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ARTICLE

The impact of internal and external factors across language domains and features in sequential bilingual acquisition

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Abstract

Factors which impact bilingual language development can often interact with different language features. The current study teases apart the impact of internal and external factors (chronological age, length of exposure, L2 richness, L2 use at home, maternal education and maternal L2 proficiency) across linguistic domains and features (vocabulary, morphology and syntax). Participants were 40 Arabic-speaking sequential bilinguals acquiring English (5;7-12;2, M = 8;4). Length of exposure predicted vocabulary and morphology, while chronological age predicted syntax. L2 richness also predicted vocabulary and syntax, although the impact on syntax was selective across structures. This split between syntax on the one hand, and vocabulary and morphology on the other, reflects the more embedded properties of the former; this contrasts with vocabulary and morphology, where transfer from the L1 and L2 may be more strongly dependent on the availability of shared forms across languages. Further implications are considered for sequential bilinguals in education contexts.

Keywords: individual difference factors; sequential bilingualism; vocabulary; morphosyntax

A key consideration in bilingual language acquisition is the extent to which individual difference factors impact linguistic development. These factors may be categorised as internal or external to the individual (Paradis, 2011; Unsworth et al., 2011): internal factors include biological and cognitive elements like chronological age and age of second language (L2) onset (Paradis, 2007, 2011; Chondrogianni & Marinis, 2011), while external factors involve the environmental context of language input. This experience may be further categorised based on quantity and quality of language exposure from both proximal (direct) and distal (indirect) sources across various settings such as at home, school, and participation in social activities (Paradis, 2007, 2011).

Investigating the impact of different factors on bilingual language acquisition is a challenging task as the factors can often co-vary with each other, or they can interact in different ways with different language features, the first language (L1), or even the language assessment itself. Variation in these elements has produced mixed results for

a range of factors. For example, age is purported to be a key predictor of language proficiency in bilingualism. This has been shown in relation to a younger age of onset advantage where those who began exposure to the L2 earlier were more proficient in comparison to those who began exposure at later ages (e.g., Johnson & Newport, 1989). Conversely, age effects have also been found in relation to older chronological age whereby older participants have been shown to have greater linguistic proficiency (e.g., Paradis, 2011; Paradis et al., 2017; Snow & Hoefnagel-Hohle, 1978). However, results are more mixed for more fine-grained measures of L2 input (e.g., de Cat, 2020; Jia & Fuse, 2007; Paradis et al., 2017; Roesch & Chondrogianni, 2016; Unsworth, 2016), and for distal input factors like socio-economic status (e.g., Armon-Lotem et al., 2011; Paradis et al., 2017; but see Bohman et al., 2010; Sorenson Duncan & Paradis, 2020).

In this paper we aim to tease apart the relationship between different factors and L2 outcomes across a number of specific linguistic domains, via regression analyses. We will do this by using both standardised expressive tests of language proficiency and a novel experimental task to evaluate language comprehension by sequential bilingual children from Arabic speaking backgrounds. The key finding is that sequential bilingual children's L2 vocabulary and morphological proficiency is predicted by (overall L2) input, while L2 syntax is predicted by the children's age. This result reflects the fact that age is a cumulative measure of experience in both the L1 and the L2 and the development of general cognitive processes; we argue that this result confirms the deeper properties of syntactic knowledge.

Individual Difference Factors

A number of individual difference factors have been examined in previous research (e.g., Armon-Lotem et al., 2011; Chondrogianni & Marinis, 2011; de Cat, 2020; Jia & Fuse, 2007; Paradis, 2011; Paradis et al., 2017; Roesch & Chondrogianni, 2016; Unsworth, 2016). Below, we begin by reviewing key biological, cognitive and environmental effects discussed in the literature: in particular we focus on age, language exposure, socio-economic status and maternal L2 proficiency.

Internal Factors

One of the most commonly measured but controversial internal factors in bilingual language acquisition research is age. In research on bilingualism, the influence of age is typically measured in one of two ways: (1) from the time at which data collection occurs, often referred to as AGE AT TIME OF TESTING or CHRONOLOGICAL AGE; and (2) from the point of first meaningful exposure to the target language, commonly referred to as AGE OF L2 ONSET. Both types of measurement can provide unique and inter-related influences on how language acquisition manifests (Chondrogianni & Marinis, 2011).

Chronological Age

Chronological age can impart insights on the cumulative impact of external experience and internal development: for bilingual acquisition, this includes language experience from both the L1 and the L2, as well as the biological development of cognitive capacities. Among others, these capacities include memory, attention, analytic reasoning, executive control and metalinguistic awareness, all of which play a role in language acquisition and

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processing (e.g., De Villiers, 2007; Harley & Hart, 1997; Long & Rothman, 2014; Paradis, 2011; Paradis et al., 2017; Szmalec et al., 2012; Tsimpli, 2014). As a result, older age predicts greater proficiency in the L1 (S. Gathercole & Baddeley, 1993; Stevens, 2006).

With the later introduction of the L2, this development occurs on a different timescale (Blom & Paradis, 2015; S. Gathercole, 1999, 2006; Paradis, 2011). Nonetheless, the greater cognitive development of older L2 children licenses higher ability of the cognitive properties which constrain perception and memory, consequently facilitating an advancement in processing language (Cummins, 1981). The more advanced cognitive development of older L2 learners is associated with the faster development of linguistic proficiency in the initial stages of L2 acquisition, also known as the rate advantage. Children at older ages also have more experience with language in general through familiarity and involvement with their native language which may facilitate particular L2 conceptual-lexical mappings if these have already been established in the L1 (Paradis, 2007).

In previous studies, age effects have varied across language domains. For example, vocabulary is consistently predicted by age, with more advanced lexical development in older bilingual children (e.g., Blom & Bosma, 2016; Paradis, 2011; Snow & Hoefnagel-Hohle, 1978; Unsworth, 2016). Similarly, chronological age has been shown to predict morphological features (e.g., Paradis, 2011; Snow & Hoefnagel-Hohle, 1978). However, age effects are less robust in the morphosyntactic domain (e.g., Bedore et al., 2016; Blom & Bosma, 2016; Chondrogianni & Marinis, 2011; Nishikawa, 2014; Roesch & Chondrogianni, 2016). In addition, mixed results are observed for sentence structures: while some studies have found an age effect (e.g., Bohman et al., 2010; Paradis et al., 2017), others have not (e.g., Chondrogianni & Marinis, 2011).

Age of L2 Onset

Age of L2 onset is both one of the most researched factors and one of the most controversial factors in bilingualism (for reviews, see Herschensohn, 2007; Muñoz & Singleton, 2011). Age of onset effects are observed in both L1 and L2 acquisition, such that those who begin exposure earlier ultimately attain greater competence than those who begin later, thus supporting an 'earlier is better' perspective for language acquisition (e.g., Abrahamsson & Hyltenstam, 2009; Coppieters, 1987; Curtiss, 1977; DeKeyser, 2000; Gleitman & Newport, 1995; Johnson & Newport, 1989, 1991; Oyama, 1976; Patkowski, 1980, 1994; Schachter, 1990; Schwartz, 2004). The early age of onset advantage for language learning has been attributed to a critical period, whereby linguistic proficiency is only possible if acquisition begins before a particular age (Johnson & Newport, 1989; Lenneberg, 1967; Meisel, 2008, 2009). Under this Critical Period Hypothesis, an innate optimal period occurs in the early years of childhood (often proposed to range from approximately two to five years of age) which is followed by an offset phase (commonly proposed to occur at around adolescence) (Lenneberg, 1967).

The early advantage is not necessarily absolute – exceptions are observed for both early and later ages, as well as interactions between the age of L2 onset and other internal and external factors (e.g., Kinsella & Singleton, 2014; Muñoz & Singleton, 2007). However, later ages of onset in L2 acquisition are generally associated with a qualitatively different developmental trajectory (e.g., error type) (e.g., Johnson & Newport, 1989; Kroffke & Rothweiler, 2006; Meisel, 2008, 2009, 2014; Rothweiler & Lleó, 2006; Sopata, 2010). Meanwhile, findings are less conclusive for sequential bilinguals: in the morphosyntactic

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domain, advantages have been observed for an earlier age of L2 onset (e.g., Bedore et al., 2016; Nishikawa, 2014; Roesch & Chondrogianni, 2016) or not at all (e.g., Blom & Bosma, 2016; Chondrogianni & Marinis, 2011; Unsworth, 2016; Paradis et al., 2017), while an older age of onset has been advantageous for L2 syntax (e.g., Rothman et al., 2016).

In sum, age as an internal factor has predicted L2 acquisition in previous studies; however the results are selective – if not mixed – with respect to language domain. These factors may also interact with external factors, discussed in the following section.

External Factors

External factors in L2 acquisition affect the environmental contexts of language exposure. These factors may be categorised under the terms PROXIMAL and DISTAL. Proximal factors refer to those which relate directly to the individual's language input and how it can vary, either quantitatively or qualitatively. In previous research on L2 acquisition, proximal factors have included quantitative measures of language input and language use (i.e., output), as well as the qualitative richness of the language environment (Paradis, 2023). Distal factors are those which impact on the language environment, resulting in variation in this environment; these have included socioeconomic status and parental L2 proficiency (Unsworth et al., 2011; Paradis, 2011; De Houwer, 2018; Paradis, 2023).

(Proximal) Quantitative Input

Quantitative language input factors are based on the amount of exposure to the target language. These factors are generally determined by measuring the overall length of exposure or the amount of target language contact at home, school, and in the community (Paradis, 2011; Unsworth et al., 2011). Variability in L2 proficiency is often attributed to the individual differences in linguistic experience, with longer L2 exposure in sequential bilingual acquisition associated with greater proficiency. This correspondence is observed across language domains, including lexical range (e.g., Chondrogianni & Marinis, 2011), morphology (e.g., Paradis, 2011) and sentence structures (e.g., Paradis et al., 2017). However, the overall length of exposure to the target language is linearly related to age of L2 onset: if chronological age is held constant, then a later age of L2 onset results in less overall L2 input. This relation complicates the interpretation of each factor individually – i.e., the impact of age of onset as an internal factor and the impact of length of exposure as an input factor (Paradis, 2011; Stevens, 2006).

To complement the overall L2 input measure, more fine-grained measures of the input aim to capture a more comprehensive representation of L2 language experience. This can involve measuring the amount of L2 input/output across the different L2 settings in which the individual participates. This more targeted measure can include specific environments such as day-care, nursery, or school, and has a positive impact on language acquisition (e.g., Blom, 2010; V. Gathercole, 2002, 2007). Meanwhile, as with an overall length of exposure measure, the language environment represents a broad overview of L2 input; as a result, there may be variation in the amount and characteristics of regular L2 exposure within these environments (Unsworth, 2013).

