Applied Psycholinguistics (2019), **40**, 1241–1267
doi:10.1017/S0142716419000249

CAMBRIDGE UNIVERSITY PRESS

ARTICLE

Syntactic development in early foreign language learning: Effects of L1 transfer, input, and individual factors

Holger Hopp[1,*], Anja Steinlen[2], Christina Schelletter[3] and Thorsten Piske[4]

[1]Technische Universität Braunschweig, [2]Friedrich-Alexander-Universität Erlangen-Nürnberg, [3]University of Hertfordshire and [4]Friedrich-Alexander-Universität Erlangen-Nürnberg
*Corresponding author. E-mail: h.hopp@tu-braunschweig.de

(Received 26 August 2018; revised 09 April 2019; accepted 16 April 2019)

ABSTRACT

This study explores parallels and differences in the comprehension of *wh*-questions and relative clauses between early foreign-language (FL) learners and monolingual children. We test for (a) effects of syntactic first-language (L1) transfer, (b) the impact of input on syntactic development, and (c) the impact of individual differences on early FL syntactic development. We compare the results to findings in child second language (L2) naturalistic acquisition and adult FL acquisition. Following work on adult FL acquisition, we carried out a picture-based interpretation task with 243 child FL learners in fourth grade at different regular, partial, and high-immersion schools in Germany plus 68 monolingual English children aged 5 to 8 years as controls. The child FL learners display a strong subject-first preference but do not appear to use the L1 syntax in comprehension. Input differences across different schools affect overall accuracy, with students at high-immersion FL schools catching up to monolingual performance within 4 years of learning. Finally, phonological awareness is implicated in both early FL learning and naturalistic child L2 development. These findings suggest that early FL development resembles child L2 acquisition in speed and effects of individual factors, yet is different from adult FL acquisition due to the absence of L1 transfer effects.

Keywords: child foreign-language acquisition; individual differences; morphosyntax; transfer

In many countries, the start of instructed second language (L2) acquisition has been moved forward from the teens to the beginning of primary school in recent years. As a consequence, foreign-language (FL) learners typically are not late (i.e., postpubescent) learners of the L2 anymore; rather, learners start getting FL exposure between the ages of 5 and 8 years. To better understand the acquisition type and the developmental trajectory among early FL learners, this paper explores parallels and differences in FL syntactic development among first-language (L1) German child instructed FL learners of English who started learning English at age 6 in comparison with monolingual children. We also compare our results to findings from early naturalistic child L2 acquisition, on the one hand, and from adult FL acquisition, on the other.[1]

Specifically, we explore similarities and differences between acquisition types in terms of (a) syntactic L1 transfer, (b) input effects on syntactic development, and (c) profile effects in the impact of individual differences on early FL syntactic development.

This study focuses on the interpretation of *wh*-questions and relative clauses. The development of questions and relative clauses has been much studied in monolingual child development (e.g., Durrleman, Marinis, & Franck, 2016) and is beginning to receive attention in child L2 acquisition (Roesch & Chondrogianni, 2016). Crucially, L1 transfer affects *wh*-questions and relative clauses in adult FL development (e.g., Grüter, 2006; Hopp, 2017; Rankin, 2014), making them suitable test cases for transfer effects in early FL syntactic development. In consequence, we examine whether the L1 affects early syntactic development in child FL acquisition in ways similar to what has been reported for adult FL acquisition.

First, our study on syntactic transfer, and development allows for delineating age effects in bilingual development (e.g., Meisel, 2009; Schwartz, 2009). If child FL learners show L1 transfer effects similar to late learners and different from, for example, simultaneous bilingual children, then the acquisition mechanisms are likely to be similar in child FL and adult FL learners in instructional settings.

Second, we focus on possible interactions of L1 transfer with input effects in child L2 development. So far, the scope of transfer effects in child L2 acquisition is unclear, with some studies finding effects of L1 transfer (Haberzettl, 2005; Haznedar, 2001; Unsworth, 2005) while others report no transfer effects (e.g., Paradis, Rusk, Duncan, & Govindarajan, 2017; Thoma & Tracy, 2006). Part of the reason for these inconclusive results may be that these studies consider different stages in L2 development, which might be differently affected by L1 transfer. According to some models of adult L2 acquisition, a full copy of the L1 forms the initial state grammar in the L2 (Schwartz & Sprouse, 1996), such that L1 effects should be most pronounced initially and increasing L2 input subsequently attenuates L1 transfer. Other models propose that effects of L1 syntactic transfer may emerge only once learners have received enough L2 input to arrive at higher levels of grammatical competence (e.g., the Developmentally Moderated Transfer hypothesis; Pienemann, 2005; Organic Grammar; Vainikka & Young-Scholten, 2011). We assess the degree to which these models transfer to child L2 acquisition in accounting for potential differential transfer effects. From a psycholinguistic perspective, then, this study allows for assessing effects of cross-linguistic influence as a function of age of onset and input.

In addition, L2 input has been identified as the primary determinant of the speed of syntactic acquisition and convergence on the target grammar in child L2 acquisition (e.g., Chondrogianni & Marinis, 2011; Unsworth, 2016b). In many studies on (child) L2 acquisition, however, differences in input are confounded with differences in age of onset and/or length of exposure, as learners at the same ages with more input had an earlier start, more time to acquire the L2, or both (e.g., Flege, Yeni-Komsian, & Liu, 1999). In this study, we avoid these confounds by studying the syntactic development in children with the same ages of onset and the same lengths of exposure who attend different types of schools offering either regular English as a foreign language (EFL) lessons or partial immersion schooling in the L2. Hence, we operationalize type of input via type of school. From an applied perspective, then, this study determines the amount of input required for EFL children to

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

approximate or reach monolingual performance in complex syntax (see Paradis & Jia, 2016), and it gauges the effects of early partial immersion schooling (Wesche, 2002).

Finally, the study assesses individual factors contributing to the target acquisition of EFL syntax in order to delineate similarities and differences between early FL and child L2 syntactic development (e.g., Paradis, 2011; Paradis et al., 2017). We ascertain which internal and external factors contribute to the child FL acquisition of complex syntax. From a developmental perspective, then, this study delineates the effect structure of contributing factors in early FL syntactic development.

We study these questions by testing 243 German-dominant FL learners of English in fourth grade at different regular, partial-, and high-immersion schools in Germany as well as 68 monolingual English children aged between 5 and 8 years in the United Kingdom. The study administered a picture-based interpretation task following Rankin (2014). In addition, cognitive, linguistic, and social variables were collected to assess the impact of individual differences.

Background

Syntactic transfer in the adult and child L2 acquisition of wh-questions and relative clauses

In L2 and FL acquisition, evidence of L1 syntactic transfer is abundant across learning contexts and across language combinations. For instance, L1 German child and adult learners of English initially transfer the underlying OV (object–verb) word order of German to the L2 (Weigl, 1999; see Sağin-Şimşek, 2006; Sánchez, 2011, for child L2A) and they continue to display persistent transfer of the German verb-second (V2) property in main clauses (Kaltenbacher, 2001; Rankin, 2012; Robertson & Sorace, 1999) as well as in *wh*-questions and relative clauses (Rankin, 2013, 2014; see also Hopp, 2017).

According to standard generative analyses (e.g., Chomsky, 1981), both *wh*-questions and relative clauses are formed by moving a *wh*-word or relative pronoun to the clause-initial position and indexing its original thematic position via traces or silent copies. In English, subject and object questions (1) and subject and object relative clauses (2) differ both in structure and in surface word order due to the underlying subject–verb–object (SVO) word order without verb raising.

(1) a. Which animal$_i$ t$_i$ chases the horse? (subject question)

b. Which animal$_i$ does the horse chase t$_i$? (object question)

(2) a. The animal that$_i$ t$_i$ chases the horse. (subject relative clause)

b. The animal that$_i$ the horse chases t$_i$. (object relative clause)

In German, subject and object *wh*-questions and relative clauses differ only in structure, yet not in surface word order, as shown by the translations of the English sentences in (3) and (4). Due to the V2 property in German main clauses, the thematic verb raises into second position in questions, leaving both subject and object in a postverbal position (den Besten, 1983). As per the basic OV order of German, a preverbal noun phrase in a relative clause can be either a subject or an

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

object. In German, grammatical roles are disambiguated by case marking on determiners; yet due to the syncretism in the German determiner paradigm, many forms are ambiguous between nominative and accusative, as, for example, in (3) and (4).

(3) a. Welches Tier$_i$ beißt$_j$ t$_i$ [$_{VP}$das Pferd t$_j$] ? (subject question)

b. Welches Tier$_i$ beißt$_j$ das Pferd [$_{VP}$t$_i$ t$_j$]? (object question)

Which animal bites the horse?

(4) a. Das Tier, das$_i$ t$_i$ [$_{VP}$das Pferd beißt]. (subject relative clause)

b. Das Tier, das$_i$ das Pferd [$_{VP}$t$_i$ beißt]. (object relative clause)

The animal that the horse bites.

Due to partial surface word order overlap, English *wh*-questions and relative clauses can be parsed using a German V2/OV grammar. Specifically, English subject questions as in (1a) overlap with both subject and object orders in German as in (3a) and (3b) and could thus receive both a subject and an object parse. For relative clauses, the object relative clause word order in English (2b) is compatible with both object and subject relative clauses in German (4a and 4b). In contrast, English object questions (1b) and English subject relative clauses (2a) cannot be parsed using German grammar. In sum, partial word order overlap between English and German questions and relative clauses creates so-called cross-linguistic syntactic conflicts (Kaan, Ballantyne, & Wijnen, 2015), as a surface string can receive alternative parses by the L1 and the L2 grammar, respectively.

