An elicited production study. Paper presented at the 35th Annual Boston University Conference on Language Development, Boston, MA.
- Radford, A. (2004).** *Minimalist Syntax: Exploring the Structure of English*. Cambridge: Cambridge University Press.
- Richards, B. (1990).** *Language development and individual differences: a study of auxiliary verb learning*. Cambridge: Cambridge University Press.
- Richards, B. & Robinson, P. (1993).** Environmental correlates of child copula verb growth. *Journal of Child Language*, 20, 343 – 362.
- Rivero, M. L. (1993).** *Finiteness and second position in long head movement languages: Breton and Slavic*. Ms. Thesis. University of Ottawa.
- Rizzi, L. (1994a).** Early null subjects and root null subjects. In T. Hoekstra & B. Schwartz (Eds.), *Language Acquisition Studies in Generative Grammar*, Amsterdam: Benjamins.
- Rizzi, L. (1994b).** Some notes on linguistic theory and language development: The case of root infinitives. *Language Acquisition*, 3, 371 – 393.
- Rizzi, L. (1997).** The fine structure of the left periphery. In L. Haegeman (Ed.), *Elements of Grammar*, Kluwer, Dordrecht, 281 – 337.

- Rizzi, L. (2000).** Remarks on early null subjects. In M.A. Friedmann and L. Rizzi, (Eds.), *The Acquisition of Syntax: Studies in Comparative Developmental Linguistics*. 103 – 128. Longman.
- Rizzi, L. (2002).** Locality and left periphery. In A. Belletti (Ed.), *Structures and Beyond. The Cartography of Syntactic Structures*, vol. 3, Oxford University Press.
- Rizzi, L. (2005).** On the grammatical basis of language development: A case study. In G. Cinque & R. S. Kayne (Eds.), *The Oxford Handbook of Comparative Syntax*. New York: Oxford University Press.
- Roberts, I. (2011).** Head movement and the Minimalist Program. In C Boeckx (Ed.), *The Oxford Handbook of Minimalism*. Oxford: Oxford University Press.
- Rowland, C. (2007).** Explaining errors in children’s questions. *Cognition*, 104, 106 – 134.
- Rowland, C. and Fletcher, S. (2006).** The effect of sampling on estimates of lexical specificity and error rates. *Journal of Child Language*, 33, 859 – 877.
- Rowland, C. & Pine, J. (2000).** Subject-auxiliary inversion errors and *wh*-question acquisition: ‘what children do know?’ *Journal of Child Language*, 27, 157 – 81.
- Rowland, C., Pine, J., Lieven, E., Theakston, A. (2003).** Determinants of acquisition order in *wh*-questions: re-evaluating the role of caregiver speech. *Journal of Child Language*, 30, 609 – 635.
- Rowland, C., Pine, J., Lieven, E., Theakston, A. (2005).** The incidence of error in young children’s *wh*-questions. *Journal of Speech, Language, and Hearing Research*, 48, 384 – 404.
- Rudin, C. (1986).** *Aspects of Bulgarian syntax: Complementizers and wh constructions*. Columbus, OH: Slavica.
- Rudin, C. (1988).** On multiple questions and multiple *wh*-fronting. *Natural Language and Linguistic Theory*, 6, 445 – 501.
- Rudin, C. (1993).** On focus position and focus marking in Bulgarian questions. Paper presented at FLSM.
- Rudin, C., Kramer, C., Billings, L., & Baerman, M. (1999).** Macedonian and Bulgarian LI Questions: Beyond Syntax. *Natural Language and Linguistic Theory*, 17, 541 – 586.
- 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, 813 – 842.

