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I: INTRODUCTION.

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Vocabulary of 2-Year-Olds Learning English and an Additional Language: Norms and Effects of Linguistic Distance

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Abstract

The majority of the world's children grow up learning two or more languages. The study of early bilingualism is central to current psycholinguistics, offering insights into issues such as transfer and interference in development. From an applied perspective, it poses a universal challenge to language assessment practices throughout childhood, as typically-developing bilingual children usually underperform relative to monolingual norms when assessed in one language only. We measured vocabulary with Communicative Development Inventories for 372 24-month-old toddlers learning British English and one Additional Language out of a diverse set of 13 (Bengali, Cantonese, Dutch, French, German, Greek, Hindi-Urdu, Italian, Mandarin, Polish, Portuguese, Spanish and Welsh). We furthered theoretical understanding of bilingual development by showing, for the first time, that linguistic distance between the child's two languages predicts vocabulary outcome, with phonological overlap related to expressive vocabulary, and word order typology and morphological complexity related to receptive vocabulary, in the Additional Language. Our study also has crucial clinical implications: we have developed the first bilingual norms for expressive and receptive vocabulary for 24-month-olds learning British English and an Additional Language. These norms were derived from factors identified as uniquely predicting CDI vocabulary measures: the relative amount of English versus the Additional Language in child-directed input and parental overheard speech, and infant gender. The resulting UKBTAT tool was able to accurately predict the English vocabulary of an additional group of 58 bilinguals learning an Additional Language outside our target range. This offers a pragmatic method for the assessment of children in the majority language when no tool exists in the Additional Language. Our findings also suggest that the effect of linguistic distance might extend beyond bilinguals' acquisition of early vocabulary to encompass broader cognitive processes, and could constitute a key factor in the study of the debated bilingual advantage.

Chapter 1 – Introduction

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Parents eagerly await the moment their one-year-old infant produces their first word, and professionals working with young children track the appearance of the two-word combination stage at around age 2. To developmental psycholinguists, these two milestones in healthy language acquisition are supported by an impressive range of achievements, from the attuning of perceptual abilities (Werker, Yeung, & Yoshida, 2012), the development of word segmentation skills (Bergmann & Cristia, 2016) and the retrieval of word meaning (Stevens, Gleitman, Trueswell, & Yang, 2017), to the discovery of syntactic, morphological and conversational rules (Gleason & Ratner, 2017; Hoff, 2013). The complexity of the task that young children naturally solve places the study of language development at the heart of the debate about the nature of the human mind (Pinker, 1995; Tomasello, 2009). In addition, the co-occurrence - and interdependence - of language development and that of other domains such as motor coordination (Iverson, 2010), object perception (Jones & Smith, 2005), or social skills (Carpenter, Nagell, Tomasello, Butterworth, & Moore, 1998), indicates that the study of language learning is fundamental to the understanding of child development as a whole.

Even more impressive than an infant acquiring her maternal language is an infant learning two or more languages, an achievement of the majority of the world's children (Kohnert, 2010), including an increasing proportion in the United Kingdom (UK) (17.5% in primary schools; NALDIC, 2012). Although knowledge about language development is mostly built around the monolingual child model, the study of early bilingualism has become a central issue in psycholinguistics. This is because it allows us to address theoretical key questions such as specificity, differentiation, transfer and interference in development, but also because, from

an applied perspective, it poses a universal challenge to language assessment practices throughout childhood. Indeed, language development in bilinguals is notoriously difficult to predict, due to a variety of situational factors related to the proportion and properties of dual-language exposure, making the use of monolingual norms largely inadequate for this population (Cattani et al., 2014). This is further complicated by the variety of language pairs being spoken in the world. For example, in the United States (US), whilst Spanish constitutes the most common other-than-English language spoken at home (62% speakers), the remaining 38% speakers share up to at least 350 languages, mostly in large metropolitan areas (United States Census 2020). Given the mounting evidence that children develop their two languages in separate, yet interfering, systems (Hoff, 2013), the degree of influence between two languages should theoretically depend upon the linguistic distance between the two languages.

The central aim of this paper is to investigate the role of linguistic distance in early language development, and through this, we address two key questions: first, we bring new theoretical knowledge by directly testing hypotheses regarding the existence of language-to-language influence in early bilingual development; second, we offer a pragmatic solution to the widespread problem of how to assess bilingual toddlers' language skills when no tools are available in the home language. Although the study was conducted in the UK, the theoretical conclusions we reached about the role of linguistic distance are not community-specific, and the principles behind the assessment tool we have designed can be exported to any other community.

We collected data about vocabulary development and contextual variables in a cohort of 372 bilingual two-year-old toddlers learning British English and one of 13 Additional Languages. We investigated how vocabulary development is modulated by linguistic distance between British English and the Additional Language, bringing new evidence about language-to-language influence in early acquisition, and the first demonstration to date of an effect of

structural similarity between languages on early vocabulary development (Study 1). In addition, we generated a vocabulary model able to predict the lexicon size of 2-year-old bilinguals in English and one the 13 target Additional Languages, which fed into a new assessment tool, the UKBTAT (UK Bilingual Toddler Assessment Tool) (Study 2). Finally we showed that this model could reliably predict the English scores of a new cohort of 58 British-English 2-year-olds learning a new, non-target Additional Language (Study 3). In what follows, we review the literature pertaining to the theoretical (Study 1) and applied contributions of this work (Studies 2 and 3). In Chapter 2 we present the methods for the cohort data collection, followed by the analyses pertaining to Study 1 in Chapter 3, Studies 2 and 3 in Chapter 4, ending with Chapter 5 where we discuss how linguistic distance shapes language development and the limiting factors of this work.

Study 1: Understanding the Role of Linguistic Distance in Bilingual Development

Most bilingual studies are conducted with homogeneous samples, with Spanish-American English bilinguals constituting the largest cohort (e.g., Marchman, Fernald, & Hurtado, 2010; Place & Hoff, 2011), followed by Canadian English-French (e.g., Paradis, Crago, Genesee, & Rice, 2003), Barcelona Catalan-Spanish (e.g., Bosch & Sebastián-Gallés, 2001) and Welsh-British English (e.g,. Gathercole & Thomas, 2009). Although it is often reasonable to generalise results obtained with one language pairing to different language pairs, is it safe to assume that bilingual children from different backgrounds are confronted with the same linguistic problems to solve, or that they are able to solve them within the same learning span?