Several studies on *wh*-questions capitalized on these cross-linguistic conflicts to examine L1 activation among adult FL learners. For beginning learners at the L2 initial state, Grüter (2006) and Grüter and Conradie (2006) tested whether L1 English and L1 Afrikaans learners of German would transfer properties of their L1 grammar. Because Afrikaans shares the OV/V2 properties with German, Afrikaans learners were expected to pattern like German native controls, while English learners should manifest subject parses of *wh*-questions as per English grammar (1a). Results of a picture-selection task showed that English learners preferred subject over object interpretations of German questions (3), while Afrikaans learners and German controls preferred object interpretations. For L1 German learners of English at intermediate to advanced proficiency levels, Rankin (2013, 2014) finds that the FL learners, unlike English natives, consider subject *wh*-questions and object relative clauses as partially ambiguous between subject and object interpretations in English, whereas object *wh*-questions and subject relative clauses only receive the target interpretations. In conjunction, these studies attest that adult FL learners at different levels of proficiency sometimes recruit the L1 grammar when assigning an interpretation to sentences in the L2.

In the present study, we adapt the picture selection task from Rankin (2014) for German-dominant children acquiring English in instructed contexts. We investigate whether child learners show similar patterns as adult FL learners or whether child EFL learners pattern with monolingual English children in the acquisition of *wh*-questions and relative clauses.

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

Wh-questions and relative clauses in child language development

For monolingual children, many studies across different languages report that they acquire subject questions and relative clauses before object questions and relative clauses and perform better in the comprehension of subject than object orders (for *wh*-questions, see De Vincenzi, Arduino, Ciccarelli, & Job, 1999; Friedmann & Novogrodsky, 2011; Guasti, Branchini, & Arosio, 2012; for relative clauses, see Adani, 2011; Adani, van der Lely, Forgiarini, & Guasti 2010; Durrleman et al., 2016; Friedmann & Novogrodsky, 2004). In both production and comprehension, subject questions emerge around age 2 to 3, while mastery of object orders is not attained until age 4 to 5 (Correa, 1995; De Villiers, Tager-Flusberg, Hakuta, & Cohen, 1979). For object relative clauses, convergence on target accuracy occurs even later around age 6, and younger children also perform significantly better on object questions than object relatives (e.g., Durrleman et al., 2016).

Furthermore, the difficulty with object questions and relative clauses is magnified for certain types of questions: among *wh*-questions, *which*-questions prove to be the hardest question type for monolingual children to interpret correctly (e.g., De Vincenzi et al., 1999; Friedmann, Belletti, & Rizzi, 2009). English-speaking children do not master *which*-questions until age 6 or 7, although they perform to criterion on *who*-questions earlier (e.g., Avrutin, 2000; Goodluck, 2005). For instance, in a recent study by Contemori, Carlson, and Marinis (2018), English monolingual children between age 5 and 7 correctly identified 63% of object *which*-questions ("Which cow is the goat pushing?") in a picture selection task, while subject questions were answered at 95% accuracy.

The general asymmetry between subject and object orders has been argued to follow from subject-first orders being the canonical order in that thematic role assignment of agent and patient is linearly mapped onto argument order (Canonicity hypothesis; Friedmann & Novogrodsky, 2004). Further, object orders are more taxing in sentence processing in that they require the parser to revise its initial subject interpretation to an object order (e.g., De Vincenzi, 1991). Given that (object) *wh*-questions are considerably more frequent in the input than relative clauses, the parser has more experience with revision in question than in relative clause contexts, such that object *wh*-questions reach target accuracy sooner in child language development than relative clauses. Finally, asymmetries between question types reflect syntactic locality constraints: a moved object constituent crosses the subject bearing similar features so that (relativized) minimality is violated and intervention effects arise (Contemori & Marinis, 2014; Friedmann et al., 2009). The greater the similarity of the *wh*-phrase to the subject in terms of its morphosyntactic features, the larger the intervention effects will be. In consequence, *which*-questions (e.g., *which animal*) present greater difficulty in sentences as in (1 and 2) than questions with a bare *wh*-phrase (e.g., *who*; Durrleman et al., 2016; Friedmann et al., 2009).

Summarizing, the monolingual acquisition of *wh*-questions and relative clauses is characterized by a general subject-over-object preference, earlier acquisition of *wh*-questions than of relative clauses, and particular difficulty with *which*-questions.

For child L2 learners of German, Roesch and Chondrogianni (2016) find that early sequential French–German bilingual children aged 4 to 5 years (mean age of acquisition to German: 3 years, 1 month) demonstrate a similar subject preference in the

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

interpretation of *wh*-questions as monolingual German and simultaneous German–French bilingual children of the same ages. However, in a picture selection task, the bilingual groups differed in their interpretation strategies of *wh*-questions in which case-marking on the second noun phrase (NP) disambiguated the question ("Welche Maus malt der$_{NOM}$/den$_{ACC}$ Frosch an?"—*Which mouse does the frog paint?/Which mouse paints the frog?*). The monolingual children integrated case marking on the NP in the parse to disambiguate the question (i.e., they chose the patient referent for the nominative-marked second NP and the agent referent for the accusative-marked NP). In contrast, the bilingual children mapped the case marking directly to the target (i.e., they chose a patient referent upon hearing accusative case and an agent referent for nominative case). Using the same stimuli as Contemori et al. (2018), Hopp (2017) tested L1 German adult learners of English and found that intermediate learners show different interpretation and processing patterns than monolingual English children because the FL learners had difficulties using English morphosyntactic cues to assign an object interpretation. Taken together, these findings suggest that L1 effects may dictate a partially different course of development in sequential and late bilingual than in monolingual acquisition.

In sum, the few studies that compare bilingual and child L2 learners to monolingual children show broad parallels in terms of a general subject-over-object preference; yet they also point to specific differences in how bilingual children and FL adults use morphosyntactic cues for disambiguation (see also Cristante & Schimke, 2018).

Input differences in the child L2/3 acquisition of English syntax

Whereas the studies reviewed above compared group performance between monolingual and child bilingual learners, an increasing body of research investigates how individual differences among child L2 learners affect the acquisition of the target language (for review, see Chondrogianni, 2018; Unsworth, 2016b). Among these factors, effects of input have been identified as paramount (Paradis & Grüter, 2014). For instance, the development of morphology as well as syntax in both production and comprehension is affected by length of exposure, time in L2 schools, or amount of input in the L2 as measured in parental questionnaires (e.g., Chondrogianni & Marinis, 2011; Paradis, 2011; Paradis et al., 2017; Unsworth, 2016a, 2016b). In the present study, we operationalize differences in input as differences in school types, namely, regular schools with two English lessons per week and two types of partial immersion schools offering bilingual programmes, in which 50% and 70% of all lessons are held in English, respectively.

Input across different school types

As in many other countries, the number of schools offering bilingual programs in Germany is steadily increasing. Currently there are over 330 primary schools offering a bilingual program; this corresponds to approximately 2% of all (private and public) primary schools (FMKS, Verein für frühe Mehrsprachigkeit an Kindertageseinrichtungen und Schulen, 2014). Many studies have shown that

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

bilingual programs are particularly effective when they follow immersion principles, that is, if several school subjects (e.g., science, music, sports, arts, and maths) are taught exclusively in the FL (e.g., Pérez-Cañado, 2012). In Europe, the term CLIL (content and language integrated learning) is frequently used to refer to bilingual programs, ranging from "bilingual modules" in individual subjects to immersion programs, in which at least 50% of the curriculum is taught in an L2. The most intensive form of such programs are total immersion programmes in which all school subjects are taught in the L2 for several years, corresponding to 100% of the teaching time. In Germany, however, only partial-immersion programs are permitted, because the subject German always has to be taught in German (Kultusministerkonferenz, 2013), that is, the FL can be used as a medium of instruction in up to 70%–80% of the teaching time.

Therefore, immersion and regular (i.e., instructed) foreign language programs, differ regarding the type and intensity of FL input (e.g., Burmeister, 2006): in regular programs, the FL (e.g., English) is taught as a subject for the duration of one to two lessons per week in primary school, depending on the federal state in Germany. In such a context, the FL is usually taught by introducing several topics (such as colors, body parts, family, or school life; see, for example, Ministry of Education, Baden-Württemberg, 2016), often based on books designed for teaching English as a subject. In bilingual programs, however, English is the medium of instruction, that is, the focus is on learning subject matter (e.g., science, maths, etc.), and the teaching follows the curriculum for this particular subject.

The crucial difference between immersion and regular programs relates to their respective general aims (Burmeister, 2006): the focus of foreign language lessons in regular primary schools is on developing a positive attitude towards the new language and language learning as well as on language and cultural awareness. The lessons focus on fostering English listening and speaking skills; literacy skills receive less attention. After 4 years of primary school, the children should usually reach or approach level A1 (see, e.g., Ministry of Education, Baden-Württemberg, 2016) of the European Framework of References (Council of Europe, 2001). In immersion programs, by contrast, children experience English in a much more functional way, because the FL is not only used in age-appropriate relevant and authentic contexts but also embedded in subject matter. Therefore, all five skills (i.e., listening, speaking, reading, writing, and mediation) are subject to systematic instruction. At the end of primary school, many children reach level B1 in English reading and level A2 in English writing in immersion programs (e.g., Steinlen 2016, 2018).