- Scarborough, H. & Wyckoff, J. (1986).** Mother, I'd still rather do it myself: some further non-effects of 'motherese'. *Journal of Child Language*, 13, 431 – 437.
- Schuetze, C. (1994).** Serbo-Croatian second position clitic placement and the phonology-syntax interface. In A. Carnie, H. Harley & T. Bures (Eds.), *Papers on Phonology and Morphology: MITWPL 21*, Cambridge, 373 – 473.
- Slobin, D. (1979).** *Psycholinguistics*. 2nd edition, Glenview, IL: Scott Foresman & Co.
- Slobin, D. I. & Welsh, C. A. (1971).** Elicited imitation as a research tool in developmental psycholinguistics. In C. B. Lavatelli (Ed.), *Language Training in Early Childhood Education*, Urbana, IL: University of Illinois Press, 170 – 185.
- Stjepanović, S. (2003).** Multiple *wh*-fronting in Serbo-Croatian matrix questions and the matrix sluicing construction. In C. Boeckx & K. Grohmann (Eds.), *Multiple Wh-Fronting*. Amsterdam: John Benjamins. 255 – 284.
- Stromswold, K. (1990).** *Learnability and the acquisition of auxiliaries*. Unpublished Ph.D. Dissertation. MIT.
- 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, 127–152.
- Thornton, R. (1996).** Elicited production. In D. McDaniel, C. McKee, & H. S. Cairns (Eds.), *Methods for Assessing Children's Syntax*. Cambridge, MA: MIT Press, 77 – 102.
- Tilkov, D., Stojanov, S., & Popov, K. (Eds.) (1983).** *Gramatika na savremenniya balgarski knizoven ezik, t. III. Sintaksis*, [A Grammar of Standard Contemporary Bulgarian: Vol. III. Syntax]. Izdatelstvo na bŕlgarskata akademija na naukite, Sofia.
- Tomasello, M. (1992).** *First verbs: A case study of early grammatical development*. Cambridge, England: Cambridge University Press.
- Tomasello, M. (2000).** Do young children have adult syntactic competence? *Cognition*, 74, 209 – 253.
- Tomasello, M. (2003).** *Constructing a language: A usage-based theory of language acquisition*. Cambridge, MA: Harvard University Press.
- Tomasello, M. (2006).** Acquiring linguistic constructions. In D. Kuhn & R. Siegler (Eds.), *Handbook of Child Psychology*. New York: Wiley.
- Tornyova, L. & Valian, V. (2009).** The role of cross-linguistic variation in the acquisition of auxiliary inversion in *wh*-questions. In J. Crawford, K. Otaki, & M. Takahashi (Eds.),

Proceedings of the 3rd Conference on Generative Approaches to Language Acquisition North America, Cascadilla Proceedings Projects, Somerville, MA.

Tornyova, L. & Valian, V. (in prep). Productivity of auxiliary use in children's *wh*-questions.

Tremblay, A. (2005). On the status of determiner fillers in early French: What the child knows. In A. Burgos, M. Clark-Cotton & S. Ha (eds.) *Proceedings of the 29th Annual Boston University Conference on Language Development*, 604 – 615, Somerville MA: Cascadilla.

Valian, V. (1986). Syntactic categories in the speech of young children. *Developmental Psychology*, 22, 562–79.

Valian, V. (1991). Syntactic subjects in the early speech of American and Italian children. *Cognition*, 40, 21 – 81.

Valian, V. (1999). Input and language acquisition. In W. C. Ritchie & T. K. Bhatia (Eds.), *Handbook of Child Language Acquisition*, 497 – 530. New York: Academic Press.

Valian, V. (2006). Young children's understanding of present and past tense. *Language Learning and Development*, 2, 251 – 276.

Valian, V. & Aubry, S. (2005). When opportunity knocks twice: two-year-olds' repetition of sentence subjects. *Journal of Child Language*, 32, 617 – 641.

Valian, V. & Casey, L. (2003). Young children's acquisition of *wh*-questions: The role of structured input. *Journal of Child Language*, 30 (1), 117 – 43.

Valian, V., Hoeffner, J., & Aubry, S. (1996). Young children's imitation of sentence subjects: evidence of processing limitations. *Developmental Psychology*, 32, 153 – 164.