Other examples of fine-grained input measures include quantitative calculations of how the language is used at the child's home (Paradis, 2011). This language use at home can refer to how much of the target language is heard by the individual (i.e., how much the other household members use the target language to the child) and how much is produced

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by the individual (i.e., how much the child uses the target language at home to other household members, e.g., parents/caregivers, siblings, and other adults). However, in previous studies on children's morphosyntactic production, L2 language use at home has not predicted children's L2 proficiency (e.g., Chondrogianni & Marinis, 2011; Paradis et al., 2017). This suggests that non-native speakers who have a restricted fluency in the L2 in the home may have a negligible impact on the child's L2 ability, a finding which has been replicated in other research (Hoff, Welsh, Place, Ribot, et al., 2014).

(Proximal) Qualitative Input

Qualitative input measures are typically based on the richness of the target language; this depends on the activities the individual engages in with the target language as the primary language in these settings. These activities can include e.g., reading, watching TV, and play or social activities (Paradis, 2011).

Acquiring language through play based activities may be beneficial in comparison to language learning through formal settings as it often involves symbolic thinking where children engage in pretend play behaviour (e.g., roleplaying, and object substitution – the non-literal use of objects, actions or persons; Kane et al., 2019). This is associated with greater visual object recognition and the development of noun vocabulary skills (Pereira & Smith, 2009; Smith, 2003; Smith & Jones, 2011). The social-interaction element of play often involves collaboration between children where they assume different roles and negotiate the direction of play; this may comprise the use of more advanced language skills including complex grammatical and pragmatic forms compared to what is used in other situations (Bergen & Mauer, 2000; Weisberg et al., 2013). In addition, a play activity offers children the opportunity to engage with a considerable amount of language input and use.

In relation to L2 language development, interaction through play has been shown to motivate preschool children to engage with the L2 and practice their L2 skills in supportive and encouraging environments (Fassler, 1998; Piker, 2013). Playing with others provides children with the opportunity to learn language from peers and to practice what they may have previously acquired in other situations (Ervin-Tripp, 1991). When richness of the language environment has been investigated as a separate L2 input measure, it has predicted children's proficiency across language domains, including vocabulary and morphology (e.g., Paradis, 2011) and syntax (e.g., Paradis et al., 2017).

Distal Input Factors

Distal factors include parental language proficiency, family size, and socioeconomic status (measured by parental educational level or occupation); which in turn influence the individual's language exposure (Hoff, 2006; Paradis & Grüter, 2014; Sorenson Duncan & Paradis, 2018). Previous studies on distal input factors like socioeconomic status and parental L2 proficiency yield mixed results. Some studies show socioeconomic status to have no impact on linguistic scores (e.g., Armon-Lotem et al., 2011; Paradis et al., 2017), whereas others do find an effect (e.g., Bohman et al., 2010; de Cat, 2020; Sorenson Duncan & Paradis, 2018). However, the impact of socioeconomic status can vary depending on various factors, e.g., whether the mother's education was completed in the L1 or L2 (Sorenson Duncan & Paradis, 2018), and can also interact with other factors, e.g., the child's length of L2 exposure (de Cat, 2020).

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These findings also vary by linguistic domain. For example, lexical development has been predicted by both maternal L2 proficiency and maternal education as measures of socioeconomic status (Hammer et al., 2012), by maternal L2 proficiency but not maternal education (Chondrogianni & Marinis, 2011), or by neither measure (Paradis, 2011). Effects are similarly mixed for morphological and syntactic development – with a positive association with maternal education (Paradis, 2011), or no association with maternal L2 proficiency (Sorenson Duncan & Paradis, 2020), or no association with either measure (Chondrogianni & Marinis, 2011; Paradis et al., 2017).

Finally, in addition to the individual measures reviewed above, recent studies on the impact of external factors have also included composite measures of input which combine quantitative, qualitative, and distal input features (e.g., de Cat, 2020; Jia & Fuse, 2007; Roesch & Chondrogianni, 2016; Unsworth, 2016). This approach aims to capture any changes in the child's language experiences over time; nevertheless, findings from previous studies using this type of combined measure of external factors are also mixed across language domains (Armon-Lotem et al., 2011; Unsworth, 2016; de Cat, 2020; Jia & Fuse, 2007; Roesch & Chondrogianni, 2016).

Summary

This review of the literature shows that there are different results in relation to the impact of different factors on language proficiency of sequential bilingual children, and a table summarising this discussion is provided in the supplementary materials. We argue that the reasons for the differences found between previous studies may be due to how the factors were measured (e.g., different task types used), differences among the participants (e.g., in terms of age or L2 exposure) and the target language domain or features under investigation. The current study therefore aims to further explore the impact of individual difference factors across a number of specific language domains and features, with a focus on L1 Arabic speaking children in Northern Ireland.

Newcomer Children in Northern Ireland

Children who fall within the category of sequential bilinguals are also often referred to as 'Newcomer' children in Northern Ireland (NI), defined by The Department of Education in NI (DENI) as a child or young person who has "enrolled in a school but who does not have satisfactory language skills to participate fully in the school curriculum and does not have a language in common with the teacher" DENI (2009, p. iii).

The growing numbers of Newcomer children in NI is a relatively recent phenomenon, with the numbers of Newcomer children having increased 12-fold over the last 20 years to represent nearly 7% of primary school enrolments, or almost 16,000 Newcomer pupils (DENI, 2019). In recent years Arabic speakers have migrated to NI with a high number being refugees resettled from the Syrian conflict. Syrian nationals now account for 0.08% of Northern Ireland's population and Arabic speaking Newcomer pupils constitute the fourth largest linguistic group in NI schools after Polish, Lithuanian and Romanian speaking pupils (DENI, 2019). Therefore, Arabic speaking children are forming an ever-increasing part of the Newcomer pupil population in NI schools and therefore constitute an important linguistic group to investigate in terms of the impact of individual difference factors.

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The Current Study

This research is a cross-sectional study of sequential bilingual children in NI which aims to tease apart the impact of different internal and external factors to determine their effect across a range of linguistic domains (vocabulary, morphology, and syntax) and features (third person singular and past tense morphology, active and passive voice, and subject and object relative clauses).

Our research questions are:

(1) How do internal and external factors affect proficiency in sequential bilinguals?
(2) Do the effects vary across language domains (vocabulary, morphology, syntax) and features (third person singular and past tense morphology, active and passive voice, and subject and object relative clauses)?

The complex and somewhat opposing findings from the literature reviewed above lead to various possible hypotheses. One hypothesis is that "earlier is better" for sequential bilinguals, i.e., an earlier AGE OF L2 ONSET supports L2 proficiency across language domains (Johnson & Newport, 1991); if so, then we would predict increased scores for children who began acquiring English at younger ages (e.g., Bedore et al., 2016; Nishikawa, 2014; Roesch & Chondrogianni, 2016). However, another hypothesis for sequential bilinguals is that L2 proficiency is higher for older children, due to more advanced cognitive development and experience with age; if so, we would predict increased scores on vocabulary, morphology, and syntax with older ages (e.g., Bohman et al., 2010; Paradis, 2011; Paradis et al., 2017; Snow & Hoefnagel-Hohle, 1978).

A further hypothesis, however, is that the L2 proficiency is driven by overall INPUT, which would predict increased scores across domains with greater exposure to the L2. This hypothesis includes the overall quantity of L2 input, but also more fine-grained external factors such as richness of the L2 environment or L2 use at home, in which case we would predict increased scores on vocabulary, morphology, and syntax with richer L2 language environments (e.g., Paradis, 2011; Paradis et al., 2017) or with more L2 use at home (c.f. Paradis, 2011; Paradis et al., 2017).

Finally, two further hypotheses concern the distal input factors SOCIOECONOMIC STATUS and MATERNAL L2 PROFICIENCY. If SOCIOECONOMIC STATUS influences L2 proficiency, then we would predict higher scores on vocabulary, morphology, and sentence structures for children from higher socioeconomic backgrounds (e.g., Bohman et al., 2010; de Cat, 2020; Sorenson Duncan & Paradis, 2020). Similarly, if MATERNAL L2 PROFICIENCY influences the child's L2 proficiency, then we would predict higher scores across domains for children with mothers who have greater L2 English abilities (e.g., Chondrogianni & Marinis, 2011; Sorenson Duncan & Paradis, 2020).

It may also be the case that these factors interact with one another – that is, the impact of one factor may depend on another factor. Interactions between variables are prevalent in language research (Winter & Grice, 2021; Winter, 2022) and therefore it is important that these are included in analyses to have a fuller understanding of the associations between variables and the impact of predictors on language outcomes.

Finally, different internal and external factors may affect different features across language domains. That is, the specific effect of a given factor on a language feature may depend on how this factor interacts with specific grammatical knowledge, specific sentence processing procedures or the combination of this knowledge and how it is deployed in a specific language assessment of a specific domain. For example, the

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processes involved in lexical retrieval are not identical to those required for identifying context-specific morphological affixes, which in turn differ from resolving long-distance dependencies (e.g., object relative clauses) and parsing non-canonical word order (e.g., passive voice sentences) (Ferreira, 2003; Lewis & Vasishth, 2005; Lewis et al., 2006; Marinis, 2007, p. 20007; Marinis & Saddy, 2013; Stromswold, 2004; Van Dyke & Lewis, 2003). Therefore, these different procedures may be impacted by different internal and external factors. If so, then the above predictions may be borne out selectively across factors or language domains and features.

Methodology

Participants

The participants were 40 typically developing sequential bilingual children (5;7-12;2, *mean* = 8;4) from L1 Arabic-speaking backgrounds acquiring English as an additional language. Each child completed three language tasks, and parents completed a questionnaire on internal and external factors. Age of L2 onset for the bilingual children ranged from 5 months to 10 years old (*mean* = 4;3) and length of L2 exposure ranged from 7 months to 10;6 years (*mean* = 4;1). The bilingual participants spoke Arabic as a main language at home, and they, or their parents, originated from thirteen different Arabic-speaking countries. None of the children who participated in the study had a language impairment or learning disability as confirmed by their schools.

Participants were recruited from nine primary schools in and around Belfast, Northern Ireland via convenience sampling. Each school involved in recruitment used English as the language of instruction and followed the Northern Ireland Curriculum (Foundation Stage to Key Stage 2). Schools varied in terms of socioeconomic area and location with some in inner city areas while others were suburban. Schools also varied with regard to whether they had specific L2 support for Newcomer children, e.g., some had specific classes for English language assessment and development for Newcomer children while others offered more limited (e.g., in-class classroom assistant support only) or no extra support.

Procedures

Each child was tested in a quiet room on school premises and the data were gathered by a native English speaker from Northern Ireland. The tasks were delivered in English – i.e., the participants' L2 – and L1 proficiency was not assessed.

Vocabulary Task

The children's lexical development was evaluated with the Word Finding Vocabulary Test from The Renfrew Language Scales (Renfrew, 1995). This assessment has been used in previous studies to assess children's vocabulary proficiency in typical development (Buckley et al., 2013; Hastie, 2015), as well as multilingual and clinical populations (e.g., Antoniou et al., 2016; Kwok et al., 2015).