L1 transfer and input

Against this backdrop, this study investigates how differences in input in the same time span of child FL acquisition affect early syntactic development of *wh*-questions and relative clauses. We concentrate on (a) input effects on L1 transfer and (b) input effects on convergence of the target language.

First, initial-state models of L1 transfer, such as the Full Transfer/Full Access model (Schwartz & Sprouse, 1996), propose that the L1 grammar transfers in full to the L2 initial state, and learners subsequently restructure their interlanguage

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

grammar on the basis of L2 input. According to this model, L1 effects should be most pronounced initially and increasing L2 input leads to gradual convergence on the target-language grammar. In contrast, developmental models of transfer hold that transfer of L1 syntax, such as verb-second, emerges only once learners have received sufficient input to overcome default or reduced syntactic representations due to processing limitations (e.g., Developmentally Moderated Transfer hypothesis; Pienemann, 2005; Organic Grammar; Vainikka & Young-Scholten, 2011).

Second, the amount of input affects the speed and degree of convergence on the target grammar in the child L2 acquisition of morphosyntax (Unsworth, 2016b). In the present study, we ask how differences in input affect convergence in qualitative and quantitative terms. In qualitative terms, monolingual children show a subject-first preference and earlier and higher accuracy on *wh*-questions than on relative clauses. Hence, we investigate whether similar acquisitional patterns arise in early FL development. In quantitative terms, we pursue the question whether nonimmersed FL learners can approximate monolingual levels of comprehension accuracy within the same time span as naturalistic child L2 learners who live in an L2 environment (Paradis & Jia, 2016). Several studies suggest that naturalistic child L2 learners take between 4 and 6 years of sustained exposure to reach similar levels as their monolingual peers (Hakuta, Goto Butler, & Witt, 2000; Saunders & O'Brien, 2006), with older learners demonstrating speedier initial learning (Paradis, 2011). However, some studies on grammatical development suggest that convergence on monolingual peers in morphosyntactic abilities may take longer than 6 years and may not happen until well into the teens (e.g., Jia & Fuse, 2007; Paradis, Tulpar, & Arppe, 2016).

Individual differences in the child L2/L3 acquisition of English syntax

In addition to effects of input, various additional linguistic, cognitive, and social factors affect early child L2 development (Paradis, 2011; Unsworth, 2016b). Often, these factors are grouped into child-external factors, such as input, parental education, and socioeconomic background and child-internal factors, such as age, knowledge and proficiency in the L1, working memory, phonological awareness, executive control, and other cognitive factors (Chondrogianni, 2018). Studying these factors may unearth profile effects in that certain child-internal or child-external factors affect different linguistic domains in different ways. For instance, vocabulary learning and the acquisition of inflection is more affected by input differences than, for example, syntactic or semantic development (e.g., Blom & Bosma, 2016; Chondrogianni & Marinis, 2011; Unsworth, 2016a). Paradis (2011) assessed child-external and child-internal predictors of vocabulary knowledge and finiteness marking in 169 English L2 children aged 4;10 years months to 7 years with a mean exposure to English of 20 months. In regression analyses, child-internal factors, that is, verbal short-term memory (nonword repetition), L1, and age, predicted a larger degree of variance than child-external factors such as length of exposure to English or richness of the English environment, that is, the amount of English activities at home. All of these factors contributed significantly to children's performance in morphosyntax. For *wh*-questions and

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

passives, Chondrogianni and Marinis (2011) report length of exposure, mother's English proficiency (*wh*-questions), and age of onset (passives) as significant predictors among L1 Turkish English learners aged 7;8 years. For complex syntax in L2 production, Paradis et al. (2017) find length of exposure, richness of the L2 environment at home, verbal working memory, and analytical reasoning scores as well as L2 vocabulary to be predictors of the amount of English sentences consisting of more than one clause. Finally, for the comprehension of *wh*-questions, Roesch and Chondrogianni (2016) report that both length of exposure and age of onset account for mastery of object-*wh* questions.

In sum, internal and external factors such as length of exposure, cognitive processing facility, as well as parental background measures predict syntactic development in child L2 learners. However, these findings are specific to naturalistic learners in an L2 environment where they additionally receive partial exposure to the L2 outside of school. Therefore, we ask whether a similar effect can be found in early nonimmersed FL acquisition. In this study, we investigate a wide variety of cognitive and linguistic factors, focusing on students at regular schools. In this subsample, we assess English skills in receptive and productive vocabulary as well as in receptive grammar. In addition, we examine possible effects of cognitive predictors (e.g., working memory, nonverbal IQ, and executive control) and phonological awareness. As linguistic predictors, we include productive vocabulary measures in all previously learned languages. Finally, we consider social factors (e.g., parental education), and personal factors (e.g., gender and age) to delineate the relative scope of internal versus external factors.

Research questions

We pose the following research questions:

1. How does L1 transfer affect early syntactic FL development of *wh*-questions and relative clauses?

We test whether child FL learners show effects of L1 German in their interpretation of *wh*-questions and relative clauses. For the sentence types investigated in this study (1 and 2), transfer predicts an interaction of order (i.e., subject vs. object orders) and structure (*wh*-questions vs. relative clauses), with subject *wh*-questions and object relative clauses presenting difficulty due to alternative parses being available by the L1 German grammar.

2. How does input quantity affect early syntactic FL development?

We assess the extent to which the groups of FL students in regular and partial-immersion schools show differences in their comprehension of questions and relative clauses. First, we assess whether differences in input across the different school types affect the degree to which L1 transfer occurs with *wh*-questions and relative clauses in English. Second, we investigate which groups demonstrate the same qualitative patterns as monolingual children, that is, main effects of order

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

and main effects of structure. We also assess whether and when early FL learners catch up with monolingual children in quantitative terms.

3. How do individual differences in linguistic, cognitive, and social factors affect early syntactic FL development?

Using the subsample of students at regular schools, we test which individual factors contribute to the target acquisition of *wh*-questions and relative clauses to identify whether similar child-internal and child-external factors predict acquisition in child FL as compared to child L2 acquisition.

The study

Participants

We tested 243 9- to 10-year-old German-dominant early FL learners of English in fourth grade at eight different regular and partial-immersion schools in Germany. In addition, we collected baseline data from 68 monolingual English children aged between 5 and 8 years from one primary school in the United Kingdom. The data were collected within the contexts of different larger research projects in Germany and the United Kingdom that partially used different measures of background factors.

Among the FL learners, there were 188 students at six regular German public schools, where they had been receiving two 45-min English-as-subject lessons per week since Grade 1. Monolingual students grew up speaking German only, and minority-language students acquired a heritage language other than German at home alongside German. In addition, 24 students at a public partial-immersion school were tested. At this school, approximately 50% of all lessons had been taught in English, starting in Grade 1. All teachers are certified English teachers with a diploma in bilingual teaching. Hence, we refer to this school as the IM-50 school. Finally, 31 students attending a private English-immersion school were tested. At this school, 70% of the teaching time is conducted in English from Grade 1 onward, including obligatory extracurricular activities, and the teachers are native English speakers. We refer to this school as the IM-70 school. Table 1 gives an overview of the student groups at the respective schools.

To compare the students in background characteristics across the different schools, we ran one-way Analyses of Variance on age, nonverbal intelligence, parental education and English proficiency (Test of the Reception of Grammar; TROG-2; see below). The groups did not differ significantly in age, $F\ (2,\ 238) = 0.198$; $p = .821$, or nonverbal intelligence, $F\ (2,\ 233) = 0.920$; $p = .400$. However, there was a significant between-group difference in parental education, $F\ (2,\ 179) = 4.355$; $p = .014$.[2] Post-hoc Tukey tests showed that the effect is attributable to the contrast between the group at regular and immersion schools, while the other groups were statistically indistinguishable. For English proficiency, which was tested by using the TROG-2 (Bishop, 2006), there were highly significant differences, $F\ (2,\ 232) = 81.316$; $p < .001$: the IM-70 students scored significantly higher than the other two groups, which were not different from each other.

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

Table 1. Descriptive statistics for FL students by school, with the tests described in the text below.

	Regular schools	IM-50 school	IM-70 school
N	188	24	31
Number of female students	103	11	16
Number of minority language students	102	13	11
Mean age in months (*SD*)	120.7 (5.7)	123.1 (7.9)	119.8 (4.7)
Mean nonverbal IQ (*SD*)	101.8 (15.2)	100.4 (23.7)	105.7 (11.9)
Mean parental education in years (*SD*)	11.6 (1.6)	12.1 (1.6)	12.7 (1.0)
Mean proficiency score (*SD*)	46.0 (10.16)	43.8 (9.0)	70.3 (3.8)

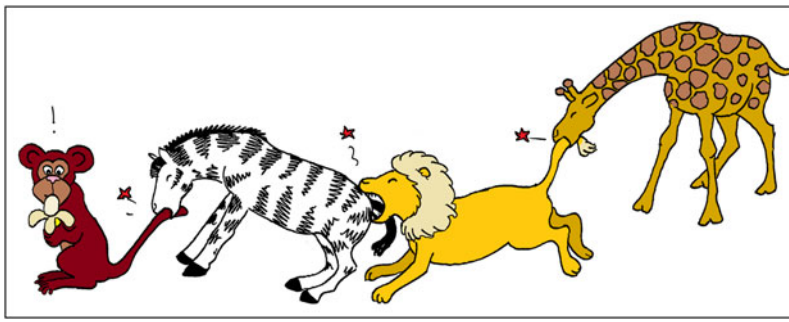

Figure 1. Example display for verb *bite*.