There is growing evidence that, according to the language they acquire, monolinguals' learning paths can differ, including for early lexical prosodic processing (Adam & Bat-El, 2009), word segmentation (across dialects: Floccia et al., 2016; Nazzi, Mersad, Sundara, Iakimova, & Polka, 2014), and phonological processing (Nazzi, Floccia, Moquet, & Butler,

2009; Mani & Plunkett, 2007; Delle Luche, Floccia, Granjon, & Nazzi, 2016; Bouchon, Floccia, Fux, Adda-Decker, & Nazzi, 2015), culminating in differences in vocabulary growth (Bleses et al., 2008; Thordardottir, 2005). Bilingualism is likely to exacerbate these language-specific differences, adding not only a new language but also the complexity of interactions between languages.

Why should we expect interactions between the two language systems in a bilingual child? In adult bilinguals, evidence for automatic cross-language activation in visual word recognition (Lauro & Schwartz, 2017), and in spoken word recognition (Mercier, Pivneva, & Titone, 2014; Spivey & Marian, 1999) strongly point to the interdependence of the two language systems (see French & Jacquet, 2004). A common position nowadays, following the original proposal of a primary, undifferentiated language system (Volterra & Taeschner, 1978), is that early bilinguals develop two independent language systems (Genesee, 1989; Genesee, Nicoladis, & Paradis, 1995). However, accumulating evidence suggest early influences from one language system onto the other, mirroring the structure of the adult system. Interaction between the two language systems is perhaps most obvious in production, where intra-sentential code-mixing, i.e., including elements of each language at the sentence level, is frequently observed in toddlers at the phonological, lexical and morphosyntactic level (e.g., Gildersleeve-Neumann, Kester, Davis, & Peña, 2008; Paradis & Genesee, 1996). More convincing however is non-selective lexical access in comprehension, that is, the fact that speech presented in one language activates word recognition in the two languages, as demonstrated in adults (e.g., Dijkstra, 2005), and observed at least as young as from three years of age (e.g., Poulin-Dubois, Bialystok, Blaye, Polonia, & Yott, 2013; Von Holzen & Mani, 2012; see the review by DeAnda, Poulin-Dubois, Zesiger, & Friend, 2016). However, even if there were an initial separation of lexicons, bilinguals would still demonstrate language-specific differences from the parallel learning of two language systems. For example, French

infants rely more on consonants than vowels for lexical processing from the age of 8 months (Nishibayashi & Nazzi, 2016), whereas British English learners process consonants and vowels equally (Mani & Plunkett, 2007; Floccia, Nazzi, Delle Luche, Poltrock, & Goslin, 2014), at least until the age of 30 months (Nazzi et al., 2009), and Danish children rely more on vowels than consonants at 20 months of age (Højen & Nazzi, 2016). How do such differences translate to the case of bilingual learners? Will language-specific routes for vowel-consonant processing be delayed until the onset of separate language processing, or will one linguistic strategy be adopted, at an efficiency cost to the other language?

In sum, each language pairing will necessarily produce a different linguistic learning problem for bilingual infants to solve, which is likely to translate to variable delays and/or adapted pathways (see Polka, Orena, Sundara, & Worrall, 2017, for word segmentation outcomes differing in bilingual and monolingual 8-month-olds). In this project we conducted the first systematic evaluation of the impact of differences between languages, as measured through metrics of linguistic distance, on vocabulary acquisition in both British English and the Additional Language.

Measuring linguistic distance. As adults, second language learning seems easier if the language is intuitively similar to our own (e.g., English/German vs English/Cantonese), which is supported by studies in second language learning for both adults and school-aged children (e.g., Lado, 1957; Lindgren & Muñoz, 2012; Van der Slik, 2010). For example Lindgren and Muñoz (2012) showed that a cognate-based measure of language distance is the most important predictive factor for formal second language learning in schools, above differences in the exposure of the languages at home. These results support the idea that in second-language learning, the knowledge and structure of L1, i.e. the maternal language, provide scaffolding for the acquisition of L2, i.e. the Additional Language (see also the literature on cross-linguistic

transfers in second language reading acquisition, e.g., Genesee, Geva, Dressler, & Kamil, 2006).

However, in early simultaneous bilinguals the effects of language distance are more complex as the languages are acquired in parallel from infancy. While similarities between the two languages may reinforce phonological, lexical and syntactic acquisition across the two languages, it would also reduce the perceptual separation between languages. Knowledge of the interaction between reinforcement and separation is crucial to our understanding of bilingual acquisition, but the complexity of multi-dimensional representations of language means that unitary measures of the seemingly intuitive notion of 'linguistic distance' are difficult to evaluate. This complexity is reflected in the many distance metrics which have been proposed, including cognate distance (e.g., Dyen, Kruskal, & Black, 1992), genetic linguistic distance (Harding & Sokal, 1988; Ruhlen, 1987), phonetic distance (Nerbonne et al., 1996), distance in terms of linguistic rhythm (Ling, Grabe, & Nolan, 2000; Ramus, Nespor & Mehler, 1999) and second language learnability (Chiswick & Miller, 2005).

Of all linguistic distance measures, cognate distance is probably the metric that has the widest currency, at least at the lexical level. Traditionally, this refers to the proportion of translation equivalents sharing common historical origins, such as *lait* in French and *leche* in Spanish (*milk*, sharing the Latin root *lac*). In an influential cognate database (e.g., Dyen et al., 1992, adapted by McMahon & McMahon, 2005), the index of linguistic cognate distance is obtained from the compilation of 200 frequent culture-neutral words in 84 Indo-European languages and dialects, and for each language pairing. However, the definition of cognates in Dyen et al.'s database makes it difficult to generalise to languages without a clear common history. Approaches based on automatic methods have been proposed to refine the definition of cognates, for example by using intra-language similarity (Ellison & Kirby, 2006) or cross-language orthographic similarity measures (Serva & Petroni, 2008). While some of these

metrics may be suitable for the adult speech environment, child-directed speech differs in lexical, prosodic and pragmatic content from adult-directed speech (e.g., Thiessen, Hill, & Saffran, 2005). Importantly, infants do not share adults' meta-linguistic and orthographic knowledge.

Given the young age of our participants it was necessary to base our distance metrics on a set of child-familiar basal words and to consider phonetic, phonological and metrical similarities rather than historical origins or orthographic properties. To this end we developed a measure of linguistic distance which focussed upon corpora related to toddlers' speech environment. We used the Oxford Communicative Developmental Inventory of Oxford CDI (Hamilton et al., 2000), which supplied us with a list of words that should be known to British English children of our target age group. Here a short introduction to the CDIs is necessary, as we will use these tools not only to develop a metric of phonological overlap, but also to collect vocabulary data from toddlers.