The Word Finding Vocabulary Test comprises 50 line-drawn pictures of objects of increasing difficulty which are shown to the participant one by one, and the participant is asked to name each target item aloud. In the current study, responses were scored either correct (1) or incorrect (0) for each of the trials and each trial was entered into the dataset individually.

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Morphology Task

The children's use of third person singular and past tense morphology was assessed using the Test of Early Grammatical Impairment Screening Test (TEGI; Rice & Wexler, 2001), a standardised test of morphosyntactic competency. The TEGI is used frequently in studies on bilingual acquisition (e.g., Blom & Paradis, 2015; Chondrogianni & Marinis, 2011; Paradis, 2011; Paradis & Blom, 2016), and comprises picture elicitation probes for the target morphological features, as in (1) (for third person singular):

(1) Experimenter: Here is a teacher. Tell me what a teacher does.
Target response: A teacher teaches.

Participants were presented with 10 test trials on the third person singular and 18 trials on the past tense (10 regular, 8 irregular). Participants scored either correct (1) or incorrect (0) for each of the trials and each trial was entered into the dataset individually.

Syntax Task

Syntax was evaluated using The Coloring Book Task, a digital colouring paradigm completed on a touchscreen PC (Pinto & Zuckerman, 2019; Zuckerman et al., 2016). In the Coloring Book Task, target structures are assessed by using the test sentence as a prompt to colour in a black and white picture; participants' interpretations are then inferred based on how they colour in the pictures. (Pinto & Zuckerman, 2019; Gerard et al., 2018; Bosch et al., 2020).

The target syntactic structures in the current study were active voice, passive voice, subject relative clauses, and object relative clauses, which were used in prompts like (2) and (3) to colour a black and white picture like Figure 1.

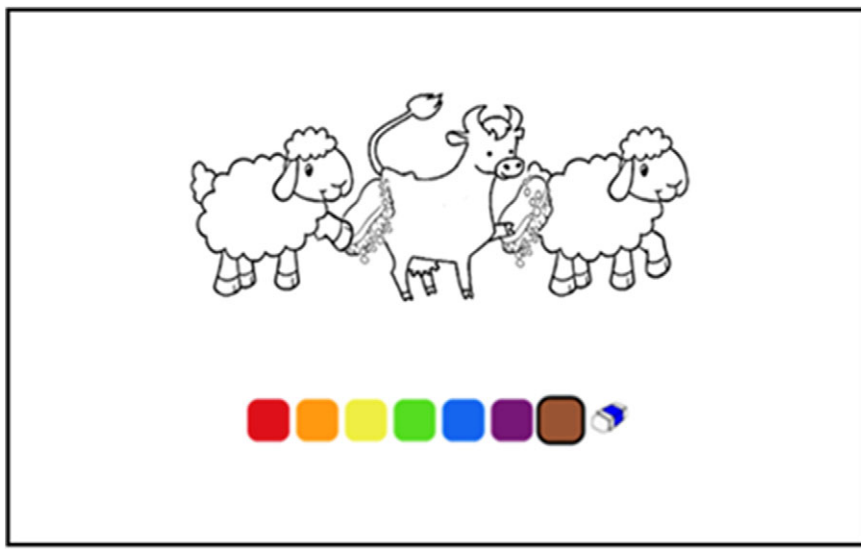

Figure 1. Sample Item from The Coloring Book Task.

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(2) a. Active voice: The cow washed the blue sheep.
b. Passive voice: The cow was washed by the blue sheep.

(3) Experimenter: Something here is blue.
[Child selects blue]
a. Subject relative clause: There's the sheep that washed the cow.
b. Object relative clause: There's the sheep that the cow washed.

The main test items consisted of 32 trials, with 8 items for each sentence structure (active voice, passive voice, subject relative clauses, object relative clauses) which were alternated with fillers as in (4):

(4) Experimenter: Something here is blue.
[Child selects blue]
It drives a bus.

Participants were scored either correct (1) or incorrect (0) for each of the trials and each trial was entered into the dataset individually.

Parent questionnaire

A parent questionnaire, adapted from the Alberta Language Environment Questionnaire (Paradis, 2011) was used to obtain a comprehensive representation of participant demographics (chronological age and age of L2 onset) and environmental (external) language factors. The questionnaire was translated to Modern Standard Arabic by a native Arabic speaker and completed by the participants' mothers. The factors measured in the questionnaire are detailed in Table 1.

Table 1. Factors Measured Using the Parent Questionnaire

Factor	Measurement
Age of L2 onset	The age of first meaningful (consistent and significant) exposure to the L2
Length of L2 exposure	The age of L2 onset subtracted from the chronological age (e.g., if age of L2 onset = 3;0 and current age = 8;0 then length of L2 exposure = 5;0)
Richness of L2 environment	Composite score based on rating of frequency of engagement in social/extracurricular activities in the L2 (0–5 scale) and frequency of L2 use between the child and the friends that they regularly play with (1–5 scale)
L2 language use at home	Rating of L2 language use on a 1–5 scale to the child by each household member (including all adults and siblings present at home, if applicable), and from the child to each household member
Maternal education	Rating on a 1–6 scale (1 = Primary education, 2 = Secondary education, 3 = Higher Educational Institution, 4 = Undergraduate degree, 5 = Masters, 6 = PhD)
Maternal L2 proficiency	Rating on a 1–5 scale of L2 English proficiency: 1 = No Understanding or speaking ability 2 = Some understanding and can say short, simple sentences 3 = Good understanding and can express myself on many topics 4 = Can understand and use English adequately for work and most other situations 5 = Can understand almost everything. Very comfortable expressing myself in English

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Note that the age of L2 onset may be calculated by subtracting the length of L2 exposure from chronological age, meaning that age of L2 onset and length of L2 exposure are not independent. While both factors are reported in the literature, the results in the following section will report the length of L2 exposure rather than the age of L2 onset both to avoid statistical non-convergence and to include both an internal and external (input-based) factor. We consider the implications of both factors in the discussion.

Results

Descriptive Statistics

Mean, standard deviation (SD), range and descriptions of scores for the internal and external predictor variables are reported in Table 2. For the linguistic measures, we report these scores along with Cronbach's Alpha for internal reliability (Table 3). Scores ranged particularly widely between participants for the third person singular and more complex syntactic structures (passive voice and object relative clauses), with generally high scores for the less complex structures (active voice and subject relative clauses). High internal reliability was also observed across tasks.

Table 2. Mean, SD, and Ranges for Predictor Variables

Factor	Mean	SD	Range
Chronological age	8;4	1;9	5;7 – 12;2
Age of L2 onset	4;3	2;4	0;5 – 10;0 (5 – 120 months)
Length of L2 exposure	4;1	2;2	0;7 – 10;6 (7 – 128 months)
Richness of L2 environment	.76	.17	.29 – 1.00 (re-scaled from 0 to 1)
English language use at home	.45	.28	0 – 1 (re-scaled from 0 to 1)
Maternal education, as a measure of socioeconomic status	3.80	1.45	1 – 6 (scale from 1 to 6)
Maternal L2 proficiency	3.70	1.33	1 – 5 (scale from 1 to 5)

Table 3. Mean, SD, range and Cronbach's Alpha for linguistic measures

Linguistic measure	Mean	SD	Range	Cronbach's Alpha
Vocabulary	0.57	0.18	0.18 – 0.86	0.93
Third person singular	0.73	0.32	0 – 1	0.90
Past Tense	0.81	0.27	0.05 – 1	0.94
Active Voice	0.82	0.24	0 – 1	0.78
Passive Voice	0.63	0.34	0 – 1	0.85
Subject relatives	0.87	0.16	0.38 – 1	0.56
Object relatives	0.62	0.31	0 – 1	0.80

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Statistical Analysis

To analyse the relationships between the internal and external factors across language domains, we performed mixed effects logistic regression modelling using R (R Core Team, 2017) and *lme4* (Bates et al., 2015). The models were developed to predict correct and incorrect responses in the children's production or comprehension. Each response was entered as an individual trial in the data set, resulting in a binary outcome variable (correct/incorrect). Fixed effects were the factors in Table 2, aside from the age of L2 onset as described above. Random effects were selected to account for variation across participants; these included 'participant,' 'item' (i.e., each item from the target linguistic measures), and 'school' (the schools the participants attended). Where a model revealed variation by a given random effect, it was retained in the model.

The modelling strategy was to find a parsimonious set of predictors that maximally explained the differences in the participants' L2 English language proficiency scores while avoiding over-fitting the data (i.e., the highest generalisability from the smallest subset of predictor variables), for each language domain. Therefore, from a model which overfitted the data, backwards stepwise elimination of fixed effects which were not significant (Bates et al., 2015) resulted in a reduced model, which was as parsimonious as possible (Paradis et al., 2017). This procedure is described for each model in the supplementary materials, available from https://osf.io/pr26s/?view_only=5c1e2dfa51374540814d7e13ee27db92.

However, before running the logistic regressions, we first conducted a correlation analysis to explore the general linear relationships across all of the factors included as fixed effects and the language measures, in Table 4 (See the supplementary materials for plots).

Table 4 includes several significant correlations. Notably, only two of these are between a predicting factor and a language measure: length of L2 exposure is significantly correlated with vocabulary ($R = 0.65$, $p = 0.002$), and chronological age is significantly correlated with subject relative clauses ($R = 0.58$, $p = 0.005$). The remaining correlations are between two language measures, or between two predicting factors.

The significant correlations between language measures include all three language domains, with correlations both across and (in the case of morphology and syntax) within domains. First, vocabulary was significantly correlated with accuracy on both TEGI morphology tasks – the third person singular ($R = 0.69$, $p < 0.001$) and the past tense ($R = 0.72$, $p < 0.001$), as well as the passive voice ($R = 0.65$, $p < 0.001$). In addition, the TEGI third person singular and past tense tasks were correlated with each other ($R = 0.73$, $p < 0.001$), and both tasks were correlated with the passive voice (third person singular $R = 0.56$, $p < 0.001$; past tense $R = 0.68$, $p < 0.001$). For syntax, significant correlations included the active voice and passive voice ($R = 0.52$, $p < 0.001$), active voice and object relative clauses ($R = 0.51$, $p < 0.001$), passive voice and subject relative clauses ($R = 0.49$, $p = 0.002$) and passive voice and object relative clauses ($R = 0.55$, $p < 0.001$)

Lastly, there were significant correlations between a number of the predicting factors. As expected, length of L2 exposure was negatively correlated with age of L2 onset ($R = -0.67$, $p < 0.001$) – that is, children with a later age of L2 onset had a lower quantity of L2 exposure. Length of L2 exposure was also correlated with L2 language use at home ($R = 0.59$, $p = 0.006$), while age of L2 onset was negatively correlated both with socioeconomic status – as measured by maternal education – ($R = -0.57$, $p < 0.001$) and with maternal L2 proficiency ($R = -0.56$, $p < 0.001$). Finally, socioeconomic status and maternal L2 proficiency were correlated with each other ($R = 0.75$, $p < 0.001$).