Tasks

Main task

The main task was a picture-selection task adapted from Rankin (2014). We constructed 10 quadruplets of sentences using the familiar verbs *bite* and *catch* as in (5). All questions began with the complex *wh*-noun phrase "which animal," and all relative clauses started with the NP "the animal."

(5) a. Which animal bites the lion?
b. Which animal does the lion bite?
c. The animal that bites the lion.
d. The animal that the lion bites.

These sentences were spread across five different display types, depicting four to five animals performing biting or catching events on each other (see Figure 1).

Each display type was paired with one *wh*-question, one relative clause, and one filler item.[3] Filler items comprised questions about location (e.g., *Which animal is behind/in front of the zebra?*) or easily identifiable events (e.g., *Which animal eats a banana?*). The sentences were distributed across two lists, with each child seeing 30 displays in total, that is, three times the display in Figure 1 and three times nine other displays.

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

Control tasks

All groups took the TROG-2 (Bishop, 2006) as a standardized test of receptive English proficiency in grammar. In addition, we tested nonverbal intelligence using the first part of the CFT-20R (CFT 20-R: Grundintelligenztest Skala 2; Weiß, 2006) for the students at regular schools and the Standard Progressive Matrices (Raven, 1976) for students at the immersion schools. Scores were transformed via age-appropriate *T* scores to a standardized scale. Parental education in years was measured in detailed parent questionnaires, collecting social, family, linguistic, and other background variables. As the experiment was embedded in different larger research projects, various additional tasks were administered to the respective groups. For the subset of students at regular schools, we also assessed phonological awareness in tasks testing phoneme manipulation in English (following Weber, Marx, & Schneider, 2007). Working memory was measured using forward digit span tasks (adapted from HAWIK-IV; Petermann & Petermann, 2008). Furthermore, executive function was assessed using the Simon Task (Simon, 1969). In addition, we tested productive vocabulary in English and in German in category fluency tasks (adapted from Delis, Kaplan, & Kramer, 2001). In this task, students named as many items as possible belonging to two semantic categories ("animals" and "food") within 1 min each, and a composite score was calculated as the mean of the two categories. In all projects, other data were collected for purposes not relevant to the current study, so that they will not be reported.

Procedure

The main experiment, the TROG, and the nonverbal IQ tests were administered in class. In the main experiment, the experimenter explained the task in German and answered questions. Students were given a booklet with the pictures corresponding to the sentences. They were told to circle the target animal that would be the answer to the question. A practice item preceded the experimental items, and a filler item initiated the 30 items. For each item, the experimenter first named all animals from left to right and then read the sentence twice at a slow pace. Students were not given any feedback, and the teachers ensured that students would not miss items or copy from each other. In all, the main experiment took approximately 25 min. The data for the other control tasks were collected in individual testing sessions.

Analysis

We excluded FL students who were bilingual with English as one of the languages ($n = 15$), 5 at regular schools, 3 at the IM-50 school, and 7 at the IM-70 school. For the remaining participants, responses to the items were coded for accuracy and type of mistakes. Based on performance on the filler items, we also excluded students who answered fewer than 5 of the 10 filler questions correctly, as these students likely did not pay attention to the task. This led to the exclusion of 35 additional FL students, all from regular schools. The remaining data set comprised 68 monolingual English children and 192 FL students. The data were analysed using mixed logistic regression modelling with *glmer* from the *lme4* package in *R Studio* (Bates, Maechler, Bolker, & Walker, 2015). Models were kept maximal in terms of the

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

Table 2. Comprehension accuracy in percentage for wh-questions: Monolingual English children, by age.

	Wh-questions					
	Subject			Object		
Age group	Target	O-interpretation	Other	Target	S-interpretation	Other
5 ($n = 19$)	93.7	5.3	1	89.5	1	9.5
6 ($n = 21$)	90.5	2.9	6.7	93.3	0	6.7
7 ($n = 22$)	97.3	0.9	1.8	98.2	0	1.8
8 ($n = 6$)	100	0	0	96.7	3.3	0

Table 3. Comprehension accuracy in percentage for relative clauses: Monolingual English children, by age.

	Relative clauses					
	Subject			Object		
Age group	Target	O-interpretation	Other	Target	S-interpretation	Other
5 ($n = 19$)	81.1	6.3	10.5	91.6	2.1	4.2
6 ($n = 21$)	87.6	5.7	6.7	83.8	3.8	11.4
7 ($n = 22$)	97.3	0.9	1.8	95.5	0.9	2.7
8 ($n = 6$)	100	0	0	96.7	3.3	0

random-effect structure. Where this maximal model did not converge, we first removed the by-item, and then the by-participant random slopes or, subsequently, random intercepts (following Barr, Levy, Scheepers, & Tily, 2013).

Results

We analysed the results for the monolingual and the FL students separately. For the English monolinguals, Table 2 shows the comprehension accuracy for wh-questions by age group, and Table 3 reports the comprehension accuracy for relative clauses.

For the monolingual students, we fitted a mixed linear logistic regression for Accuracy, with Order (subject vs. object) and Structure (*wh*-question vs. relative clause) as well as Age (as group) as fixed effects including their interactions. Participant and Item were included as crossed random factors with random intercepts and uncorrelated random slopes for Order and Structure. Due to convergence issues, we needed to remove the interaction of Order and Structure as random slopes. The final model (Table 4) returned only main effects of structure and age. Despite the overall high interpretation accuracy, comprehension accuracy improved with age, and relative clauses proved to be more difficult to understand than *wh*-questions.

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

Table 4. Mixed-effects logistic regression for monolingual students (n = 68).

Predictor	Parameter estimates		Wald's test	
Fixed effects	Estimate	Std. error	*z* value	Pr (>|*z*|)
(Intercept)	1.59	0.51	3.13	.002
Order	0.01	0.20	0.06	.954
Structure	–0.43	0.20	–2.13	.033
Age	0.88	0.22	4.05	<.001
Order × Structure	0.30	0.25	1.20	.23

In the following, we present the results of the FL students in three steps. First, we tested whether we find evidence of L1 effects. Second, we probed whether differences in input (i.e., type of school), affect the interpretation of questions and relative clauses, and third, we explored the impact of individual differences among the subgroup of students at regular schools.

First, to address the issue of L1 transfer effects, we tested for an interaction of order and structure, as recourse to German would predict lower accuracy on subject *wh*-questions and object relative clauses. We fitted a mixed-linear logistic regression for Accuracy, with Order, Structure, and Type of School as fixed effects (with regular schools as the reference) and Participant and Item as crossed random factors with random intercepts and uncorrelated random slopes for Order and Structure. Due to convergence issues, we needed to remove the interaction of Order and Structure as random slopes. The model that converged (see Table 5) showed main effects of Order, Structure, and Type of School, yet no significant interaction of Order and Structure. However, there was a marginal three-way interaction of Order, Structure, and Type of School. We also ran the models for the monolingual German students only to see whether the inclusion of students who speak a minority language at home on top of German changes the pattern of results (see Appendix A). The pattern of effects does not change, and in particular, there were no interactions of Order and Structure in the subsets of monolingual students either, so we continue to present the results for all students.

In a next step, we ran individual regressions by school type. For the regular schools, the model included the same random effect structure as above and School as an additional random intercept to control for effects of the six different schools among the students. The final model returned a highly significant main effect of Order, yet no effect of Structure or any interaction of the two (Table 5).

Figures 2 and 3 plot the interpretations of the sentences by condition for the students at regular schools showing the percentages of target responses, responses involving the other animal (i.e., object or subject), and other responses (i.e., the animal named in the question). As seen in both figures, subject orders receive significantly more target interpretations than object orders, which were predominantly interpreted as subject orders. This effect held equally for questions and relative clauses.

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

Table 5. Mixed-effects logistic regression for all FL students (n = 192) and by type of school.

Predictor	Parameter estimates		Wald's test	
Fixed effects	Estimate	Std. error	*z* value	Pr (>|*z*|)
All schools (*n* = 192)				
(Intercept)	−1.72	0.29	−5.85	<.001
Order	3.97	0.39	10.183	<.001
Structure	−0.40	0.28	−1.40	.160
Type of School_IM-50	1.92	0.45	4.23	<.001
Type of School_IM-70	4.11	0.53	7.72	<.001
Order × Structure	−0.01	0.31	−0.01	.993
Order × Type of School_IM-50	−1.51	0.73	−2.08	.038
Order × Type of School_IM-70	−2.27	0.81	−2.81	.005
Structure × Type of School_IM-50	1.20	0.45	2.69	.007
Structure × Type of School_IM-70	0.77	0.59	1.31	.191
Order × Structure × Type of School_IM-50	−1.02	0.71	−1.45	.148
Order × Structure × Type of School_IM-70	−1.47	0.84	−1.75	.080
Regular schools (*n* = 147)				
(Intercept)	−0.07	0.22	−0.30	.766
Order	−1.92	0.19	−10.19	<.001
Structure	0.01	0.01	0.07	.945
Order × Structure	−0.07	0.06	−1.31	.190
IM-50 school (*n* = 23)				
(Intercept)	0.18	0.47	0.38	.702
Order	2.45	0.85	2.90	.004
Structure	0.75	0.54	1.38	.170
Order × Structure	−1.29	0.80	−1.62	.110
IM-70 school (*n* = 24)				
(Intercept)	3.31	0.89	3.72	<.001
Order	−0.21	1.01	−0.21	.834
Structure	−0.17	1.05	−0.16	.872
Order × Structure	0.86	1.55	0.55	.580

For the IM-50 school, the same random effect structure was used, and only the main effect of Order was significant (Table 5). Figures 4 and 5 show that subject questions and relative clauses received mostly target interpretations, while target interpretations were around chance level for object orders.