Valian, V., Lasser, I. & Mandelbaum, D. (1992). Children's early questions. Paper presented at the *17th Annual Boston University Conference on Language Development*.

Valian, V., Prasada, S., & Scarpa, J. (2006). Direct object predictability: effects on young children's imitation of sentences. *Journal of Child Language*, 33, 247 – 269.

Valian, V., Solt, S., & Stewart, J. (2009). Abstract categories or limited-scope formulae? The case of children's determiners. *Journal of Child Language*, 36, 743 – 778.

Valian, V., Winzemer, J., & Erreich, A. (1981). A little-linguist model for learning syntax. In S. Tavakolian (Ed.), *Language acquisition and linguistic theory*. Cambridge, Mass.: MIT.

Van Heugten, M. (2006). *Dutch-learners' use of definite articles in speech processing*. MA Thesis. Radboud Universiteit, Nijmegen, The Netherlands.

Van Valin, R. (2002). The development of subject-auxiliary inversion in English *wh*-questions: an alternative analysis. *Journal of Child Language*, 29, 161 – 175.

- Van Riemsdijk, H. (2002).** The unbearable lightness of GOing: The projection parameter as a pure parameter governing the distribution of elliptic motion verbs in Germanic. *Journal of Comparative Germanic Linguistics*, 5, 143 – 196.
- Veneziano, E. & Sinclair, H. (2000).** The changing status of ‘filler syllables’ on the way to grammatical morphemes. *Journal of Child Language*, 27, 1 – 40.
- Wagner, L. (2002).** Children’s comprehension of completion entailments in the absence of agency cues. *Journal of Child Language*, 29, 109 – 125.
- Wagner, L. (2009).** I’ll never grow up: continuity in aspect representations. *Linguistics*, 47(5), 1051 – 1074.
- Waxman, S. R. & Booth, A. E. (2001).** Seeing pink elephants: Fourteen-month-olds’ interpretations of novel nouns and adjectives. *Cognitive Psychology*, 43, 217 – 242.
- Weist, R. M., Atanassova, M., Wysocka, H., & Pawlak, A. (1999)** Spatial and temporal systems in child language and thought: A cross-linguistic study. *First Language*, 19, 267 – 311.
- Westergaard, M. R. (2003).** Word order in *wh*-questions in a North Norwegian dialect: Some evidence from an acquisition study. *Nordic Journal of Linguistics*, 26(1), 81–109.
- Westergaard, M. (2008).** Acquisition and change: On the robustness of the triggering experience for word order cues. *Lingua*, 118(12), 1841 – 63.
- Westergaard, M. (2009).** Usage-based vs. rule-based learning: the acquisition of word order in *wh*-questions in English and Norwegian. *Journal of Child Language*, 36, 1023 – 1051.
- Wexler, K. (1994).** Optional infinitives, head movement, and the economy of derivation in child language. In D. Lightfoot & N. Hornstein, (Eds.), *Verb Movement*, Cambridge, MA: Cambridge University Press.
- Wexler, K. (1998).** Very early parameter setting and the unique checking constraint: A new explanation of the optional infinitive stage, *Lingua*, 106, 23 – 79.
- Williams, E. (1980).** Predication. *Linguistic Inquiry*, 11, 203 – 238.
- Yang, C. (1999).** A Selectionist Theory of Language Acquisition, In *Proceedings of the 37th Meeting of the Association for Computational Linguistics*, East Stroudsburg, PA.
- Yang, C. (2002).** *Knowledge and learning in natural language*, Oxford University Press, New York.

Yang, C. (2004). Universal Grammar, statistics, or both, *Trends in Cognitive Sciences*, 8, 451–456.

Zangl, R. & Fernald, A. (2007). Increasing flexibility in children's online processing of grammatical and nonce determiners in fluent speech. *Language Learning and Development*, 3, 199 – 231.