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Table 4. Correlation Coefficients Between Fixed Effects and Language Measures

	Age	LoE	AoA	Lang Use	L2rich	SES	MatL2	Vocab	TPS	Past tense	Active	Passive	SRC	ORC
Age														
Length of L2 Exposure (LoE)	0.35													
Age of L2 onset (AoA)	0.47	–0.67***												
L2 use at home (LangUse)	0.18	0.59**	–0.41											
L2 richness	0.18	0.29	–0.13	0.42										
Maternal education (SES)	–0.17	0.46	–0.57***	0.37	0.1									
Maternal L2 proficiency (MatL2)	–0.17	0.45	–0.56***	0.49	0.18	0.75***								
Vocabulary	0.18	0.65**	–0.47	0.36	0.39	0.24	0.34							
TEGI third person singular (TPS)	0.18	0.33	–0.17	0.32	0.36	–0.09	0.19	0.69***						
TEGI Past tense	0.39	0.44	–0.11	0.19	0.39	0.04	0.16	0.72***	0.73***					
Active voice	0.23	0.24	–0.05	0.16	0.51	–0.04	–0.04	0.48	0.39	0.46				
Passive voice	0.49	0.41	0.001	0.18	0.31	0.09	0.13	0.65***	0.56***	0.68***	0.52***			
Subject Relatives (SRC)	0.58**	0.28	0.19	–0.02	0.15	–0.02	–0.14	0.37	0.23	0.39	0.39	0.49**		
Object Relatives (ORC)	0.48	0.39	0.01	0.09	0.33	0.29	–0.01	0.43	0.27	0.47	0.51***	0.55***	0.36	

***p < 0.001
**p < 0.01
*p < 0.05

With the high number of correlations between measures, a stepwise elimination approach was used for the regression analyses to avoid cancelling effects. The analyses for each language domain are presented in the following sections.

Logistic Regression Analyses for Vocabulary

Stepwise elimination of fixed effects which did not reach significance resulted in a model for vocabulary which included the predictors Chronological age, Length of L2 exposure, L2 language use at home, Richness of the L2 environment and Socioeconomic status, as well as random effects for participants, items and schools; this model included 2000 observations (i.e., individual trials). The significant predictors for the vocabulary task were Length of L2 exposure ($\beta = 0.05$, $Z = 4.68$, $p < 0.001$) and Richness of the L2 environment ($\beta = 2.65$, $Z = 2.20$, $p = 0.028$), with marginal significance observed for the remaining predictors (Table 5).

The significant main effect of length of L2 exposure indicates that those who had longer exposure to L2 English were more likely to give a correct response on the vocabulary task compared to those who had less exposure to L2 English (Figure 2). Meanwhile, the main effect of Richness of the L2 environment is due to higher accuracy on the vocabulary task with a higher degree of participation in L2 play and social activities (Figure 3).

Logistic regression analyses for morphology

The morphology model included the third person singular and the past tense as two levels of a single fixed effect morpheme to identify the impact of factors across the two types of morphological features. Stepwise elimination of fixed effects which did not reach significance resulted in a model for morphology which included the predictors chronological age, length of L2 exposure and morpheme, as well as an interaction between morpheme and length of L2 exposure, and random effects for participants and items; this model included 1120 observations. The model revealed a main effect of length of L2 exposure ($\beta = 0.4$, $Z = 2.74$, $p = 0.006$), with no significant interaction between the predicting factors and morpheme (Table 6).

Table 5. Mixed-Effects Logistic Regression Modelling Results for Impact of Factors on Vocabulary

Fixed effects	β	SE	Z	p
Intercept	–2.12	1.39	–1.52	0.128
Chronological age	0.002	0.01	.28	0.078
Length of L2 exposure	0.05	0.01	4.68	0.001***
L2 language use at home	–1.28	0.77	–1.67	0.095.
Richness of the L2 environment	2.65	1.20	2.20	0.028*
Socio-economic status	–0.30	0.17	–1.78	0.076.

***p < 0.001
**p < 0.01
*p < 0.05
.p < 0.1

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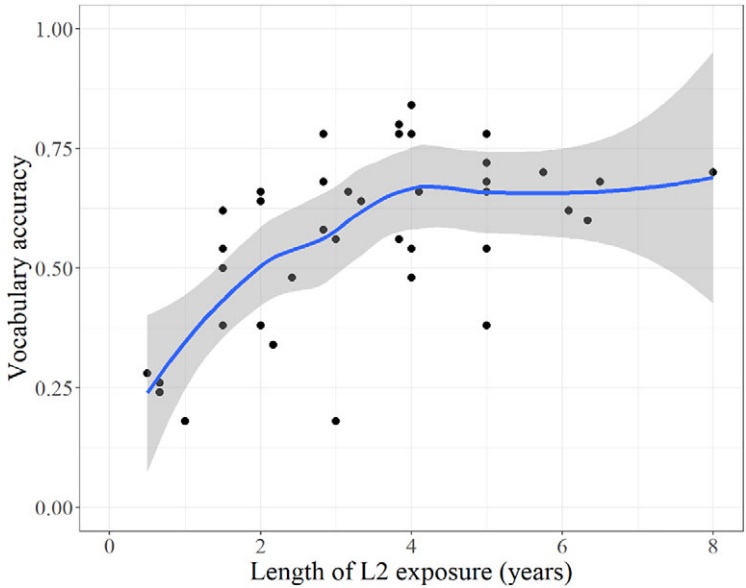

Figure 2. Accuracy on the Vocabulary task by Length of L2 Exposure.

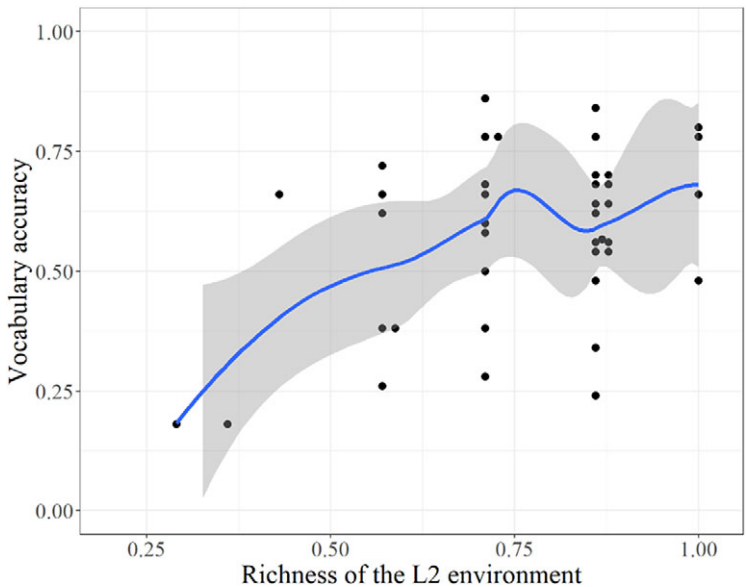

Figure 3. Accuracy on the Vocabulary task by Richness of the L2 environment.

The main effect of length of L2 exposure reflects that those who had longer exposure to L2 English had greater accuracy compared to those who had less exposure to L2 English, for both third person singular and past tense morphology (Figure 4).

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Table 6. Mixed-Effects Logistic Regression Modelling Results for Impact of Factors on Morphology

Fixed effects	β	SE	Z	p
Intercept	–1.62	1.54	–1.06	0.292
Morpheme – third person singular	–0.20	0.50	–0.40	0.687
Chronological age	0.02	0.02	1.45	0.146
Length of L2 exposure	0.04	0.01	2.74	0.006**
Interaction: Morpheme (third person singular) & length of exposure	–1.62	1.54	–1.06	0.292

Note:
***p < 0.001
**p < 0.01
*p < 0.05
˙p < 0.1

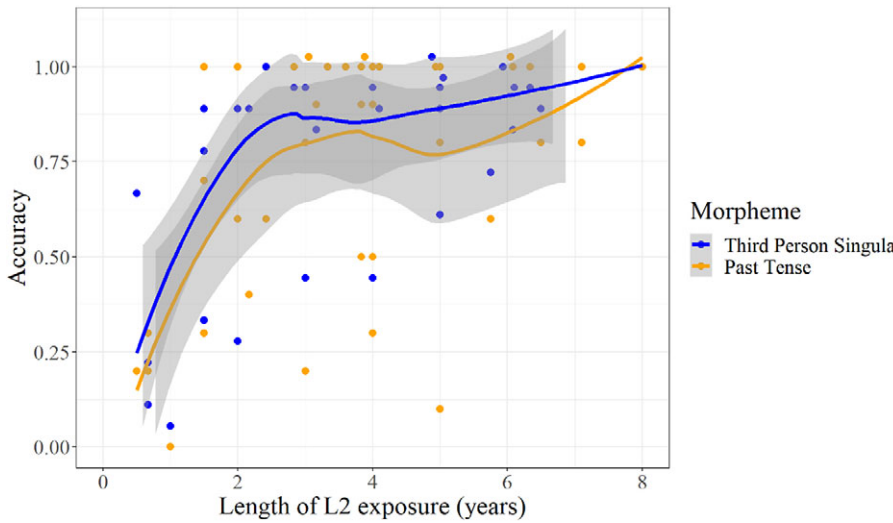

Figure 4. Accuracy in morpheme production by LENGTH OF L2 EXPOSURE in years.

Logistic regression analyses for syntax

For the syntax model, STRUCTURE and COMPLEXITY were included as fixed effects to determine whether the impact of the internal and external factors depended on the type of language structure (voice or relative clause) and the language feature's complexity (low – active voice and subject relative clause; high – passive voice and object relative clause). Stepwise elimination of fixed effects which did not reach significance resulted in a model for syntax which included the predictors CHRONOLOGICAL AGE, RICHNESS OF THE L2 ENVIRONMENT, COMPLEXITY and STRUCTURE, as well as an interaction between COMPLEXITY, STRUCTURE and RICHNESS OF THE L2 ENVIRONMENT, and random effects for participants; this model included 1280 observations.

The results of this model are presented in Table 7: significant main effects were observed across all syntactic structures for CHRONOLOGICAL AGE (β = 0.03, Z = 3.84, p < 0.001) and RICHNESS OF THE L2 ENVIRONMENT (β = 2.04, Z = 2.20, p =0.028). In addition, we observed the expected main effect of COMPLEXITY due to higher accuracy

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Table 7. Mixed-Effects Logistic Regression Modelling Results for Impact of Factors on Syntax

Fixed effects	β	SE	Z	p
Intercept	0.77	0.22	3.47	0.001
Structure (voice)	0.06	0.19	0.30	0.763
Complexity (low)	1.64	0.23	7.28	<0.001***
Chronological age	0.03	0.01	3.84	<0.001***
Richness of the L2 environment	2.04	0.93	2.20	0.028*
Structure(voice)*Complexity(low)* Richness of the L2 environment	2.90	1.28	2.27	0.024*

Note:
***p < 0.001
**p < 0.01
*p < 0.05
˙p < 0.1

with low complexity (β = 1.64, Z = 7.28, p < 0.001), as in Table 3. Finally, there was a significant three-way interaction between COMPLEXITY, STRUCTURE and RICHNESS OF THE L2 ENVIRONMENT (β = 2.90, Z = 2.27, p = 0.024).