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

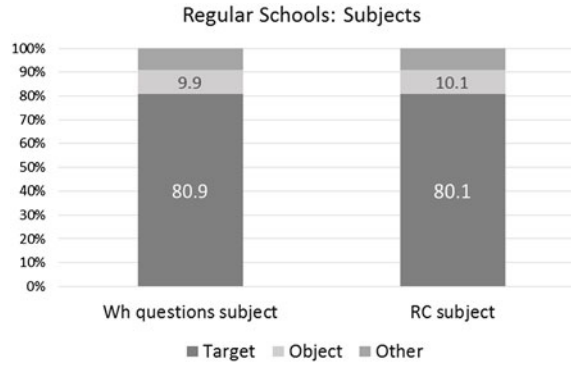

Figure 2. Interpretations of subject *wh*-questions and relative clauses: Students at regular schools ($n = 147$).

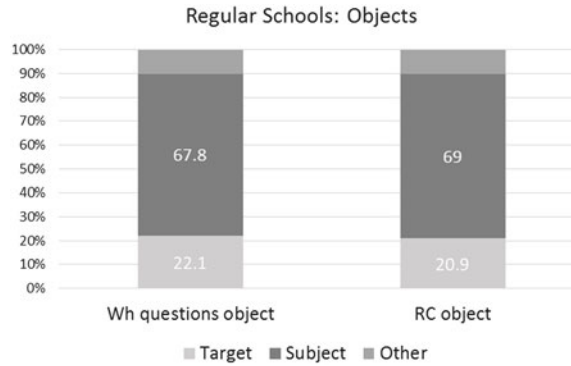

Figure 3. Interpretations of object *wh*-questions and relative clauses: Students at regular schools ($n = 147$).

Finally, the model for the IM-70 school (Table 5) did not return any significant effects. As Figures 6 and 7 show, interpretation accuracy was high for both subject and object orders and for both *wh*-questions and relative clauses.

In sum, both the overall and the by-group analyses reveal that neither the students at regular schools nor the students at the IM-50 school showed differences in the proportion of correct responses between the two structures. For both questions and relative clauses, they demonstrated a clear advantage for subject over object orders, with object orders being interpreted correctly below chance among students at regular schools or at chance among students at the IM-50 school. In contrast, the students at the IM-70 school had above-chance accuracy on object orders throughout, and object orders were interpreted as well as subject orders.

Second, we turn to effects of input. The significant effects of Type of School in the overall analysis (Table 5) demonstrate that students differed in their comprehension accuracy of*wh*-questions and relative clauses across schools. Overall, comprehension accuracy was highest in the IM-70 school. For the students at the IM-70 school, overall comprehension accuracy was comparable to that among 5- and 6-year-old monolingual children (Tables 2 and 3).

Moreover, there were qualitative differences in the effect structure of the monolingual children and all EFL students. The monolingual group demonstrated a significant effect of Structure (Table 4), indicating that relative clauses pose greater

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

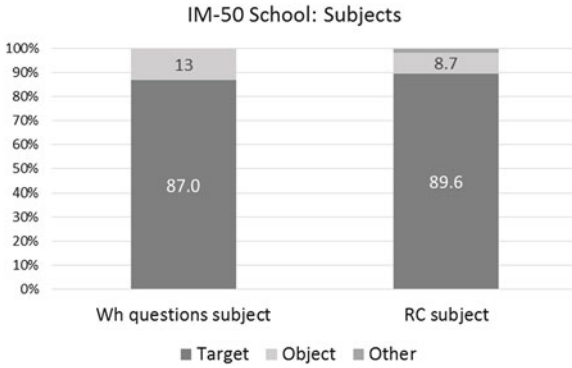

Figure 4. Interpretations of subject *wh*-questions and relative clauses: Students at IM-50 school ($n = 23$).

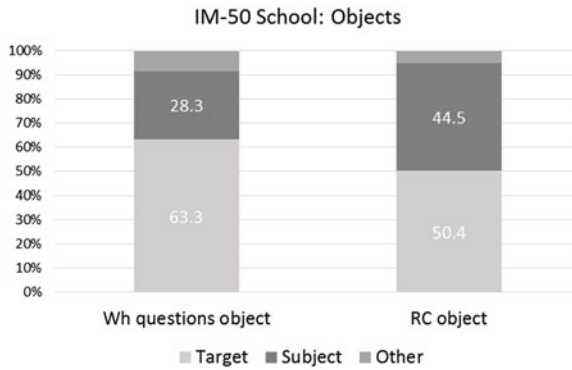

Figure 5. Interpretations of object *wh*-questions and relative clauses: Students at IM-50 school ($n = 23$).

difficulty than *wh*-questions. In contrast, the EFL students showed only main effects of Order. As Figures 2 through 7 illustrate, the schools predominantly differed in the comprehension accuracy of object orders, while comprehension accuracy for subject orders was universally high. These findings indicate that differences in amount of input predominantly affect the ability to assign an object interpretation in both *wh*-questions and relative clauses. None of the EFL groups showed a significant effect of Structure, which suggests that object orders are difficult to comprehend, irrespective of the constructions in which they appear.

Seeing that object orders present the greatest challenge to the FL learners, we finally assess the contributions of linguistic, cognitive, social, and individual factors underlying the students' ability to interpret object orders correctly. For this purpose, we focussed on students at regular schools, for whom a large variety of additional measures were available. We fitted mixed logistic regression models to the data with accuracy on object sentences as the dependent variable. Accuracy on object sentences ranged from 0% to 100%, so that there was substantial variability among the students. Fixed factors were age, sex, minority language, parental education, Condition (*wh*-questions vs. relative clauses), nonverbal IQ (CFT-R), phonological awareness, executive control (Simon Task), verbal working memory (digit span), and productive vocabulary in German and in English (fluency task; see earlier

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

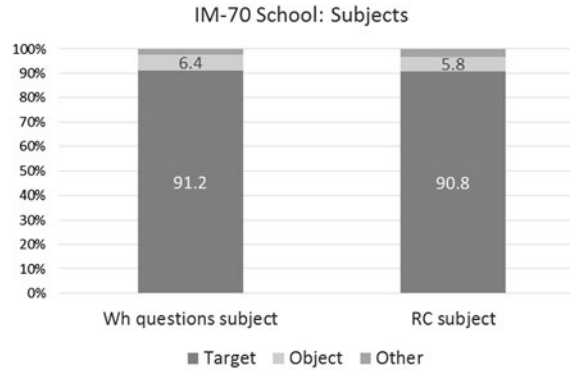

Figure 6. Interpretations of subject *wh*-questions and relative clauses: Students at IM-70 school ($n = 24$).

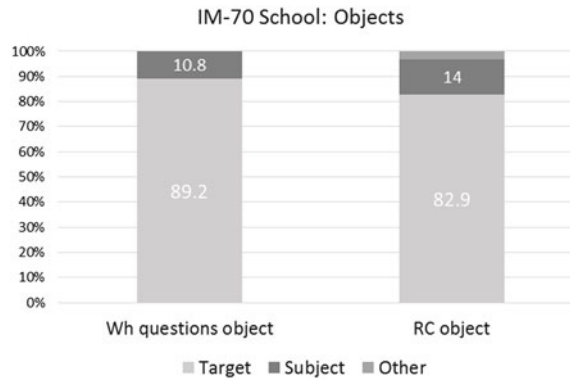

Figure 7. Interpretations of object *wh*-questions and relative clauses: Students at IM-70 school ($n = 24$).

section for task descriptions). Participant and Item were added as crossed and random intercepts with condition as random slopes for each. All continuous factors were scaled and centered, and collinearity was checked. Due to missing data for some factors in some participants, we could only use 112 of the 147 participants for nested model comparisons in order to determine the optimal model. We fitted the optimal model via forward fitting starting from the null model with the intercept only by running chi-square likelihood ratio tests. The optimal model in Table 6 that provided a significantly better fit than a reduced model ($\chi^2 = 5.8371$, $p = .016$) contained only one significant predictor variable, namely, phonological awareness. When added as an individual predictor to the null model, parental education also improved model fit significantly, but its inclusion on top of phonological awareness did not improve the model fit any further ($\chi^2 = 2.1068$, $p = .147$). None of the other factors acted as a significant predictor in any model or improved model fit.

Figure 8 plots the relation between phonological awareness and the sum of accurate object interpretations.

Discussion

In this study, we used a picture selection task to probe the interpretation of *wh*-questions and relative clauses among fourth-grade students at three different

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

Table 6. Mixed-effects logistic regression for FL students (n = 112) at regular schools.

Predictor	Parameter estimates		Wald's test	
Fixed effects	Estimate	Std. error	*z* value	Pr (>|*z*|)
(Intercept)	−1.9	0.26	−7.23	<.001
Phonological awareness	0.44	0.18	2.40	.016

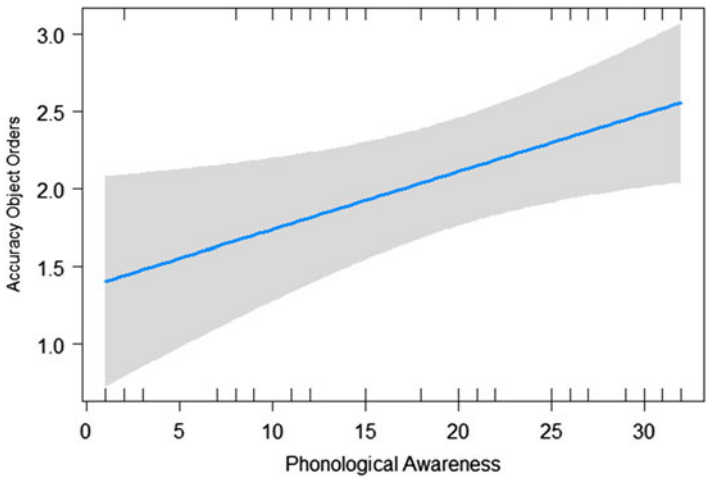

Figure 8. Relation between phonological awareness and accuracy on object orders (out of 10): Model output for students at regular schools ($n = 112$).

types of primary schools, namely, regular schools with two 45-minute lessons of EFL per week, partial-immersion schools with 50% of lessons held in English, and high immersion schools with 70% of lessons held in English.