The first Communicative Developmental Inventories, which are parental reports of their children's vocabulary on a checklist of familiar words, were developed for American English children (Fenson et al, 1994), with norms published in two separate forms for different age ranges (8-18 months for the Words and Gestures form, and 16-30 months for the Words and Sentences form). An updated norming sample of 2,550 US children was produced later for the two forms (MacArthur-Bates CDI, Fenson et al., 2007). Crucially, the normed CDI parent reports have been adapted (not translated) in a multitude of languages, with the purpose of mirroring the structure of the reference language as much as possible. The availability of CDIs in many languages has created new opportunities for cross-linguistic studies of language development (see e.g., CLEX database now called Wordbank: Jørgensen, Dale, Bleses, & Fenson, 2009; Frank, Braginsky, Yurovsky, & Marchman, 2017) and for bilingual studies (e.g., Armon-Lotem, & Ohana, 2017; Cattani et al., 2014; Gatt, 2017; Pearson, Fernandez, & Oller,

1993; O'Toole et al., 2017). The reliability and validity of CDIs is long established for use in research (Mancilla-Martinez, Gamez, Vagh, & Lesaux, 2016; Marchman, Thal, Dale, & Reznick, 2006) and for clinical assessment (e.g., Charman, Drew, Baird, & Baird, 2003; Heilmann, Weismer, Evans, & Hollar, 2005; Thal, DesJardin, & Eisenberg, 2007).

To produce vocabularies for the 13 target Additional Languages, we could have used the words listed in each language-specific CDI as a proxy of toddler vocabulary for each Additional Language. However, these CDI vocabularies would largely reflect the cultural and physical environment in which the language was predominantly spoken. As our bilinguals all live in the UK it is likely that both their British English and Additional Language vocabulary would reflect a British English environment, rather than the environment of the monolingual Additional Language CDI. As such, we believe that the bilingual Additional Language lexicon would be better represented by translation equivalents of the words of the Oxford CDI. This approach also has the advantage that it is unaffected by variations in the methodologies used to construct Additional Language CDIs, which can result in wide differences in CDI word counts. Details of these toddler-centric metrics can be found in the method section (Chapter 2). Note that the use of a common CDI inventory across all language groups was restricted to the calculation of a metric of phonological overlap, and not to collect vocabulary knowledge from toddlers, which was performed with language-specific inventories.

With this first metric based on lexical phonological overlap, we expected phonological similarity between languages to facilitate the acquisition of words in each language. This hypothesis is supported by results from Bosch and Ramon-Casas (2014) showing that 18-month-old Catalan-Spanish bilinguals were more likely to produce highly similar cognates than less similar ones.

In addition to measures of linguistic distance based on lexical overlap, we also ranked language pairs on measures of grammatical distance, namely word order typology and

morphological complexity. Languages can be broadly distinguished on the basis of the relative order of the main verb (V) and its object (O) (Dryer, 1991; Greenberg, 1963), with VO order as in English and Spanish, OV as in Bengali and Hindi/Urdu and mixed OV/VO for German and Dutch. Children's very first combinations of words show knowledge of this basic word order (e.g., Bates et al., 1984; Brown, 1973), demonstrated even earlier in comprehension (e.g., Höhle, Weissenborn, Schmitz, & Ischebeck, 2001), although the full knowledge of native language word order patterns takes several years to develop (e.g., Abbot-Smith, Lieven, & Tomasello, 2008; Akhtar & Tomasello, 1997; Guasti, 2002). To retrieve information about their language's syntactic typology, monolingual infants have been found to rely on the relative order of function and content words in their first year of life (Gervain, Nespor, Mazuka, Horie, & Mehler, 2008), as well as on prosodic correlates of word order (Bernard & Gervain, 2012; Christophe, Nespor, Guasti, & Van Ooyen, 2003). In bilingual infants, Gervain and Werker (2013) recently showed that when learning languages with opposite word orders, such as English and Hindi, 7-month-old bilinguals would also exploit the appropriate prosodic information, revealing an early sensitivity to cues that can be used to acquire basic word order in their two languages. Once acquired, knowledge of word order would logically boost word segmentation and grammatical parsing, and therefore learning two languages with a common word order might facilitate these processes. We examined whether vocabulary scores in English and in the Additional Language at the age of 2 could be predicted from the similarity of British English and the Additional Language in terms of word order typology.

Finally, languages can also be ranked on a continuum of morphological complexity (Brown, 2010; Comrie, 1989; Greenberg, 1960), with analytic or isolating languages on one end of the continuum (lowest ratio of morphemes to words, as in Cantonese, and to a lesser extent, in English), inflecting/fusional (Russian, Italian, French) as well as agglutinating (Finnish, Basque, Turkish, Hungarian) languages in the middle, and polysynthetic languages

on the other end (highest ratio of morphemes to words, such as in Yupik). The most intuitive expectation is that speed of acquisition would vary as a function of the morphological complexity of the to-be-acquired language (see Caselli, Casadio, & Bates, 1999, for this suggestion). Xanthos et al. (2011) found, by contrast, that the more morphologically complex the ambient language, the faster children will acquire morphological rules (see also Leonard, 2000). However, it is possible that the nature of the cognitive resources engaged in language acquisition vary as a function of its morphological complexity, with analytic languages making greater demands on memory than synthetic languages (Fortescue & Lennert Olsen, 1992). In the bilingual situation, acquisition could be boosted when confronted with morphologically close pairs of languages as compared to more distant ones, simply because of a better alignment of cognitive demands. In support for this hypothesis is the study by Paradis (2011) showing that 6-year-old second language learners from immigrant families in Canada had a better command of English verb morphology if their language at home was closer to English in terms of verb morphology typology (marking tense/agreement). Here we evaluated whether vocabulary scores in English and in the Additional Language could be predicted from the proximity of languages in terms of morphological complexity.