The main effect of CHRONOLOGICAL AGE is due to the overall higher accuracy for older children across structures than for younger children (Figure 5). Although this effect varied numerically across structures, the interaction with age was not included in the optimal model.

In addition, the main effect of L2 Richness is due to the higher accuracy with greater L2 richness, across structures (Figure 6). However, the effect of L2 richness was modulated by

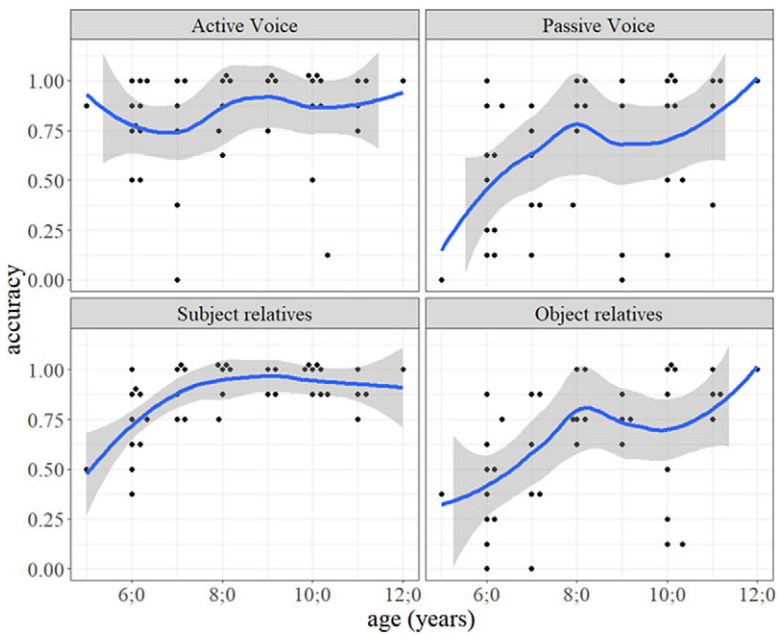

Figure 5. Accuracy for each sentence structure by CHRONOLOGICAL AGE.

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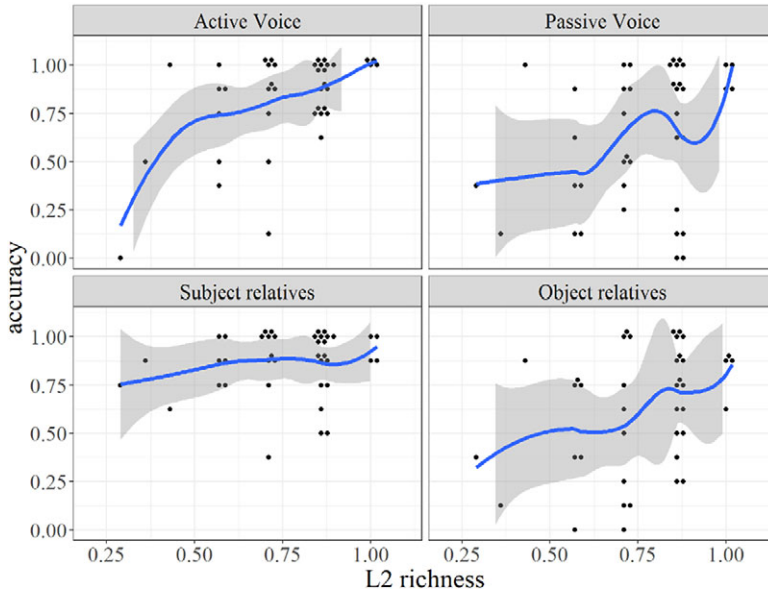

Figure 6. Accuracy for each sentence structure by RICHNESS OF THE L2 ENVIRONMENT.

both STRUCTURE and COMPLEXITY, as indicated by the three-way interaction between these factors. That is, for both the active and passive voice, L2 richness predicted children's accuracy, with higher accuracy observed with higher L2 richness. However, this effect of L2 richness was not observed for both relative clause structures, due to the overall ceiling accuracy for subject relatives. Instead, the effect of L2 richness was observed only for object relative clauses, resulting an interaction with L2 richness for relative clauses, but not for voice (i.e., an interaction between structure, complexity and L2 richness).

Discussion

The aim of this study was to tease apart the relations between different internal and external factors by measuring their impact across a number of different language domains and features in sequential bilingual acquisition in childhood. The research questions were (a) how internal and external factors affect L2 proficiency in sequential bilinguals, and (b) whether the effects vary across language domains and features. Different tasks were used to measure L2 proficiency, including standardised tests to measure production, and a novel experimental task to measure comprehension.

Consistent with the observation that different language domains involve different linguistic knowledge and different parsing procedures, we found that L2 proficiency for vocabulary, morphology and syntax was affected differently by different factors. In particular:

- vocabulary was predicted both by LENGTH OF L2 EXPOSURE and by RICHNESS OF THE L2 ENVIRONMENT (measured as participation in L2 play and social activities)

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- MORPHOLOGY was predicted only by LENGTH OF L2 EXPOSURE, with no interaction by MORPHEME (past tense/3rd person singular)
- SYNTAX was predicted by AGE, with higher accuracy observed at older ages, particularly for the more complex structures (i.e., passive voice and object relative clauses); in addition, SYNTAX was predicted by RICHNESS OF THE L2 ENVIRONMENT, although to different degrees across the different structures.

Meanwhile, we observed no interactions between the internal and external factors: the above main effects were not modulated by any other internal or external predictor variable. The following section will revisit the internal and external factors and their impact across language domains. We then consider implications for theory and practice, and end with some limitations and future directions.

Internal and External Factors Revisited

Mixed results have been observed across previous studies in relation to the impact of different internal and external factors on L2 proficiency. The current study aimed to tease apart potential sources of this variation by investigating the impact of these factors across language domains. In the following sections, we discuss our results in the context of previous studies.

Internal factors: Age

Age in the current study was measured by way of chronological age and age of L2 onset. In this section we consider the impact of chronological age, while age of L2 onset is addressed below in relation to the length of L2 exposure (and is therefore discussed as an external factor).

In previous studies, age effects have been generally consistent within the lexical and morphological domains, but less so for morphosyntactic knowledge (e.g., Bohman et al., 2010; Paradis, 2011; Paradis et al., 2017; Snow & Hoefnagel-Hohle, 1978). Consistent with these studies, chronological age did predict children's interpretation of the sentence structures (active and passive voice, and subject and object relative clauses). However, the slopes of the age effect revealed greater differences in accuracy between the younger and older children for the more complex structures (passive voice and object relative clauses) compared to the less complex structures (active voice and subject relative clauses). This suggests that the age effect may be selective to specific measures of syntactic knowledge – e.g., more complex structures, if not also specific types of assessment, particularly in contexts with ceiling or floor effects for a given age range. This specificity may account for variation in the literature where we see contrasting results with different structures and assessments.

In addition, chronological age did not predict children's vocabulary or morphology, which contrasts with previous research (e.g., Blom & Bosma, 2016; Paradis, 2011; Paradis & Blom, 2016; Snow & Hoefnagel-Hohle, 1978). This disparity for vocabulary and morphology may be due to actual variation in age effects; however, as we mention above, another source of variation is the type of task used across studies. For example, in previous studies, grammaticality judgements were also included in the lexical and morphological scores alongside the production tasks for these language measures. In contrast, the current study focused solely on production measures for vocabulary and morphology.

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While the different tasks are designed to draw on the same underlying linguistic knowledge, the specific extragrammatical processes involved in deploying this knowledge in tasks like grammaticality judgments and elicited production are likely to differ across tasks; these differences in task-specific demands may then result in variation in age effects (McDaniel & Cairns, 1990).

In general, the effect of age for syntax is consistent with previous studies (e.g., Bohman et al., 2010; Paradis et al., 2017; contra Chondrogianni & Marinis, 2011). This result suggests that the characteristics associated with older ages in childhood may be more important factors for the acquisition of syntax in sequential bilingualism as opposed to vocabulary and morphology; these characteristics include (a) more developed cognitive mechanisms (e.g., memory, attention, theory of mind, reasoning, and executive functioning skills including organising, planning and monitoring of information) and (b) more well-established linguistic experience and knowledge in both the L1 and the L2 (Paradis, 2007, 2011). These mechanisms may therefore be advantageous for interpretation of syntactic structures in childhood, in both the L1 and the L2 (e.g., Armon-Lotem et al., 2011; Rothman et al., 2016). This advantage is discussed further below, in the context of the linguistic input. In addition, older children on account of being in later stages of primary school may have more exposure to a number of syntactic structures delivered through the educational curriculum.

External Factors: Length of L2 Exposure

The external factor length of L2 exposure has predicted children's L2 proficiency in previous studies across language domains (e.g., Chondrogianni & Marinis, 2011; Paradis, 2011; Paradis et al., 2017). This is generally consistent with our results, in which length of exposure predicted children's accuracy for both vocabulary and morphology, including both third person singular and the past tense. The exception was the syntactic domain, where length of L2 exposure did not interact with the type of sentence structure. This pattern of results is particularly notable given that it is complementary to the pattern observed for chronological age: while syntax was predicted by age – i.e., a measure reflecting cumulative experience in both the L1 and the L2 and the development of general cognitive processes – children's lexical and morphological proficiency was instead predicted by the overall quantitative input in the L2, above and beyond any effect of age.

This split between syntax on the one hand, and vocabulary and morphology on the other, reflects the more embedded properties of the former – all four structures (actives, passives, subject relatives and object relatives) are realized cross-linguistically, such that knowledge in the L1 may be transferred to the L2 (Greenberg, 1963). This contrasts with vocabulary and morphology, where the possibility of transfer from the L1 and L2 may be more strongly dependent on the availability of shared forms across languages (Oksuz et al., 2022). In the current study with Arabic as the L1 and English as the L2, this overlap may be less prominent compared to languages within the same language family and/or with a higher degree of cognates, resulting in the overall effect of input for domains like vocabulary and morphology, but not for syntax.

The contrast between age and length of L2 exposure raises the question of the role of the Age of L2 Onset, which is derived from L2 exposure subtracted from age. As discussed above, due to this direct relation between the age of L2 onset and the length of L2 exposure, both factors could not be included in the same regression model. In general, age of onset effects are particularly reliable across a wide age range, especially in samples

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which include both child and adult L2 speakers. However, results have been mixed for sequential bilingual acquisition, where L2 onset is within the critical period (e.g., Blom & Bosma, 2016; Chondrogianni & Marinis, 2011; Unsworth, 2016; Paradis et al., 2017). Accordingly, correlations with age of onset were not observed between age of L2 onset and the language measures (Table 2). Future qualitative analyses of children's error types may shed further light on the impact of age of L2 onset within this age range (e.g., Meisel, 2018).