For students across these schools, we first tested the extent to which L1 transfer affects the early foreign language development of complex syntax. If students made recourse to L1 German in their interpretation of English *wh*-questions and relative clauses, they should show an interaction of Order and Structure. Subject *wh*-questions and object relative clauses should be more difficult to comprehend than object questions and subject relative clauses, because the former can receive a competing parse using German syntax.

Neither overall nor in the by-group analyses did any interaction of Order and Structure emerge. Across schools, we found no evidence that the learners resort to their L1 syntax in interpreting questions and relative clauses. Instead, the groups at regular and partial-immersion (IM-50) schools demonstrated a strong and general preference for subject over object orders in both *wh*-questions and relative clauses, irrespective of whether these surface orders map onto a possible interpretation according to German syntax. In contrast, IM-70 school students had above-chance accuracy on subject and object orders, approximating the overall comprehension accuracy of 5- to 6-year-old monolingual children.

These patterns among early FL learners are different from those found in beginning adult FL learners (Grüter & Conradie, 2006) and intermediate to advanced FL learners (Rankin, 2014) who show effects of L1 transfer in the interpretation of

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

wh-questions. The lack of transfer effects in the regular school and the IM-50 students may be attributed to the effects of a blanket subject-first preference in the interpretation of *wh*-questions and relative clauses as in early monolingual acquisition (e.g., Roeper & de Villiers, 2011). As neither the regular students nor the IM-50 group showed effects of Structure, it appears that they did not differ in their interpretation accuracy between *wh*-questions and relative clauses; instead, they interpreted the first NP as the subject to the same extent in both types of structure. These findings are consistent with the Canonicity hypothesis (Friedmann & Novogrodsky, 2004), which also guides child L1 acquisition.

It may be argued that canonicity effects or a processing strategy favoring subject-first parses may overshadow possible effects of L1 transfer that counteract subject-first interpretations in *wh*-questions. In this respect, the IM-70 students provide critical evidence, as they had high comprehension accuracy for both object and subject orders, that is, they had overcome a subject-first preference. All the same, this group did not show any differences between conditions indicative of L1 influence. This finding suggests that L1 transfer does not surface even at more advanced stages of child L2 acquisition.[4] With respect to the interpretation of *wh*-questions and relative clauses, then, the results do not align with the expectations of initial-state models of transfer (Schwartz & Sprouse, 1996) or developmental models of transfer (Pienemann, 2005; Vainikka & Young-Scholten, 2011).

Second, we asked how differences in input would affect early FL development of complex syntax. Input differences were operationalized in terms of type of school. Effects of Type of School became highly significant, in particular for accuracy on object orders. Students at regular and IM-50 schools had below-chance and chance performance on object orders, respectively. This pattern held both for *wh*-questions, which are frequent in the classroom input and are subject to instruction in textbooks (e.g., Gerngross, Puchta, & Becker, 2014), and for relative clauses, which do not robustly occur in the input. For students at regular schools, the percentage of non-target subject answers for object orders was virtually the same as the amount of target answers for subject-initial orders. In other words, they do not use word order differences in English to establish interpretive differences. In contrast, the IM-50 group did make a difference between target interpretations of subject orders and non-target interpretations of object orders, suggesting that they develop sensitivity to word order differences in *wh*-questions and relative clauses. However, they failed to map object orders consistently to object interpretations. Finally, the students at the IM-70 school interpreted *wh*-questions and relative clauses at levels comparable to the monolingual children aged 5 and 6. Their results indicate that convergence on monolingual performance is possible within a few years of early FL learning provided learners continue to receive extensive English input. Previous studies on English L2 development suggested that the time it takes naturalistic English L2 learners to catch up with their monolingual peers ranges from 4 to 6 years (Hakuta et al., 2000; Paradis & Jia, 2016; Saunders & O'Brien, 2006). Our findings corroborate this time frame for EFL learners who have received 4 years of exposure to English in instructed high-immersion contexts (IM-70). Further, they underscore that child L2 learners need overall less time than monolingual children to acquire complex syntax (Paradis et al., 2017; Tracy & Thoma, 2009),

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

and they illustrate that partial immersion schooling can yield comparable gains in syntactic development as naturalistic L2 acquisition.

In a third step, we investigated the degree to which individual differences in age, gender, socioeconomic background, and linguistic and cognitive factors affect accuracy on English object orders, using the sample of students at regular schools. The regression analysis found only phonological awareness to be significantly related to students' ability to interpret object orders correctly. In addition, parental education made an individual contribution to accuracy.

For effects of parental education, the findings resemble the results on the comprehension of passives and *wh*-questions among naturalistic child L2 learners of English in Chondrogianni and Marinis (2011). In their study, family factors, such as socioeconomic status and proficiency in English as well as length of exposure predicted performance on English syntax as measured in the TROG. Positive effects of maternal education were also found for the comprehension of complex paragraphs among L1 Chinese L2 English learners in Paradis and Jia (2016; but see Paradis et al., 2017, for syntactic production).

For phonological awareness, the present study echoes results from Farnia and Geva (2011), who report positive associations between phonological awareness and child L2 English vocabulary. For the present study, it may be argued that the ability measured in phonological awareness tasks to manipulate words irrespective of their meaning taps into combinatorial skills that are similar to those implicated in the revision of a subject-first preference in *wh*-questions and relative clauses in sentence comprehension. In both tasks, participants need to override a predominant interpretation and construct a novel structure. Further, the child L2 comprehension of non-canonical word orders has been linked to the development of cognitive control (Cristante & Schimke, 2018). In adult monolingual and bilingual sentence processing, success in recovering from garden-paths is associated with cognitive control ability (e.g., Woodard, Pozzan, & Trueswell, 2016). In the present study, the Simon score for executive control did not contribute to accuracy on object orders, such that there was no direct indication that aspects of cognitive control modulate syntactic development. However, these effects may be task specific, and in light of the poor correlations between various tests of executive control (e.g., Paap & Greenberg, 2013), other measures of cognitive control may have acted as significant predictors.

In other respects, though, the effect structure of individual differences differed from those found in previous studies. Partially, discrepancies likely reflect the different variables assessed across studies; yet they may also point to differences between modalities and domains. For instance, Paradis et al. (2017) found L2 vocabulary, verbal memory, and analytical reasoning to be relevant predictors in the production of complex clauses in child L2 English. For our students at regular schools, productive English vocabulary correlated significantly with receptive grammatical skills as measured in the TROG. However, such correlations did not extend to complex syntax, as even bivariate correlations between productive English vocabulary and accuracy on object orders were rather weak, $r\,(114) = .308$. Such an asymmetry between studies may point to differences between production and comprehension in that sentence planning implicates different skills than

https://doi.org/10.1017/S0142716419000249 Published online by Cambridge University Press

interpretation. These findings also suggest profile effects for different domains in that lexical and syntactic development are dissociable in language comprehension in early FL and L2 contexts (see also Chondrogianni & Marinis, 2011; Unsworth, 2016a).

Needless to say, the present study has a number of limitations. First, it would have been interesting to include younger monolingual children to assess whether children younger than 5 years show similar interpretation patterns as the students at regular and IM-50 schools. Second, it would be desirable to test for a large set of individual differences also among the immersion FL students and to include early FL learners from a different L1 background to see whether the developmental patterns in early FL learning of complex syntax generalize across L1 backgrounds. Future research should also aim to test students at later points of developments (i.e. in secondary school), in order to determine whether and at which point students at regular or IM-50 schools catch up in syntactic development (Paradis & Jia, 2016).

In conclusion, this study systematically investigated how L1 effects, input, and individual differences affect early FL syntactic development in children with the same ages of onset and the same lengths of exposure at different schools. We found systematic differences between early and late FL acquisition and similarities between child FL and child L2 acquisition. Unlike in adult FL acquisition, early FL learners do not demonstrate L1 transfer effects in the interpretation of *wh*-questions and relative clauses. Moreover, sufficient input allows FL children in high immersion schools to reach monolingual levels of comprehension within 4 years, while adult FL acquisition remains non-target-like even after considerably longer exposure to these structures (Rankin, 2014). Hence, early FL acquisition appears different from late acquisition both in quality regarding cross-linguistic influence and in the speed of acquisition. Finally, as was also found for naturalistic child L2 learners, parental education and phonological awareness affect the acquisition of early FL syntax. Taken together, these similarities in speed and contributing factors between child FL and child L2 acquisition suggest that early FL and child L2 acquisition proceed along comparable lines.

Acknowledgments. We would like to thank Tom Rankin for allowing us to use pictures from his previous studies, and we thank Teresa Kieseier, Lea Pöschik, and our research assistants for help with data collection. We are indebted to Anke Lenzing, the audience at EUROSLA 28 in Münster, and four anonymous reviewers for helpful comments. Part of the research was funded by the German Federal Ministry for Education and Research (BMBF) as part of the research initiative "Sprachliche Bildung und Mehrsprachigkeit" (FKZ 01JM1401; 2014–2017).