Language community and culture. In addition to linguistic distance, each language pairing also comes with a range of cultural and social idiosyncrasies, which are impossible to explore exhaustively and often difficult to disentangle from linguistic factors. For example, cultural differences can relate to the degree to which parents communicate with infants (Bavin, 1992; Brown, 2001), the characteristics of infant-directed speech (Fernald et al., 1989), the degree of focus on objects in conversations (Tardif, Shatz, & Naigles, 1997), parents' attitude towards bilingualism (De Houwer, 1999), or the level of involvement of siblings in early interactions (Super & Harkness, 2013). Studies which have attempted to examine the combined or separate effects of cultural and linguistic variations in early language development are, to

our knowledge, very scarce. One such study by Barac and Bialystok (2012) compared three groups of 6-year-olds on English verbal tasks for receptive vocabulary, grammatical knowledge and metalinguistic awareness, testing Spanish-English, French-English and Chinese-English bilinguals, all attending similar schools in Canada. When controlling for SES and the amount of exposure to each language at home, it was found that Spanish-English bilinguals outperformed French-English and Chinese-English children on verbal tasks. The poorer performance of French-English children was attributed to the fact they were they were the only group whose schooling was in French – therefore resulting in less exposure to English - whereas the other groups received English schooling. More pertinently, the higher performance of Spanish-English bilinguals as compared to the Chinese-English bilinguals was accounted for by the greater linguistic similarity between Spanish and English than Chinese and English; this was, however, a speculative explanation since the authors acknowledged an unclear understanding of what would constitute cultural differences between these communities. Similarly, Bialystok, Majumber and Martin (2003) showed an advantage for metalinguistic awareness in Spanish-English bilinguals at 6-7 years of age, as compared to English monolinguals, with Chinese-English bilinguals performing worse than both other groups. The authors attributed these differences to English and Spanish being closer in terms of consonant-vowel alternation, as compared to the phonological and tonal structure of Chinese, and also to an advantage of Spanish itself provided by its greater phonological transparency. Once again, however, a combination of cultural and linguistic factors might explain the differences, for example if one community engaged more in communication overall, or made a greater use of intra-sentential code-mixing.

Disentangling the effect of linguistic distance from that of language community. It is impossible to account for all variation associated with each language, and a fortiori, for each language pairing. In the current study we examined a large number of language pairs (13 pairs)

with British English common across all pairs. Our sample provides variation in terms of linguistic distance and cultural background, as a subsample of all possible pairings. These data were analysed with linear mixed models which include a factor for random variation due to language community, but also linguistic distance as a "between-language" fixed factor. If linguistic distance has an effect then it can be used to usefully explain some of the variance in scores that would otherwise simply be apportioned to language community.

In sum, we discussed how linguistic distance between a bilingual's two languages can be estimated on three dimensions: phonological overlap, subject-verb order typology and morphological complexity. We also reviewed how current views on the structure of the early bilingual language system can accommodate an effect of linguistic distance on vocabulary size. This was the rationale for our first study, to quantify the amount of variation due to linguistic distance in the development of vocabulary at age two. In what follows we discuss our second, applied aim, which was to build a model of the bilingual early lexicon able to account for the variance due to situational factors related to bilingual experience, linguistic distance and language community, providing norms of vocabulary development for assessment purposes (the UKBTAT).

Study 2: Providing Norms of Vocabulary Development for Bilingual Toddlers

It is well documented that bilinguals generally command a smaller vocabulary in each language than monolinguals (e.g., Bialystok, Luk, Peets, & Yang, 2010; Hoff et al., 2012; Miękisz et al., 2016; Oller & Eilers, 2002; Perani et al., 2003; Portocarrero, Burright, & Donovick, 2007; Smithson, Paradis, & Nicoladis, 2014). This fact is critical for assessing children's language development because vocabulary size is a central measure of progress in both the oral and literate forms of language (Muter, Hulme, Snowling, & Stevenson, 2004). Indeed, vocabulary size correlates highly with grammatical development (Conboy & Thal, 2006; Hoff, Quinn, & Giguere, 2017; Thal, Bates, Goodman, & Jahn-Samilo, 1997), and is

strongly predictive of later language impairment (Conti-Ramsden & Botting, 1999; Dale, Price, Bishop, & Plomin, 2003) and reading comprehension skills (Duff, Reen, Plunkett, & Nation, 2015), making it a reasonable proxy of language development achievements in young toddlers (see also Cattani et al., 2014).

Getting an accurate estimate of the "bilingual difference" in vocabulary size for each language is a prerequisite to adapting existing assessment tools for the evaluation of bilingual toddlers' language achievements. Furthermore, language disorders occur with similar prevalence in both the monolingual and bilingual populations (Kohnert, 2010), with all children having a 7-15% chance of experiencing delayed language acquisition due, for example, to pervasive developmental disorders such as autism (e.g., 2.6%, Kim et al., 2011), hearing impairment (e.g., 1% in Fortnum et al., 2001) or Developmental Language Disorder (e.g., 7%, Tomblin et al., 1997). Current language assessment methods are based upon expectations for monolingual learners, and take no account of comparative delays seen in typical bilingual lexical development (Gathercole, 2007) or grammar (Bedore & Peña, 2008; Bialystok, 2009; Kohnert, 2010). Thus, according to circumstances, bilinguals, who are in reality typically-developing, may be diagnosed with spurious acquisition problems or have genuine problems ignored (e.g., Crutchley, 2000; Salameh, Nettelbladt, Håkansson, & Gullberg, 2002, for evidence of under-referral in bilingual children). Moreover, whilst recommendations to practitioners are that proficiency in both languages should be assessed (American Speech-Language-Hearing Association, 1999; Royal College of Speech and Language Therapists, 2007), this is in practice complicated by the diversity of language pairs (Cattani et al., 2014; Thordardottir, Rothenberg, Rivard, & Naves, 2006).

An approach advocated by Pearson, Fernandez and Oller (1993) for Spanish-English and Junker and Stockman (2002) for German-English bilinguals is to obtain for each child her total vocabulary in the two languages, either by counting all tokens (Total Vocabulary or TV;

e.g., *dog* and its French equivalent *chien* would count as one entry each) or counting two known translation equivalents as one (Total Conceptual Vocabulary or TCV; e.g., *dog* and *chien* would count as one entry). Based on findings that bilingual children score similar to monolinguals when using their TV or TCV measures, it was proposed that bilingual norms might not be necessary, as long as vocabulary could be estimated in both languages. However, Thordardottir et al. (2006) reported that the use of TCV/TV measures was not appropriate for balanced bilinguals, that is, those hearing equal amounts of each language on a regular basis, or children whose language dominance is not clear. They attributed this to the large overlap in knowledge from their two languages, which would modulate the relationship between measures using one language (monolingual norms) or two languages (TV/TCV). In addition and most importantly, they found that the comparison of TCV/TV to monolingual norms was highly dependent on which monolingual group is used for comparison, as vocabulary growth can vary substantially between languages (Thordardottir, 2005), for example when presented with a particularly complex vowel system as in Danish (Bleses et al., 2008). Core, Hoff, Rumiche and Señor (2013) also found that between 22 and 30 months, TCV scores placed significantly more bilinguals below the 25th percentile on monolingual norms than single-language scores did for monolinguals (see also Gross, Buac, & Kaushanskaya, 2014).