The complementary distribution of age effects for syntax on the one hand, and length of exposure effects for vocabulary and morphology on the other, suggests that syntactic development in bilingualism is impacted more by either biological components related to maturation and cognition or by overall language input in both the L1 and the L2, rather than by the specific input in the L2. At the same time, syntactic development was also influenced by more fine-grained L2 input measures, discussed further in the following section.

External Factors: Richness of the L2 Environment

Like the length of L2 exposure, previous studies have observed an impact across language domains for the richness of the L2 environment, as measured by the degree of participation in L2 play and social activities (e.g., Paradis, 2011; Paradis et al., 2017). Therefore, the hypothesis for this factor was that it would predict performance across language features and would therefore result in increased scores on vocabulary, morphology, and syntax for children with richer L2 language environments. Indeed, richer L2 environmental experiences did predict both vocabulary and syntax; however, they predicted L2 syntax only selectively and they did not predict L2 morphology. Thus, our prediction was only partially borne out, suggesting that fine-grained measures are selectively impactful across language features and domains. Conceivably, richer L2 experiences are providing the children with valuable opportunities to hear and use vocabulary and specific aspects of the L2 syntax.

These findings support previous research which associates peer play and social interaction with language development in bilingual and child L2 acquisition (e.g., Ervin-Tripp, 1991; Fassler, 1998; Piker, 2013). It is likely that the play and social settings that the sequential bilingual children are participating in offers engagement with native English speakers who may be providing skilful language in the respective domains. This supports research which indicates that interaction with peers on its own is not enough for some language development. Rather, children require exposure to considerable amounts of 'expert' speakers (native or highly proficient speakers) for peer interaction to have an impact on language acquisition (Hoff, 2006).

External Factors: L2 Language Use at Home

In previous studies, the impact of L2 language use at home on children's L2 proficiency has been mixed at best, and in general has not predicted L2 outcomes (e.g., Paradis, 2011; Paradis et al., 2017). The use of the L2 at home was therefore not expected to predict children's L2 proficiency in the current study. As expected, L2 language use at home was not associated with greater proficiency of any language measure and therefore our prediction was borne out. This supports previous research findings (e.g., Paradis, 2011; Paradis et al., 2017) and the view that input from non-native speakers who have a restricted fluency in the L2 in the home may have a negligible impact on the child's L2 ability (Hoff, Welsh, Place, & Ribot, 2014).

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External Factors: Socioeconomic Status

In the current study, socioeconomic status was measured by way of maternal education. This measure has yielded mixed results in predicting children's L2 proficiency across domains. Consistent with previous studies which have observed no relation with socioeconomic status, we observed that higher socioeconomic status was not associated with greater ability for any language measure.

One caveat of this conclusion is that the sample included a disproportionate number of mothers with higher level qualifications. Maternal education was calculated in terms of the highest qualification obtained, and the majority of participants' mothers in the current study had advanced level qualifications which included an undergraduate degree, master's degree or PhD level education (n=24). While some also had higher educational institution level qualifications (n=10), fewer (n=6) had lower level qualifications (including primary or secondary school level education) as their highest qualification. If maternal education is most impactful within populations which were less represented within the current study, then this impact may not have been possible to detect with the current study.

However, it is important to note that although maternal education is used as the measure for socioeconomic status in the current study and previous research, this measure may not be as valid for economic and social position in the current study: as many of the mothers had conceivably come to Northern Ireland as refugees, it may be the case that on arrival to Northern Ireland, and indeed for some time afterward, many may not have been able to secure employment comparable to their level of education or that which they had in their country of origin. Therefore, maternal education in the case of refugee families may not in fact equate to socioeconomic status, a discrepancy which has also been observed for research in the United States (Passel & Cohn, 2009).

External factors: Maternal L2 proficiency

In the current study, maternal L2 proficiency was measured by participants' mothers' ratings of their own L2 English levels on a scale between 1-5 (Table 1). Like maternal education, the factor of maternal L2 proficiency has yielded mixed results across language domains, producing a range of hypotheses for each language domain (Hammer et al., 2012; Chondrogianni & Marinis, 2011; Paradis, 2011; Sorenson Duncan & Paradis, 2020; Paradis et al., 2017). However, also like for maternal education, we found that maternal L2 proficiency was not associated with greater ability for any language measure.

The lack of impact found for this factor may again be due to the lack of variation across the mothers' L2 proficiency scores, as participants' mothers in the current study mostly had higher L2 English ability. Most mothers could either understand and use English adequately for work and most other situations (n=10) or could understand almost everything/were very comfortable expressing themselves in English (n=15). Therefore, as with maternal education, an impact of maternal L2 proficiency may be observed in a sample with greater variation in this factor.

Implications for theory and practice

Theory

Importantly, our findings suggest that there is a delineation between the impact of predicting factors depending on the language domain and features under investigation.

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This contrast is most notable for language features predicted by overall quantitative L2 input – i.e., L2 vocabulary and morphology – and those which are predicted by age – i.e., L2 syntax (particularly complex syntax). This complementary pattern across domains contrasts a range of studies which have observed homogenous impacts across domains; the current study contributes to this literature by teasing apart the impacts of different predicting factors across different language domains.

In addition, our analysis with chronological age and length of exposure, to the exclusion of age of onset, demonstrates how these factors are more useful for predicting L2 proficiency for sequential bilinguals in comparison to the measure of age of L2 onset as a predictor for more wide-ranging samples. While these latter studies garner support for a 'younger is better' perspective and critical period effects for language acquisition, the findings from our study are not consistent with this. We think the reason behind these differing results is that age of L2 onset is often confounded with input effects. In the present study, age of L2 onset was highly and negatively correlated with length of L2 exposure: with a later age of onset, children had less exposure to the L2. As discussed previously, this 'younger is better' perspective is generally consistent for broader age ranges (e.g., Johnson & Newport, 1991); however, the correlation between age of L2 onset and length of L2 exposure demonstrates how this relation may be misleading for narrower ranges as in the current study. Moreover, this may indicate that in previous studies where an age of onset effect has been found but length of exposure has not been accounted for, then this input variable may in fact be driving these results.

Practice

The results from the current study have important implications for teaching and supporting Newcomer children in educational settings. While the 'earlier is better' view for L2 acquisition is pervasive (Abrahamsson & Hyltenstam, 2009; Johnson & Newport, 1989; Patkowski, 1980), previous and more current research has demonstrated that older sequential bilingual children, at least in the initial stages of acquisition, have an advantage in acquiring language (e.g., Armon-Lotem et al., 2011; Blom & Bosma, 2016; Bohman et al., 2010; Paradis, 2011; Paradis et al., 2017; Rothman et al., 2016; Snow & Hoefnagel-Hohle, 1978). This is often referred to as the RATE ADVANTAGE. While it has been proposed that those who begin earlier catch up and may surpass those who started acquiring the language at a later age (e.g., Jia & Fuse, 2007), this is often confounded with length of exposure effects.

In the current study, the sequential bilingual participants had a mean length of L2 exposure of 4;2 years. This suggests that the older age advantage found for syntax may hold for a considerable number of years and possibly within the children's time at primary school. This could have implications on how sequential bilingual children can be best supported in educational settings. In this case, educators could harness the advantages associated with older ages by ensuring older sequential bilingual children have a wealth of opportunities for engagement with more language structures and features so that these can be practised to become established language features within their L2 language repertoire. This could have positive effects on sequential bilingual children's academic skills (e.g., in writing where both complex and less complex language features are often utilised) which may ultimately have far-reaching consequences regarding future educational prospects (McEachron, 1998; Paradis, 2005). In addition, the impact of a richer L2 experience on L2 proficiency suggests that practitioners advocating for English as an

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additional language (EAL)/Newcomer children and their linguistic and educational outcomes or integration within school and the community may consider encouraging greater participation in L2 play and social activities which involve native speakers as a way to support vocabulary skills and development of sentence structures (Kane et al., 2019).

Limitations and Future Directions

The generalisability of the results is limited by the study's sample size (n=40), as well as the absence of an L1 assessment. The sample size was constrained by the challenges of recruiting sequential bilingual children from one language background and age range in the specific location of the current study, with multiple assessments. To offset these limitations, each separate model in the analysis comprised a large number of observations/data points (Vocabulary: 2000; Morphology: 1200; Syntax: 1200); these numbers were achieved by collecting many observations from each child on each task.[1] Children's responses were generally reliable within a given task (within individuals), even for measures with higher variance between individuals. Nevertheless, future research investigating this population and phenomena would benefit from a larger sample size to ensure the higher statistical power of the analysis, as well as a longitudinal analysis to investigate whether the older age advantage observed for L2 syntax holds over an extended course of time.

In addition, bilingual children are a heterogenous population, and their language abilities can be shaped by many different factors which can change over time and can also interact to form complex non-linear relationships (Paradis, 2023). Therefore, the statistical analysis used in the current study, which maximises prediction accuracy, cannot account for all the complex relationships between all the individual difference factors and the participants' language proficiency. Paradis (2023) and others (de Cat & Unsworth, 2023; Chondrogianni, 2023) appeal for caution in establishing causal paths between predictor variables and outcomes when incorporating analyses which try to maximise prediction accuracy. Thus, while the analyses in the current study are suggestive of causal relations in theory, further evidence is needed to support these links in practice.

Finally, while the current study investigated several individual difference factors, other factors were not included. For example, the parent questionnaire was shortened from its original form in order to increase return rates; this resulted in the removal of questions about parental professions and household income, and these questions may be included in a future study with a stronger focus on SES. Moreover, a factor which more recent research has considered for refugee children is the relationship between language outcomes and socioemotional wellbeing (e.g., Soto-Corominas et al., 2020). This is important for the current study, as a large proportion of the sample were likely refugees. This status may have impacted their attendance at school both in and outside of their home country with consequences in terms of literacy skills. In addition, many refugees may face key risk factors prior to resettlement, which can include exposure to violence, separation from family, and poverty. Challenges can endure long after resettlement as individuals may

[1] An anonymous reviewer points out that greater power may still be achieved with a larger sample size, due to the nested format of the analysis. We agree, and also note that our sample size is similar to previous studies with a similar subject population (e.g., Chondrogianni & Marinis, 2011), while previous studies with a larger sample size have generally included a much wider range of L1s (e.g., Paradis, 2011; Paradis et al., 2017). By controlling for L1 (Arabic), we reduce the number of factors which may increase variation within the sample.

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experience post-traumatic stress disorder, discrimination, and culture shock (Soto-Corominas et al., 2020). Consequently, this population can experience many challenges to their wellbeing, and this factor of wellbeing (including confidence, self-esteem and interpersonal and social skills) can impact L2 proficiency (e.g., Han, 2010; McNally et al., 2019; Soto-Corominas et al., 2020; Hadfield et al., 2017; Zins, 2004). Including these factors in future research (i.e., wellbeing and refugee status) would therefore provide further insight on sequential bilingual acquisition.