Notes

1. In this paper, we make a difference between (instructed) FL learners who acquire the L2 in an educational setting in a non-L2-environment, on the one hand, and (naturalistic) L2 learners who acquire the L2 in an L2-immersion context, on the other.

2. Note that the differences in parental education between groups for the subset of participants whose data were analysed in the experiment were not significant, $F\ (2,\ 144) = 2.496$; $p = .086$.

3. In English, the use of the progressive form would be more appropriate when describing the events depicted in the pictures. However, the textbooks and instruction for the students at regular schools do not go beyond the present simple, so that we decided to use sentences in present simple, as did the studies on adult FL of English (Rankin, 2013, 2014).

4. Alternatively, due to the relatively high amount of daily exposure to English, German may have had too low activation levels for effects of L1 transfer to surface in the IM-70 groups. In any case, the low amount of non-target L1 effects in the highly immersed learners mirrors findings from adult L2 acquisition that immersion experience may attenuate non-target L2 processing and L1 transfer (e.g., Pliatsikas & Marinis, 2013).

References

Adani, F. (2011). Rethinking the acquisition of relative clauses in Italian: Towards a grammatically based account. *Journal of Child Language*, **38**, 141–165.

Adani, F., van der Lely, H., Forgiarini, M., & Guasti, M. T. (2010). Grammatical feature dissimilarities make relative clauses easier: A comprehension study with Italian children. *Lingua*, **120**, 2148–2166.

Avrutin, S. (2000). Comprehension of discourse-linked and non-discourse-linked questions by children and Broca's aphasics. In Y. Grodzinsky, L. Shapiro, and D. Swinney (Eds.), *Language and the brain: Representation and processing* (pp. 295–313). San Diego: Academic Press.

Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language*, **68**, 255–278.

Bates, D., Maechler, D., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, **67**, 1–48.

Bishop, D. V. M. (2006). *Test for Reception of Grammar: TROG-2: Manual (Version 2)*. London: Pearson.

Blom, W. B. T., & Bosma, E. (2016). The sooner the better? An investigation into the role of age of onset and its relation with transfer and exposure in bilingual Frisian-Dutch children. *Journal of Child Language*, **43**, 581–607.

Burmeister, P. (2006). Immersion und Sprachunterricht im Vergleich. In M. Pienemann, J.-U. Keßler, and E. Roos (Eds.), *Englischerwerb in der Grundschule. Ein Studien- und Arbeitsbuch* (pp. 197–216). Paderborn: Schöningh/UTB.

Chomsky, N. (1981). *Lectures on government and binding: The Pisa lectures*. Holland: Foris Publications.

Chondrogianni, V. (2018). Child L2 acquisition. In F. Bayram, D. Miller, J. Rothman, & L. Serratrice (Eds.), *Bilingual cognition and language: The state of the science across its subfields* (pp. 103–126). Amsterdam: Benjamins.

Chondrogianni, V., & Marinis, T. (2011). Differential effects of internal and external factors on the development of vocabulary, tense morphology and morpho-syntax in successive bilingual children. *Linguistic Approaches to Bilingualism*, **1**, 318–342.

Contemori, C., Carlson, M., & Marinis, T. (2018). On-line processing of English which-questions by children and adults: A visual world paradigm study. *Journal of Child Language*, **45**, 415–441.

Contemori, C., & Marinis, T. (2014). The impact of number mismatch and passives on the real-time processing of relative clauses. *Journal of Child Language*, **41**, 658–689.

Correa, L. M. (1995). An alternative assessment of children's comprehension of relative clauses. *Journal of Psycholinguistic Research*, **24**, 183–203.

Council of Europe. (2001). *Common European Framework of Reference for Languages: Learning, teaching and assessment*. Strasbourg: Language Policy Unit.

Cristante, V., & Schimke, S. (2018). Verarbeitung von Passiv- und OVS-Sätzen bei Kindern mit Deutsch als früher L2. In S. Schimke & H. Hopp (Eds.), *Sprachverarbeitung im Zweitspracherwerb* (pp. 169–194). Berlin: De Gruyter.

Delis, D. C., Kaplan, E., & Kramer, J. H. (2001). *Delis-Kaplan Executive Function System (D-KEFS)*. San Antonio, TX: Psychological Corporation.

den Besten, H. (1983). On the interaction of root transformations and lexical deletive rules. In W. Abraham (Ed.), *On the formal syntax of the Westgermania: Papers from the 3rd Groningen Grammar Talks* (pp. 155–216). Amsterdam: Benjamins.

De Villiers, J., Tager-Flusberg, P., Hakuta, K., & Cohen, M. (1979). Children's comprehension of relative clauses. *Journal of Psycholinguistic Research*, **17**, 57–64.

De Vincenzi, M. (1991). *Syntactic parsing strategies in Italian*. Dordrecht: Kluwer.

De Vincenzi, M., Arduino, L. S., Ciccarelli, L., & Job, R. (1999). Parsing strategies in children: Comprehension of interrogative sentences. In S. Bagnara (Ed.), *Proceedings of the European Conference on Cognitive Science* (pp. 301–308). Rome: Instituto di Psicologia del CNR.

Durrleman, S., Marinis, T., & Franck, J. (2016). Syntactic complexity in the comprehension of wh-questions and relative clauses in typical language development and autism. *Applied Psycholinguistics*, **37**, 1501–1527.

Farnia, F., & Geva, E. (2011). Cognitive correlates of vocabulary growth in English language learners. *Applied Psycholinguistics*, **32**, 711–738.

Flege, J. E., Yeni-Komshian, G., & Liu, H. (1999). Age constraints on second language acquisition. *Journal of Memory & Language*, **41**, 78–104.

FMKS, **Verein für frühe Mehrsprachigkeit an Kitas und Schulen** (2014). *Ranking: Bilinguale Kitas und Grundschulen im Bundesvergleich*. Retrieved from http://www.fmks-online.de/download.html

Friedmann, N., Belletti, A., & Rizzi, L. (2009). Relativized relatives: Types of intervention in the acquisition of A-bar dependencies. *Lingua*, **119**, 67–88.

Friedmann, N., & Novogrodsky, R. (2004). The acquisition of relative clause comprehension in Hebrew: A study of SLI and normal development. *Journal of Child Language*, **31**, 661–681.

Friedmann, N., & Novogrodsky, R. (2011). Which questions are most difficult to understand? The comprehension of wh-questions in three subtypes of SLI. *Lingua*, **121**, 367–382.

Gerngross, G., Puchta, H., & Becker, C. (2014). *Playway 4*. Berlin: Klett.

Goodluck, H. (2005). D(iscourse)-linking and question formation: Comprehension effects in children and Broca's aphasics. In A. M. Di Sciullo (Ed.), *UG and external systems: Language, brain and computation* (pp. 185–192). Amsterdam: Benjamins.

Grüter, T. (2006). Another take on the L2 initial state: Evidence from comprehension in L2 German. *Language Acquisition*, **13**, 287–317.

Grüter, T., & Conradie, S. (2006). Investigating the L2 initial state. Additional evidence from the production and comprehension of Afrikaans-speaking learners of German. In R. Slabakova, S. A. Montrul, and P. Prévost (Eds.), *Inquiries in linguistic development: In honor of Lydia White* (pp. 89–114). Amsterdam: Benjamins.

Guasti, M. T., Branchini, C., & Arosio, F. (2012). Interference in the production of Italian subject and object wh-questions. *Applied Psycholinguistics*, **33**, 185–223.

Haberzettl, S. (2005). *Der Erwerb der Verbstellungsregeln in der Zweitsprache Deutsch durch Kinder mit russischer und türkischer Muttersprache*. Tübingen: Niemeyer.

Hakuta, K., Goto Butler, Y., & Witt, D. (2000). *How long does it take English learners to attain proficiency? (Policy Report)*. Stanford, CA: University of California Linguistic Minority Research Institute. Retrieved from http://www.stanford.edu/~hakuta/

Haznedar, B. (2001). The acquisition of the IP system in child L2 acquisition. *Studies in Second Language Acquisition*, **23**, 1–39.

Hopp, H. (2017). The processing of English which-questions in adult L2 learners: Effects of L1 transfer and proficiency. *Zeitschrift für Sprachwissenschaft*, **36**, 107–134.

Jia, G., & Fuse, A. (2007). Acquisition of English grammatical morphology by native Mandarin-speaking children and adolescents. *Journal of Speech, Language and Hearing Research*, **50**, 1280–1299.

Kaan, E., Ballantyne, J. C., & Wijnen, F. (2015). Effects of reading speed on second-language sentence processing. *Applied Psycholinguistics*, **36**, 799–830.

Kaltenbacher, M. (2001). *Universal grammar and parameter resetting in second language acquisition*. Frankfurt am Main: Lang.

Kultusministerkonferenz. (2013). *Konzepte für den bilingualen Unterricht– Erfahrungsbericht und Vorschläge zur Weiterentwicklung*. Retrieved from http://www.kmk.org/fileadmin/veroeffentlichungen_beschluesse/2013/201_10_17-Konzepte-_bilingualer-_Unterricht.pdf

Meisel, J. (2009). Second language acquisition in early childhood. *Zeitschrift für Sprachwissenschaft*, **28**, 5–34.