Therefore, measuring bilingual vocabulary appears to be an impractical task given the variety of factors that might shape lexical growth in these children, from the variation between language pairs to situational factors such as amount and mode of exposure (e.g., Hoff et al., 2012; Place & Hoff, 2011). The aim of our second study was to provide a new functional approach to the evaluation of vocabulary knowledge in bilingual children, addressing the diversity of bilingual children's situations, in particular, variation in the linguistic distance between each bilingual child's two languages. To our knowledge, this is the first time that data were collected from a large cohort of bilingual children learning a variety of language pairs, in

an attempt to capture empirically the effect of language community and linguistic distance on other factors known to modulate vocabulary growth in bilingual children. In addition, by focusing on children who share one language (here, British English), we avoid having to rely on different standardised tools that may vary dramatically across languages (Thordardottir, 2005). Whilst the resulting norms of vocabulary growth are specific to children learning British English as one of their languages, our rationale and methods are, we believe, generalisable to any new population of bilingual toddlers.

Assessing language development: The case of the UK. In the historical context of the British Empire and more recent European Union expansion, the UK bilingual population is characterised by a great diversity of language backgrounds, with no predominant group such as Spanish-English in the US (with the exception of Welsh in North Wales). As such, it can be taken as a representative case study for the widespread situation where the professionals who assess young children have no easy access to an appropriate standardised monolingual assessment tool, let alone a bilingual tool. In what follows we will review briefly the current practices of screening and assessment of bilingual children in the UK.

Recently, the Dynamic Assessment of Preschoolers' Proficiency in Learning English (DAPPLE) was developed in the UK to respond to the clinical need to distinguish between a disorder and the bilingual difference, using a mixed group of bilinguals, that is, children learning English and a variety of Additional Languages (Hasson, Camilleri, Jones, Smith, & Dodd, 2013). This assessment examines the children's ability to learn vocabulary, sentence structure and phonology. This battery of language skills assessments sounds promising as a pre-diagnostic tool but is designed for children aged 42 months; in addition, it has been criticised for issues regarding inter-rater reliability (Hasson & Joffe, 2007) and is usually very time-consuming (De Lamo White & Jin, 2011).

Since 2013 the professionals who assess young children use general developmental questionnaires at age 2 which include language components, such as the revised Ages and Stages Questionnaires (ASQ: Squires & Bricker, 2009). However, each of these tools is designed and normed for monolingual development which, along with the lack of adequate language assessment tools for that age range, means that bilingual 24-month-olds continue to be at risk of under-referral (Crutchley, 2000; Salameh et al., 2002).

The linguistic heterogeneity of the UK regarding its bilingual population, and the clear clinical need, motivated the second and third studies reported in this paper: from the estimation of the impact of language community and linguistic distance on bilingual lexical development obtained in Study 1, we developed a full model of the bilingual lexicon at age 2 which provided norms of development, the UKBTAT (Study 2), and showed that it could be used for bilingual toddlers learning British English and a new Additional Language not included in the original target set (Study 3). The UKBTAT, designed to address issues faced by childhood professionals in a range of bilingual situations, has the following characteristics: (1) it is targeted for 24-month old children, a milestone age easy to remember for parents and practitioners, and relevant for the UK policy of assessing children from this age; (2) it is usable for any child learning British English and any other Additional Language from our 13 target languages – and can also provide useful information regarding English development for children learning another Additional Language; (3) it is user-friendly and easy to administer, relying on short parental questionnaires about the child's vocabulary knowledge, and a 10-minute interview with the parent/carer (which can be done on the phone) to collect critical data on language exposure and demographics; (4) it provides interpretable results even if parents or carers estimate their child's knowledge of English only, although the added information about the Additional Language, when available, enriches the outcome; and (5) it can be used by a non-

language-specialist practitioner, it is freely accessible online on a dedicated website and easily printable if needed.

From the cohort of toddlers tested in this project, we collected detailed information about family composition and characteristics, and level/mode of exposure to English and the Additional Languages. Many studies have examined situational factors that could impact the rate of language development in bilingual children, including socio-economic status (e.g., Calvo & Bialystok, 2014; Gross et al., 2014), relative amount of exposure to each language (e.g., Hoff et al., 2014), mode of exposure, such as number of speakers per language (e.g., Gollan, Starr & Ferreira, 2015), daycare attendance (e.g., Hansen & Hawkes, 2009), or language mixing (e.g., Byers-Heinlein, 2013). Such studies typically focus on no more than three factors at a time, making it difficult to quantify the relative contributions and interactions of all factors on a single measure of language achievement. A recent exception is the 250-children study by O'Toole et al. (2017), who compared vocabulary in six groups of bilingual children aged 24 to 36 months growing up in different countries (Maltese-English, Polish-English, French-Portuguese, Hebrew-English, Irish-English, Turkish-German) using adaptations of CDIs, and examining the contribution of a range of situational factors to TCV measures. They reported some large, unexplained variations in TCV measures across language groups, possibly due to linguistic distance, with for example Maltese-English and Polish-English groups scoring lower than the other groups. However because they tested children from a range of linguistic, cultural and geographical backgrounds, it is impossible to disentangle variance due to any of these factors from that due to linguistic distance.

The current study is the first extensive study of the effects and interactions of the potentially critical factors for language development in bilingual toddlers learning one common language: relative exposure to the two languages, family demographics, mode of exposure (which uncovers a range of factors, as described below) and, innovatively, language

community (i.e., the specific Additional Language being spoken) and linguistic distance between English and the Additional Language. Quantifying the contributions of these factors to the trajectory of vocabulary development in bilingual toddlers will be critical to provide an accurate picture of expected language outcomes at 2 years. In what follows we review the potential factors that influence vocabulary knowledge at age 2 in bilingual toddlers.