Conclusion

This study aimed to contribute to the understanding of sequential bilingualism and the effect of individual differences by providing further insights on their impact across specific language domains and features by L1 Arabic speaking children. The study results suggested that for sequential bilingual children, overall exposure to the L2 is important for the development of vocabulary and morphology, while older age is related to better sentence structure proficiency especially in terms of complex syntax. In addition, participation in L2 play and social activities is associated with vocabulary and syntax.

A better understanding of sequential bilingualism and the factors which impact it has not only the potential to enlighten theory, but also practice in terms of helping educators deliver more appropriate activities and materials which ultimately better facilitate the educational progress and outcomes of EAL/Newcomer pupils (Paradis, 2011, 2023). Future research will further explore the relevant interactions between predicting factors, including causal relations and dynamic models which can account for more complex interactions, as well as real-world practical applications for EAL pupils in education settings.

Supplementary material. The supplementary material for this article can be found at http://doi.org/10.1017/S0305000924000497.

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References

Abrahamsson, N., & **Hyltenstam, K.** (2009). Age of Onset and Nativelikeness in a Second Language: Listener Perception Versus Linguistic Scrutiny. *Language Learning*, **59**(2), 249–306. https://doi.org/10.1111/j.1467-9922.2009.00507.x

Antoniou, K., **Grohmann, K. K.**, **Kambanaros, M.**, & **Katsos, N.** (2016). The effect of childhood bilectalism and multilingualism on executive control. *Cognition*, **149**, 18–30. https://doi.org/10.1016/j.cognition.2015.12.002

Armon-Lotem, S., **Walters, J.**, & **Gagarina, N.** (2011). The impact of internal and external factors on linguistic performance in the home language and in L2 among Russian-Hebrew and Russian-German preschool children. *Linguistic Approaches to Bilingualism*, **1**(3), 291–317. https://doi.org/10.1075/lab.1.3.04arm

Bates, D., **Mächler, M.**, **Bolker, B.**, & **Walker, S.** (2015). Fitting Linear Mixed-Effects Models Using lme4. *Journal of Statistical Software*, **67**(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Bedore, L., **Peña, E.**, **Griffin, Z.**, & **Hixon, J. G.** (2016). Effects of Age of English Exposure, Current Input/Output, and grade on bilingual language performance. *Journal of Child Language*, **43**(3), 687–706. https://doi.org/10.1017/S0305000915000811

Bergen, D., & **Mauer, D.** (2000). *Symbolic play, phonological awareness, and literacy skills at three age levels.*

Blom, E. (2010). Effects of input on the early grammatical development of bilingual children. *International Journal of Bilingualism*, **14**(4), 422–446.

Blom, E., & **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**(3), 581–607.

Blom, E., & **Paradis, J.** (2015). Sources of individual differences in the acquisition of tense inflection by English second language learners with and without specific language impairment. *Applied Psycholinguistics*, **36**(4), 953–976.

Bohman, T., **Bedore, L.**, **Peña, E.**, **Mendez-Perez, A.**, & **Gillam, R.** (2010). What you hear and what you say: Language performance in Spanish–English bilinguals. *International Journal of Bilingual Education and Bilingualism*, **13**(3), 325–344. https://doi.org/10.1080/13670050903342019

Bosch, J. E., **Zuckerman, S.**, & **Pinto, M.** (2020). The Acquisition of 'Bridging' Tested with the Coloring Book Method. In P. Guijarro-Fuentes & C. Suárez-Gómez (Eds.), *New Trends in Language Acquisition Within the Generative Perspective* (pp. 289–311). Springer Netherlands. https://doi.org/10.1007/978-94-024-1932-0_12

Buckley, S., **Underwood, C.**, & **Purdie, N.** (2013). *Footprints in Time: Who Am I? and Renfrew Word Finding Vocabulary Test: Report on Wave 2 data.*

Chondrogianni, V. (2023). Individual differences differentially influence language domains and learning mechanisms. *Journal of Child Language*, 1–4. https://doi.org/10.1017/S0305000923000028

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**(3), 318–345. https://doi.org/10.1075/lab.1.3.05cho

Coppieters, R. (1987). Competence differences between native and near-native speakers. *Language*, 544–573.

Cummins, J. (1981). Age on arrival and immigrant second language learning in Canada: A Reassessment1. *Applied Linguistics*, **2**(2), 132–149.

Curtiss, S. (1977). *Genie: A psycholinguistic study of a modern-day wild child*. Academic Press.

de Cat, C. (2020). Predicting language proficiency in bilingual children. *Studies in Second Language Acquisition*, **42**(2), 279–325. https://doi.org/10.1017/S0272263119000597

de Cat, C., & **Unsworth, S.** (2023). So many variables, but what causes what? *Journal of Child Language*, 1–5. https://doi.org/10.1017/S0305000923000107

De Houwer, A. (2018). *The role of language input environments for language outcomes and language acquisition in young bilingual children* (D. Miller, F. Bayram, J. Rothman, & L. Serratrice, Eds.; pp. 127–154). John Benjamins. https://doi.org/10.1075/sibil.54.07hou

DeKeyser, R. M. (2000). The robustness of critical period effects in second language acquisition. *Studies in Second Language Acquisition*, **22**(4), 499–533.

DENI (Department of Education, NI). (2009). *Every School a Good School–Supporting Newcomer Pupils.* Department of Education Bangor.

De Villiers, J. (2007). The interface of language and theory of mind. *Lingua*, **117**(11), 1858–1878.

Ervin-Tripp, S. (1991). Play in language development. In B. Scales, M. Almy, A. Nicolopoulou, & S. Ervin-Tripp (Eds.), *Play and the social context of development in early care and education* (pp. 84–97). Teachers College Press.

Fassler, R. (1998). Room for talk: Peer support for getting into English in an ESL kindergarten. *Early Childhood Research Quarterly*, **13**(3), 379–409.

Ferreira, F. (2003). The misinterpretation of noncanonical sentences. *Cognitive Psychology*, **47**(2), 164–203.

Gathercole, S. (1999). Cognitive approaches to the development of short-term memory. *Trends in Cognitive Sciences*, **3**(11), 410–419.

Gathercole, S. (2006). Nonword repetition and word learning: The nature of the relationship. *Applied Psycholinguistics*, **27**(4), 513–543.

Gathercole, S., & **Baddeley, A.** (1993). Phonological working memory: A critical building block for reading development and vocabulary acquisition? *European Journal of Psychology of Education*, **8**(3), 259.

Gathercole, V. (2002). *Monolingual and bilingual acquisition: Learning different treatments of that-trace phenomena in English and Spanish.* na.

Gathercole, V. (2007). Miami and North Wales, so far and yet so near: A constructivist account of morphosyntactic development in bilingual children. *International Journal of Bilingual Education and Bilingualism*, **10**(3), 224–247.

Gerard, J., **Lidz, J.**, **Zuckerman, S.**, & **Pinto, M.** (2018). The acquisition of adjunct control is colored by the task. *Glossa: A Journal of General Linguistics*, **3**(1). https://doi.org/10.5334/gjgl.547

Gleitman, L. R., & **Newport, E. L.** (1995). The invention of language by children: Environmental and biological influences on the acquisition of language. *An Invitation to Cognitive Science*, **1**, 1–24.

Greenberg, J. H. (1963). *Universals of language*. MIT Press.

Hadfield, K., **Ostrowski, A.**, & **Ungar, M.** (2017). What can we expect of the mental health and well-being of Syrian refugee children and adolescents in Canada? *Canadian Psychology/Psychologie Canadienne*, **58**(2), 194.

Hammer, C. S., **Komaroff, E.**, **Rodriguez, B. L.**, **Lopez, L. M.**, **Scarpino, S. E.**, & **Goldstein, B.** (2012). Predicting Spanish–English Bilingual Children's Language Abilities. *Journal of Speech, Language, and Hearing Research*, **55**(5), 1251–1264. https://doi.org/10.1044/1092-4388(2012/11-0016)

Han, W.-J. (2010). Bilingualism and socioemotional well-being. *Children and Youth Services Review*, **32**(5), 720–731.

Harley, B., & **Hart, D.** (1997). Language aptitude and second language proficiency in classroom learners of different starting ages. *Studies in Second Language Acquisition*, 379–400.

Hastie, B. A. (2015). *Measuring the vocabulary development of new entrant children: A pilot study.*

Herschensohn, J. (2007). *Language Development and Age*. Cambridge University Press. https://doi.org/10.1017/CBO9780511486487

Hoff, E. (2006). How social contexts support and shape language development. *Developmental Review*, **26**(1), 55–88. https://doi.org/10.1016/j.dr.2005.11.002

Hoff, E., **Welsh, S.**, **Place, S.**, **Ribot, K.**, **Grüter, T.**, & **Paradis, J.** (2014). Properties of dual language input that shape bilingual development and properties of environments that shape dual language input. *Input and Experience in Bilingual Development*, **13**, 119–140.

Hoff, E., **Welsh, S.**, **Place, S.**, & **Ribot, K. M.** (2014). Properties of Dual Language Input that Shape Bilingual Development and Properties of Environments that Shape Dual Language Input. In J. Paradis & T. Grüter (Eds.), *Input and Experience in Bilingual Development* (pp. 119–140). John Benjamins. https://doi.org/10.1075/tilar.13.07hof

Jia, G., & **Fuse, A.** (2007). Acquisition of English Grammatical Morphology by Native Mandarin-Speaking Children and Adolescents: Age-Related Differences. *Journal of Speech, Language, and Hearing Research*, **50**(5), 1280–1299. https://doi.org/10.1044/1092-4388(2007/090)

Johnson, J., & **Newport, E.** (1989). Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology*, **21**(1), 60–99.

Johnson, J., & **Newport, E.** (1991). Critical period effects on universal properties of language: The status of subjacency in the acquisition of a second language. *Cognition*, **39**(3), 215–258.

Kane, F., **Kennedy, L.**, **Sevdali, C.**, **Folli, R.**, & **Rhys, C. S.** (2019). Language made fun: Supporting EAL students in primary education. *TEANGA, the Journal of the Irish Association for Applied Linguistics.* https://doi.org/10.35903/TEANGA.V10I0.73

Kinsella, C., & **Singleton, D.** (2014). Much more than age. *Applied Linguistics*, **35**(4), 441–462.

Kroffke, S., & **Rothweiler, M.** (2006). Variation im frühen Zweitspracherwerb des Deutschen durch Kinder mit türkischer Erstsprache. *Variation in Sprachtheorie Und Spracherwerb. Akten Des*, **39**, 145–154.