Ministry of Education, Baden-Württemberg. (2016). *Bildungsstandards für Englisch Grundschule: Klassen 2, 4*. Retrieved from http://www.bildung-staerkt-menschen.de/service/downloads/Bildungsstandards/GS/GS_E_bs.pdf

Paap, K. R., & Greenberg, Z. I. (2013). There is no coherent evidence for a bilingual advantage in executive processing. *Cognitive Psychology*, **66**, 232–258.

Paradis, J. (2011). Individual differences in child English second language acquisition: Comparing child-internal and child-external factors. *Linguistic Approaches to Bilingualism*, **1**, 213–237.

Paradis, J., & Grüter, T. (2014). Introduction to "input and experience in bilingual development." In T. Grüter, and J. Paradis (Eds.), *Input and experience in bilingual development* (pp. 1–14). Amsterdam: Benjamins.

Paradis, J., & Jia, R. (2016). Bilingual children's long-term outcomes in English as a second language and sources of individual differences in their rate of English development. *Developmental Science*, **20**, e12433.

Paradis, J., Rusk, B., Duncan, T. S., & Govindarajan, K. (2017). Children's second language acquisition of English complex syntax: The role of age, input, and cognitive factors. *Annual Review of Applied Linguistics*, **67**, 1–20.

Paradis, J., Tulpar, Y., & Arppe, A. (2016). Chinese L1 children's English L2 verb morphology over time: Individual variation in long-term outcomes. *Journal of Child Language*, **43**, 553–580.

Pérez-Cañado, M. L. (2012). CLIL research in Europe: Past, present and future. *International Journal of Bilingual Education and Bilingualism*, **15**, 315–341.

Petermann, F., & Petermann, U. (2008). HAWIK-IV. *Kindheit und Entwicklung*, **17**, 71–75.

Pienemann, M. (2005). *Cross-linguistic aspects of processability theory*. Amsterdam: Benjamins.

Pliatsikas, C., & Marinis, T. (2013). Processing empty categories in a second language: When naturalistic exposure fills the (intermediate) gap. *Bilingualism: Language and Cognition*, **16**, 167–182.

Rankin, T. (2012). The transfer of V2: Inversion and negation by German and Dutch learners of English. *International Journal of Bilingualism*, **16**, 139–158.

Rankin, T. (2013). Competing grammars in the comprehension of questions and relative clauses in L1 German-L2 English. In J. Cabrelli Amaro, T. Judy, & D. Pascual y Cabo (Eds.), *Proceedings of the 12th Generative Approaches to Second Language Acquisition Conference (GASLA 2013)* (pp. 170–179). Somerville, MA: Cascadilla Proceedings Project.

Rankin, T. (2014). Variational learning in L2: The transfer of L1 syntax and parsing strategies in the interpretation of wh-questions by L1 German learners of L2 English. *Linguistic Approaches to Bilingualism*, **4**, 432–461.

Raven, J. C. (1976). *SPM. Standard Progressive Matrices*. San Antonio, TX: Pearsons.

Robertson, D., & Sorace, A. (1999). Losing the V2 constraint. In E. C. Klein & G. Martohardjono (Eds.), *The development of second language grammars: A generative approach* (pp. 317–361). Amsterdam: Benjamins.

Roeper, T., & de Villiers, J. (2011). The acquisition path for wh-questions. In J. De Villiers, and T. Roeper (Eds.), *Handbook of generative approaches to language acquisition* (pp. 189–246). Berlin: Springer.

Roesch, A. D., & Chondrogianni, V. (2016). "Which mouse kissed the frog?" Effects of age of onset, length of exposure, and knowledge of case marking on the comprehension of wh-questions in German-speaking simultaneous and early sequential bilingual children. *Journal of Child Language*, **43**, 635–661.

Sağin-Şimşek, Ç. (2006). *Third language acquisition: Turkish-German bilingual students' acquisition of English word order in a German educational setting*. Münster, NY: Waxmann.

Sánchez, L. (2011). Luisa and Pedrito's dog will the breakfast eat: Interlanguage transfer and the role of the second language factor. In G. De Angelis & J.-M. Dewaele (Eds.), *New trends in crosslinguistic influence and multilingualism research* (pp. 86–104). Bristol: Multilingual Matters.

Saunders, W., & O'Brien, G. (2006). Oral language. In F. Genesee, K. Lindholm-Leary, W. Saunders, D. Christian (Eds.), *Educating English language learners: A synthesis of research evidence* (pp. 14–63). Cambridge: Cambridge University Press.

Schwartz, B. D. (2009). Unraveling inflection in child L2 development. *Acquisition et interaction en langue étrangère*, **1**, 63–83.

Schwartz, B. D., & Sprouse, R. A. (1996). L2 cognitive states and the Full Transfer/Full Access model. *Second Language Research*, **12**, 40–72.

Simon, J. R. (1969). Reactions toward the source of stimulation. *Journal of Experimental Psychology*, **81**, 174–176.

Steinlen, A. K. (2016). Primary school minority and majority language children in a partial immersion program: The development of German and English reading skills. *Journal of Immersion and Content-Based Language Education*, **4**, 198–224.

Steinlen, A. K. (2018). The development of English and German writing skills in a bilingual primary school in Germany. *Journal of Second Language Writing*, **39**, 42–52.

Thoma, D., & Tracy, R. (2006). Deutsch als frühe Zweitsprache: zweite Erstsprache? In B. Ahrenholz (Ed.), *Kinder mit Migrationshintergrund: Spracherwerb und Fördermöglichkeiten* (pp. 58–79). Freiburg: Fillibach.

Tracy, R., & Thoma, D. (2009). Convergence on finite V2 clauses in L1, bilingual L1 and early L2 acquisition. In P. Jordens, and C. Dimroth (Eds.), *Functional categories in learner language* (pp. 1–43). Berlin: de Gruyter.

Unsworth, S. (2005). *Child L2, adult L2, child L1: Differences and similarities—A study on the acquisition of direct object scrambling in Dutch* (Unpublished PhD thesis, Utrecht University, The Netherlands).

Unsworth, S. (2016a). Early child L2 acquisition: Age or input effects? Neither, or both? *Journal of Child Language*, **43**, 608–634.

Unsworth, S. (2016b). Quantity and quality of language input in bilingual language development. In E. Nicoladis, and S. Montanari (Eds.), *Lifespan perspectives on bilingualism* (pp. 136–196). Berlin: de Gruyter.

Vainikka, A., & Young-Scholten, M. (2011). *The acquisition of German: Introducing organic grammar*. Berlin: de Gruyter.

Weber, J., Marx, P., & Schneider, W. (2007). Die Prävention von Lese-Rechtschreibschwierigkeiten bei Kindern mit nichtdeutscher Herkunftssprache durch ein Training der phonologischen Bewusstheit. *Zeitschrift für Pädagogische Psychologie*, **21**, 65–75.

Weigl, W. (1999). Die Verbposition im Englisch deutscher Gymnasiasten. *Beitraege zur Fremsprachenvermittlung*, **36**, 25–41.

Weiß, R. (2006). *CFT 20-R: Grundintelligenztest Skala 2. Manual*. Göttingen: Hogrefe Verlag.

Wesche, M. B. (2002). Early French immersion: How has the original Canadian model stood the test of time? In P. Burmeister, T. Piske & A. Rohde (Eds.), *An integrated view of language development* (pp. 357–379). Trier: WVT.

Woodard, K., Pozzan, L., & Trueswell, J. (2016). Taking your own path: Individual differences in executive function and language processing skills in child learners. *Journal of Experimental Child Psychology*, **141**, 187–209.

APPENDIX A

Table A.1. Mixed-effects logistic regression for all monolingual German-speaking FL students (n = 105) and by type of school.

	Parameter estimates		Wald's test	
Fixed effects	Estimate	Std. error	*z* value	Pr (>|z|)
All schools (*n* = 105)				
(Intercept)	−1.75	0.33	−5.326	<.001
Order	3.90	0.46	8.482	<.001
Structure	−0.14	0.30	0.456	.648
Type of School_IM-50	2.31	0.59	3.901	<.001
Type of School_IM-70	3.90	0.59	6.632	<.001
Order × Structure	−0.14	0.43	0.331	.740
Order × Type of School_IM-50	−1.12	1.01	−1.108	.268
Order × Type of School_IM-70	−2.40	0.90	−2.665	.008
Structure × Type of School_IM-50	1.48	0.65	2.268	.023
Structure × Type of School_IM-70	0.63	0.69	0.914	.361
Order × Structure × Type of School_IM-50	−1.31	1.13	−1.163	.245
Order × Structure × Type of School_IM-70	−0.80	1.03	0.78	.440
Regular schools (*n* = 75)				
(Intercept)	−1.69	0.34	−4.962	<.001
Order	4.15	0.54	7.647	<.001
Structure	−0.20	0.30	−0.641	.522
Order × Structure	−0.30	0.43	−0.701	.483
IM-50 school (*n* = 11)				
(Intercept)	0.58	0.45	1.30	.194
Order	2.86	1.25	2.29	.022
Structure	0.92	0.60	1.54	.124
Order × Structure	−0.56	1.14	−0.487	.626
IM-70 school (*n* = 19)				
(Intercept)	3.44	1.18	2.92	.004
Order	0.01	1.19	0.008	.994
Structure	0.01	1.36	0.004	.997
Order × Structure	0.62	1.75	0.35	.720

Cite this article: Hopp H., Steinlen A., Schelletter C., and Piske T. (2019). Syntactic development in early foreign language learning: Effects of L1 transfer, input, and individual factors. *Applied Psycholinguistics* **40**, 1241–1267. https://doi.org/10.1017/S0142716419000249