Relative amount of exposure to languages. It is firmly established that the relative exposure to each language strongly influences bilingual children's rate of development in those languages (Welsh: Gathercole & Thomas, 2009; Spanish: Hoff et al., 2012; Pearson, Fernandez, Lewedeg, & Oller, 1997; French: Thordardottir, 2011; Cantonese and Mandarin: Law & So, 2006); indeed, relative exposure has been advocated as a proxy for language dominance (Unsworth, 2012). Relative exposure predicts development of phonology (Law & So, 2006), lexicon (Cattani et al., 2014) and grammar (Gathercole, 2002a; 2002b; 2002c; Nicholls, Eadie, & Reilly, 2011; Oller & Eilers, 2002). How to measure the exposure to each language varies from one study to the next or from one lab to the next, for example asking parents to use a prospective language diary (e.g., De Houwer & Bornstein, 2003; Place & Hoff, 2011), or using a detailed questionnaire or interview about regular exposure to each language (e.g., ALEQ: Paradis, 2011; Language Exposure Questionnaire: Bosch & Sebastián-Gallés, 1997; Thordardottir, 2011; Hoff et al., 2012). Because these questionnaires tend to be long and complex to administer, we developed our own Plymouth Language Exposure Questionnaire tool (Cattani et al., 2014), consisting of a 5 to 10 min interview with the parent (face-to-face or on the phone), comprising 10 to 12 simple questions about a child's typical week. In a group of 35 mixed bilinguals aged 30 months, Cattani et al. (2014) showed that the amount of exposure as measured by the Plymouth Language Exposure Questionnaire predicted vocabulary scores in comprehension and production as measured by the Oxford CDI (Hamilton, Plunkett, & Schafer, 2000): specifically, the more exposure to English

(relative to the Additional Language) children experienced in a typical week, the more words they understood and used in English. Recently, Abdelwahab, Stone, Slee, Cattani and Floccia (2016) also showed a strong correlation between scores from the Plymouth Language Exposure Questionnaire and three other widely-used questionnaires (ALEQ: Paradis, 2011; MLEQ: Yang, Blume, & Lust, 2006; Language Exposure Questionnaire by Bosch & Sebastián-Gallés, 1997), with correlations ranging from .62 to .79.

The Plymouth Language Exposure Questionnaire primarily collects information about speech directed towards children, as the consensus is that children's language development benefits from joint attention situations (e.g., Tomasello & Farrar, 1986) and infant directed speech (Weisleder & Fernald, 2013). However, in many cultures children are not directly addressed (Lieven, 1994), and recent studies have showed that word learning at 18 months, for example, can be elicited from overheard speech (Floor & Akhtar, 2006). Furthermore, bilingual infants as young as 3.5 months benefit from overheard speech in their ability to discriminate between their two native language(s) (Molnar, Gervain, & Carreiras, 2014). In fact, in many tools used to quantify the relative amount of exposure to each language, both direct (speech to the child) and indirect (speech between adults) sources are taken into account in the calculations (e.g., Paradis, 2011; Yang et al., 2006). To complement the Plymouth Language Exposure Questionnaire measure and ensure that we quantify all possible sources of English/Additional Language input, the proportion of British English versus Additional Language used in overheard speech between parents was also evaluated in the current study.

Mode of exposure. Mode of exposure is probably the most complex factor to estimate, as it includes a range of variables such as the *source* of each language (e.g., presence of siblings, number of speakers per language, social context of exposure, e.g., crèche versus home), the *status* of the languages in the environment (minority language, such as Mandarin in a Plymouth family, or predominant cultural bilingualism as Welsh and British English in Bangor), and the

properties of the input (language mixing; native versus non-native input). It is a current matter of debate whether these variables have a significant effect on bilingual language development, especially in toddlers.

   Source of each language. The bilingual child's relative proficiency between languages appears to be modulated by the source of exposure, that is, who is speaking to them in each language. For example, Barrena, Ezeizabarrena and Garcia (2008) reported that Basque-Spanish young bilinguals knew more words in the Additional Language (Basque) when both parents were Additional Language speakers as compared to when only one was an Additional Language speaker - although this factor could be confounded with the amount of exposure in this study. It is also possible that there may also be differences depending on *which* parent is the source of Additional Language (please note that at this stage, the wording in the various questionnaires follows the heterosexual family model). Fathers generally direct less verbal output to their children than mothers, as they spend a greater proportion of their time interacting through play activities, especially physical play, which reduces the density of their speech (e.g., Pancsofar & Vernon-Feagans, 2006).

   More generally, the effect of the number of speakers per language has recently been studied (e.g., Gollan et al., 2015), given theoretical proposals that variability in speech input supports the construction of phonological categories in early infancy (e.g., Rost & McMurray, 2009; Singh, 2008). Place and Hoff (2011) report that 25-month-olds Spanish-English bilinguals knew more words in English if they interacted with a larger number of speakers in that language, once corrected for the overall amount of exposure to English (see also Gollan et al., 2015). However, this finding was only partially replicated in Place and Hoff (2016) with a larger sample of 90 30-month-olds learning Spanish and English, where modest speaker number effects were found, predictive of knowledge in Spanish only. In the current study, we

therefore examined the effect of vocabulary scores on the number of speakers per input language.

The impact of daycare attendance on children's development is a longstanding question in child development research, with mixed data (e.g., Brooks-Gunn, Han & Waldfogel, 2002; Ruhm, 2004). One of the few consistent overall results is that daycare attendance tends to benefit children from low SES. For example, using data from about 13,000 children in the British Millennium cohort, Côté, Doyle, Petitclerc and Timmins (2013) report a cognitive advantage at age 3 for children who have attended daycare, but only for those from low SES, and only below age 5. However, Hansen and Hawkes (2009), using the same cohort data, show that vocabulary outcomes are not significantly affected by daycare, with the exception of grandparent care which benefit mainly children from higher SES families. We measured how vocabulary outcomes are modulated by daycare attendance and language spoken within that environment.

The presence of older siblings is another potential source of variation. In monolingual homes, first-born children tend to acquire language faster than later born siblings (e.g., Fenson et al., 1994, 2007, for production; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 2010), presumably because they get more joint attention opportunities with adults and because child-directed speech produced by adults is of better quality than that produced by children. For bilingual children, this should result in a larger vocabulary in both languages for first-borns than later children. However, Bridges and Hoff (2014) found that North American bilingual toddlers with older siblings were more proficient in English compared to other bilingual children with no older siblings, presumably because older bilingual siblings were more likely to use English when addressing toddlers than other members of the family. Therefore, although input from older siblings may contain more ungrammatical structures and less diverse vocabulary, it nonetheless tends to contain a higher proportion of English, thus leading to

higher levels of English vocabulary in the target children. Based on these findings we examined whether the number of older siblings at home had any effect on vocabulary development and especially English production skills.