Kwok, E. Y. L., **Brown, H. M.**, **Smyth, R. E.**, & **Oram Cardy, J.** (2015). Meta-analysis of receptive and expressive language skills in autism spectrum disorder. *Research in Autism Spectrum Disorders*, **9**, 202–222. https://doi.org/10.1016/j.rasd.2014.10.008

Lenneberg, E. H. (1967). The biological foundations of language. *Hospital Practice*, **2**(12), 59–67.

Lewis, R. L., & **Vasishth, S.** (2005). An activation-based model of sentence processing as skilled memory retrieval. *Cognitive Science*, **29**(3), 375–419.

Lewis, R. L., **Vasishth, S.**, & **Van Dyke, J. A.** (2006). Computational principles of working memory in sentence comprehension. *Trends in Cognitive Sciences*, **10**(10), 447–454.

Long, D., & **Rothman, J.** (2014). Some caveats to the role of input in the timing of child bilingualism. *Linguistic Approaches to Bilingualism*, **4**(3), 351–356.

Marinis, T. (2007). On-line processing of passives in L1 and L2 children. *Proceedings of the 2nd Conference on Generative Approaches to Language Acquisition North America (GALANA)*, 265–276.

Marinis, T., & **Saddy, D.** (2013). Parsing the passive: Comparing children with specific language impairment to sequential bilingual children. *Language Acquisition*, **20**(2), 155–179.

McDaniel, D., & **Cairns, H. S.** (1990). The child as informant: Eliciting linguistic intuitions from young children. *Journal of Psycholinguistic Research*, **19**(5), 331–344.

McEachron, G. (1998). Multilingual programs in England, Wales, and the United States. The School Field. *International Journal of Theory and Research in Education*, **9**(3/4), 107–132.

McNally, S., **Darmody, M.**, & **Quigley, J.** (2019). The socio-emotional development of language-minority children entering primary school in Ireland. *Irish Educational Studies*, **38**(4), 519–534.

Meisel, J. (2008). Child second language acquisition or successive first language acquisition. *Current Trends in Child Second Language Acquisition: A Generative Perspective*, 55–80.

Meisel, J. (2009). Second language acquisition in early childhood. *Zeitschrift Für Sprachwissenschaft*, **28**(1), 5–34.

Meisel, J. (2014). On timing in monolingual and bilingual acquisition: Grammatical properties interacting with age of onset and input. *Linguistic Approaches to Bilingualism*, **4**(3), 357–362.

Meisel, J. (2018). Early child second language acquisition: French gender in German children. *Bilingualism: Language and Cognition*, **21**(4), 656–673. https://doi.org/10.1017/S1366728916000237

Muñoz, C., & **Singleton, D.** (2007). Foreign accent in advanced learners: Two successful profiles. *Eurosla Yearbook*, **7**(1), 171–190.

Muñoz, C., & **Singleton, D.** (2011). A critical review of age-related research on L2 ultimate attainment. *Language Teaching*, **44**(1), 1–35.

Nishikawa, T. (2014). Nonnativeness in Near-native Child L2 Starters of Japanese: Age and the Acquisition of Relative Clauses. *Applied Linguistics*, **35**(4), 504–529. https://doi.org/10.1093/applin/amu018

Oksuz, D. C., **Alexopoulou, D.**, **Derkach, K.**, & **Maria, I.** (2022). *The influence of L1 typology on the acquisition of the L2 English articles: A large-scale learner corpus study*. 91.

Oyama, S. (1976). A sensitive period for the acquisition of a nonnative phonological system. *Journal of Psycholinguistic Research*, **5**, 261–283.

Paradis, J. (2005). Grammatical morphology in children learning English as a second language: Implications of similarities with specific language impairment. *Language, Speech, and Hearing Services in Schools*, **36**(3), 172–187. https://doi.org/10.1044/0161-1461(2005/019)

Paradis, J. (2007). *Second language acquisition in childhood.*

Paradis, J. (2011). Individual differences in child English second language acquisition: Comparing child-internal and child-external factors. *Linguistic Approaches to Bilingualism*, **1**(3), 213–237.

Paradis, J. (2023). Sources of individual differences in the dual language development of heritage bilinguals. *Journal of Child Language*, 1–25. https://doi.org/10.1017/S0305000922000708

Paradis, J., & **Blom, E.** (2016). Do early successive bilinguals show the English L2 pattern of precocious BE acquisition? *Bilingualism: Language and Cognition*, **19**(3), 630–635.

Paradis, J., & **Grüter, T.** (2014). Introduction. In T. Grüter & J. Paradis (Eds.), *Input and experience in bilingual development* (pp. 1–14). John Benjamins. https://doi.org/10.1075/tilar.13.01int

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*, **37**, 148–167. https://doi.org/10.1017/S0267190517000022

Passel, J., & **Cohn, D.** (2009). *A Portrait of Unauthorized Immigrants in the United States.* The Pew Hispanic Center. http://madreanna.org/immref/pew/107Full.pdf

Patkowski, M. (1980). The sensitive period for the acquisition of syntax in a second language. *Language Learning*, **30**(2), 449–468. https://doi.org/10.1111/j.1467-1770.1980.tb00328.x

Patkowski, M. (1994). The critical age hypothesis and interlanguage phonology. *First and Second Language Phonology*, 205–221.

Pereira, A. F., & **Smith, L. B.** (2009). Developmental changes in visual object recognition between 18 and 24 months of age. *Developmental Science*, **12**(1), 67–80.

Piker, R. A. (2013). Understanding influences of play on second language learning: A microethnographic view in one Head Start preschool classroom. *Journal of Early Childhood Research*, **11**(2), 184–200.

Pinto, M., & **Zuckerman, S.** (2019). Coloring Book: A new method for testing language comprehension. *Behavior Research Methods*, **51**(6), 2609–2628. https://doi.org/10.3758/s13428-018-1114-8

R Core Team. (2017). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing.

Renfrew, C. E. (1995). *Word Finding Vocabulary Test*. Winslow.

Rice, M. L., & **Wexler, K.** (2001). *Test of Early Grammatical Impairment*. The Psychological Corporation.

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**(3), 635–661. https://doi.org/10.1017/S0305000916000015

Rothman, J., **Long, D.**, **Iverson, M.**, **Judy, T.**, **Lingwall, A.**, & **Chakravarty, T.** (2016). Older age of onset in child L2 acquisition can be facilitative: Evidence from the acquisition of English passives by Spanish natives. *Journal of Child Language*, **43**(03), 662–686. https://doi.org/10.1017/S0305000915000549

Rothweiler, M., & **Lleó, C.** (2006). The acquisition of V2 and subordinate clauses in early successive acquisition of German. *Interfaces in Multilingualism*, 91–113.

Schachter, J. (1990). On the issue of completeness in second language acquisition. *Interlanguage Studies Bulletin (Utrecht)*, **6**(2), 93–124.

Schwartz, B. (2004). Why child L2 acquisition? *LOT Occasional Series*, **3**, 47–66.

Smith, L. B. (2003). Learning to recognize objects. *Psychological Science*, **14**(3), 244–250.

Smith, L. B., & **Jones, S. S.** (2011). Symbolic play connects to language through visual object recognition. *Developmental Science*, **14**(5), 1142–1149.

Snow, C. E., & **Hoefnagel-Hohle, M.** (1978). The critical period for language acquisition: Evidence from second language learning. *Child Development*, **49**(4), 1114–1128. https://doi.org/10.2307/1128751

Sopata, A. (2010). *V2 Phenomenon in Child Second Language Acquisition*. Second Language Research Forum, 211–228.

Sorenson Duncan, T., & **Paradis, J.** (2018). How does maternal education influence the linguistic environment supporting bilingual language development in child second language learners of English? *International Journal of Bilingualism*, **24**(1), 46–61. https://doi.org/10.1177/1367006918768366

Sorenson Duncan, T., & **Paradis, J.** (2020). How does maternal education influence the linguistic environment supporting bilingual language development in child second language learners of English? *International Journal of Bilingualism*, **24**(1), 46–61.

Soto-Corominas, A., **Paradis, J.**, **Al Janaideh, R.**, **Vitoroulis, I.**, **Chen, X.**, **Georgiades, K.**, **Jenkins, J.**, & **Gottardo, A.** (2020). Socioemotional wellbeing influences bilingual and biliteracy development: Evidence from Syrian refugee children. *Proceedings of the 44th Boston University Conference on Language Development. Edited by Megan M. Brown and Alexandra Kohut. Somerville: Cascadilla Press*, 620–633.

Stevens, G. (2006). The Age–Length–Onset Problem in Research on Second Language Acquisition Among Immigrants. *Language Learning*, **56**(4), 671–692. https://doi.org/10.1111/j.1467-9922.2006.00392.x

Stromswold, K. (2004). Who did what to whom. *John Hopkins University IGERT Workshop, January* 2004.

Szmalec, A., **Brysbaert, M.**, & **Duyck, W.** (2012). Working memory and (second) language processing. In *Memory, language, and bilingualism: Theoretical and applied approaches* (pp. 74–94). Cambridge University Press.

Tsimpli, I. M. (2014). Early, late or very late?: Timing acquisition and bilingualism. *Linguistic Approaches to Bilingualism*, **4**(3), 283–313.

Unsworth, S. (2013). Assessing the role of current and cumulative exposure in simultaneous bilingual acquisition: The case of Dutch gender. *Bilingualism: Language and Cognition*, **16**(1), 86–110.

Unsworth, S. (2016). Early child L2 acquisition: Age or input effects? Neither, or both? *Journal of Child Language*, **43**(3), 608–634. https://doi.org/10.1017/S030500091500080X

Unsworth, S., **Hulk, A.**, & **Marinis, T.** (2011). Internal and external factors in child second language acquisition: Introduction. *Linguistic Approaches to Bilingualism*, **1**.

Van Dyke, J. A., & **Lewis, R. L.** (2003). Distinguishing effects of structure and decay on attachment and repair: A cue-based parsing account of recovery from misanalyzed ambiguities. *Journal of Memory and Language*, **49**(3), 285–316.

Weisberg, D. S., **Zosh, J. M.**, **Hirsh-Pasek, K.**, & **Golinkoff, R. M.** (2013). Talking it up: Play, language development, and the role of adult support. *American Journal of Play*, **6**(1), 39–54.

Winter, B. (2022). Mapping the landscape of exploratory and confirmatory data analysis in linguistics. *Data Analytics in Cognitive Linguistics: Methods and Insights*, **41**, 13.

Winter, B., & **Grice, M.** (2021). Independence and generalizability in linguistics. *Linguistics*, **59**(5), 1251–1277.

Zins, J. E. (2004). *Building academic success on social and emotional learning: What does the research say?* Teachers College Press.

Zuckerman, S., **Pinto, M.**, **Koutamanis, E.**, & **Spijk, Y.** (2016). A New Method for Testing Language Comprehension Reveals Better Performance on Passive and Principle B Constructions. In J. Scott & D. Waughtal (Eds.), *BUCLD 40: Proceedings of the 40th annual Boston University Conference on Language Development* (pp. 443–456).

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