Properties of the input. We use "properties of input" to refer to whether children interact with speakers who are consistent in their language use, and whether or not the input is produced by a native speaker. Within-speaker consistency can be measured as the degree of code-switching or language mixing (i.e., including elements of each language at the sentence level), which is estimated to occur significantly often for many bilingual children (e.g., over 20% in Marathi-English bilinguals: Tare & Gelman, 2011; between 2 and 10% in Brazilian-Portuguese English bilinguals: Nicoladis & Secco, 2000). It can also be measured more broadly as the adherence to the one-parent-one-language principle, that is, the extent to which children hear the two languages from the same person. Within-speaker inconsistency is potentially seen as a delaying factor in language development (especially code-switching at the sentence level), as language acquisition theorists usually argue that language separation early in development should optimise learning mechanisms (e.g., Curtin, Byers-Heinlein, & Werker, 2011). Indeed, Byers-Heinlein (2013) found that intra-sentential code-switching was detrimental at 18 months, although only marginally at 24 months. Evidence for the importance of the one-parent-one-language principle is less straightforward (e.g., de Houwer, 2007). Place and Hoff (2016) tested ninety 30-month-old Spanish-English bilingual children (see also Place & Hoff, 2011), and after controlling for gender, maternal education, and the child's relative language exposure, they reported no robust relations between the frequency of mothers' use of the two languages (measured at the discourse level, not within sentences) and measures of their children's English or Spanish skills. They concluded that the negative effect of the adherence to the one-parent-one-language principle may be minimal on children's language development or perhaps influential only at the very early stages of language development. Here we assessed the effect

of consistency of parental language use on our target population of bilinguals. One possibility, which we examined here, is that the negative impact of parental code-switching on vocabulary development (Byers-Heinlein, 2013) might be mainly found for pairs of languages with a minimal phonological overlap, as Byers-Heinlein primarily examined distant language learners whereas Place and Hoff (2016) – who used the broader measure of adherence to the one-parent-one-language principle - looked at close language learners. The rationale behind this hypothesis is that frequent switches between distant languages would require a greater flexibility (and therefore cognitive resources) to navigate from one set of representations over another, as compared to close languages which activate overlapping representations.

Another qualitative aspect of the input that might modulate bilingual children's vocabulary growth, is the nativeness of the adult speaker in each language. The hypothesis that native speakers provide more supportive input in their language than non-native speakers is a matter of controversy. Fernald (2006) suggested that being presented with both native and non-native speech in their two languages could lead infants to have more difficulties in discriminating between them, and subsequently impair development of phonological categories (young bilinguals do learn some phonological contrasts later than monolinguals: Bosch & Sebastián-Gallés, 2003; Burns, Werker, & McVie, 2003). It could be also that non-native speakers tend to use less varied vocabulary (Hoff, Coard, & Señor, 2013). However, Paradis (2011) examined 4- to 7-year-old immigrant children in Canada and found that mothers' proficiency in English was not a significant predictor of children's English vocabulary - although children's exposure to native speakers through media or friends was a predictor. In contrast, Hammer et al. (2012) reported that for Spanish-English 59-month-old bilinguals, English proficiency of mothers was a fair predictor of their children's scores in English tests, although they did not control for the relative exposure to English/Spanish. Place and Hoff (2011) reported that in 29 Spanish-English bilinguals aged 25 months, English

vocabulary was positively correlated with the amount of English produced by native as opposed to non-native speakers, controlling for overall exposure. More recently, Place and Hoff (2016), with a larger sample of 90 30-month-old Spanish-English bilinguals, also reported a small but positive influence of the proportion of native-speaker input on English knowledge when measured with standardised tests (PLS-4: Zimmerman, Steiner & Pond, 2002; EOWPVT: Martin, 2012). They found no effect on CDI measures, however. Based on these findings, we examined if the proportion of parental native versus non-native speech has an effect on children's vocabulary size in each language.

Status of the Additional Language. Whether children grow up bilingual in a monolingual or bilingual society may have consequences for their degree of achievement in both languages. Bilingual children from minority populations such as recent immigrants (e.g., Cantonese/English speakers in the UK) tend to have lower academic outcomes in mainstream education than monolinguals (Prevoo Malda, Mesman, & van IJzendoorn, 2016), likely driven by poorer English reading comprehension skills. This disadvantage is particularly acute if English is not their dominant language (Strand, Malmberg, & Hall, 2015). In contrast, when bilingualism is the norm within a particular society, such as in certain Welsh communities, the cognitive and academic achievements of bilingual children can be equal (Rhys & Thomas, 2013) or even better (i Trueta, Barrachina, & Pascual, 2012) than their monolingual peers. Thus, in a bilingual society children's achievements in both their languages might be advantaged, as compared to children learning English and an Additional Language in a monolingual community. We explicitly tested this hypothesis through the inclusion of a target cohort of Welsh-English toddlers selected from a bilingual community in North Wales.

Demographic factors (SES and gender). Monolingual children from lower socio-economic groups tend to have poorer language skills than those from higher SES (Deutsch, 1965; Hoff-Ginsberg, 1998; Rack, Snowling, & Olson, 1992), perhaps because of the

characteristics of maternal input (Hoff, 2003) and/or the home attitude towards literacy (Payne, Whitehurst, & Angell, 1994), which includes low frequency of shared reading activities at home (Britto, Fuligni, & Brooks-Gunn, 2002; see Tomalski et al., 2013, for showing that SES shapes brain activity in early infancy). Unsurprisingly, this SES related language advantage also extends to bilingual children (e.g., Calvo & Bialystok, 2014; Gathercole, Kennedy, & Thomas, 2016; Ollers & Eilers, 2002; Paradis, 2009). It has similarly been proposed that this effect is partially due to the higher quality of language provided by mothers with a high education background, improving their children's acquisition of the maternal language, and transferring to an advantage in the Additional Language even if the mother does not use it (Goldberg, Prause, Lucas-Thompson, & Himsel., 2008; Paradis, 2009).

It is important to note however, that in monolingual toddlers the effect of SES on vocabulary size as measured by CDIs is heavily dependent on the presence of children from *very low* SES backgrounds in the sample. Where such children are not systematically recruited there are negligible or null effects: for example, in the latest cohort tested with the MacArthur CDI (Fenson et al., 2007; N = 2007), no effect of SES (as measured by maternal education) was found between 13 and 20 months, and significant but very small effects were reported in production from the age of 21 months onwards. The original MacArthur CDI cohort (Fenson et al., 1994; N = 1130) found a very small correlation between SES and vocabulary production in 16-30 months old toddlers (r = .05). Similarly, in the Oxford CDI, Hamilton et al. (2000) did not find any correlation between SES and vocabulary scores in production or comprehension. In contrast, the studies of Fernald, Marchman and Weisleder (2013) and Arriaga, Fenson, Cronan and Pethick (1998), which sampled extensively from low SES families, demonstrated significant if modest SES effects.

This pattern of findings suggests that the effect of SES may be limited to the lower thresholds of SES indexing. Note that this is not to be necessarily expected from other measures

of vocabulary, such as naturalistic recordings as used by Hoff (2003), who found differences between mid and high-SES children.

Gender is also a well-documented factor in vocabulary growth, with girls usually producing more words than boys (Huttenlocher et al., 1991), without necessarily showing better comprehension scores than boys (girl advantage in Fenson et al., 2007; equal levels in Eriksson et al., 2012). In the original MacArthur CDI cohort of 8- to 30-month-olds (Fenson et al., 1994), gender was found to account overall for 1 to 2% of the variance, and more in production than comprehension. This production advantage for girls was found to be consistent across linguistic communities as demonstrated with CDI data collected from 10 large non-English groups (Eriksson et al., 2012), pointing to a common neurophysiological explanation rather than sociological/cultural causes - or perhaps to widely shared conventions of encouraging more communication with girls.

To summarise, we have reviewed the situational factors which might shape vocabulary knowledge in bilingual toddlers: relative amount of exposure, mode of exposure (an umbrella term for a range of factors related to the source of the Additional Language, the properties of the input, and the Additional Language status), and demographics. These factors, together with language community and metrics of linguistic distance, were used to build a model of the bilingual lexicon at age 2 for assessment purposes, the UKBTAT (Study 2). In what follows, we discuss the rationale and objectives of the third study, which was to extend this model to bilingual toddlers speaking British English and any Additional Language different from those used to generate the lexical model in Study 2.

Study 3: Generalising Language Assessment to any UK-Raised Bilingual

As mentioned above, professional bodies such as the Royal College of Speech and Language Therapists recommend that bilinguals should be assessed in their two languages, as the variety of factors modulating bilingual development prevents a direct comparison of their

achievements with corresponding monolingual norms (Kohnert, 2010). Our aim in Study 2 was to accommodate these factors to provide norms of development in English and 13 target Additional Languages and create the UKBTAT assessment tool; in Study 3 we aimed at establishing whether the estimates of English vocabulary generated for the UKBTAT would allow identification of possible language delays for any incoming non-target Additional Language (avoiding the requirement for normed data on all possible language pairs, which is practically impossible).

The possibility of an English-only screening tool is based on two theoretical premises. First, in bilinguals, Developmental Language Disorder, as well as language-based learning disabilities, affect both languages (Håkansson, Salameh, & Nettelbladt, 2003), insofar as such disorders are underpinned by a genotype affecting neurological functioning (e. g. Leonard, 1987; Schwarz, 2010). Therefore, any domain of impairment, for example morphosyntax – the most documented so far (e. g. Rice, 2004) – will be observable in the two languages. However, due to relative delays in growing the two languages, and to the language-specificity of the complexity of morphological rules, difficulties in language learning could appear more severe in one language as compared to the other. But our point remains that a delay or a difficulty is expected in both languages, when compared to norms of development.

The second premise is that, although not all late talkers in early childhood are going to develop a primary language impairment (e.g., Rescorla, 2005), almost all children diagnosed with DLD later in childhood had a history of initial language delay, in the form of protracted vocabulary development in comprehension and production (Conti-Ramsden et al., 1997). Hence, Dale et al. (2003) reported that monolingual 2-year-olds who scored below the 10th percentile on the MacArthur–Bates Short Form CDI in production were significantly more likely to be diagnosed as DLD when reaching the age of 3 to 4 years. Out of the 6,500 children who scored above the 10th percentile for vocabulary production at 2 years, only a tiny fraction

exhibited grammatical difficulties one or two years later. Early receptive language difficulties have an even higher predictive validity of later language disorder diagnosis (e.g., Beitchman et al., 1994; Chiat & Roy, 2008).

The corollary of these two premises is as follows: if we could detect the late bilingual talkers at age 2 years in English only, when all other sources of variation have been factored in, we would have identified the main cohort from whom language impaired children will be diagnosed one or two years later. While we agree that collecting information about a bilingual child's language development in both languages is still relevant and informative for clinical and research purposes, practitioners or researchers might not always be familiar with both languages. Thus the ability to work with only one of the two languages of a bilingual is important from a theoretical as well as a practical point of view.

In order to achieve this goal, we examined whether the model of the bilingual lexicon generated in Study 2 using a sample of 13 target bilingual groups could reliably predict the English scores of a new sample of children learning British English and a non-target Additional Language.

Summary of Research Questions and Key Predictions

We analysed vocabulary data, situational factors, linguistic distance and language community in a sample of two-year-olds learning British English plus either one of 13 target Additional Languages (N = 372) or one non-target Additional Language (N = 58). Three studies were performed with the same data set: investigating the effect of linguistic distance on vocabulary development (Study 1, just using the target Additional Languages), building a model of the bilingual lexicon at age 2 using a range of situational variables and linguistic distance for the target Additional Languages learners, resulting in the UKBTAT (Study 2), and testing its generalisability for the non-target learners (Study 3). To fulfil the objectives of Study 1 and estimate the impact of linguistic distance on vocabulary development, it was necessary

to first get a full estimate of the effects of all situational factors that were known or suspected to shape bilingual development. The following predictions were formulated:

- Given the solid evidence of the importance of the amount of language exposure in expressive and receptive vocabulary growth (e.g., Hoff, 2003), we expected this factor to be a robust predictor of vocabulary knowledge. In particular, we predicted that children with more exposure to English would have higher scores in both receptive and expressive vocabulary scores in English - and conversely, lower vocabulary scores in the Additional Language. We predicted that these effects would be strongest in our measure of direct exposure, obtained through the Plymouth Language Exposure Questionnaire, but might also be found in our measure of indirect exposure via overheard conversation between parents (referred to as Overheard speech).

- We predicted an effect of gender, with girls outperforming boys (Eriksson et al. 2012), especially in expressive vocabulary (Fenson et al., 2007).

- SES was expected to modulate language outcomes, with smaller expressive and receptive vocabularies for children from lower SES families (Gathercole et al., 2016).

- Regarding the effect of those factors related to the mode of exposure to each language (source, properties and status), one objective of this first study was to assess whether effects described in the literature for specific English-Additional Language pairings are robust over a range of languages.

- The effect of language community was an unknown variable, and was expected to generate a large amount of unexplained variance, due to a variety of cultural and linguistic factors. We hypothesised that part of the variance attributed to language community could be accounted for by linguistic distance between British English and the Additional Language, as measured by the phonological overlap between translation equivalents, the word order typology and morphological complexity.

Study 2 did not generate predictions per se, as its objectives were to build an assessment tool based on findings from Study 1. However, for Study 3, we predicted the following:

- In our models of vocabulary developed in Studies 1 and 2, Language Community was treated as a random factor to acknowledge that our 13 target languages comprise a non-exhaustive sampling of possible language pairs. The success with which the random effects modelling could produce a model that generalises beyond these target languages was assessed by establishing how well our models could generalise to a test set of 58 children whose Additional Language was not part of our 13 target languages, and therefore not represented in the model.