In the beginning was the word

A study of monolingual
and bilingual children's lexicons

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Abstract

All words have inherent properties linked to their form, meaning and usage patterns affecting when they are acquired and how easily they are processed. As languages and cultures differ, words with equivalent meanings may be acquired at different ages across languages. Cross-linguistic research and assessment must take such differences into account; this issue is particularly important for a valid assessment of multilingual children. In addition, children's language acquisition is influenced by their dispositions and personal preferences as well as their linguistic and sociocultural environment.

This dissertation asks how linguistic factors may account for the composition of monolingual and bilingual children's lexicons, and whether a tool that does take such factors into account can be expected to yield comparable results across different groups of bilinguals. It explores data on lexical development and tests two new assessment tools designed to provide a valid assessment of bilingual children's language skills; one of these tools is also used to profile the children's language background (exposure and use).

The dissertation documents common patterns as well as cross-linguistic differences in children's first words. It shows that lexical properties must be taken into account in any linguistic assessment that strives for comparability across languages. Furthermore, it confirms the prominent roles of type and token frequency on the lexicon, and underlines that studies of frequency effects and assessment tools aiming to account for such effects must pay attention to the source of frequency data. It confirms that a new lexical assessment tool that takes into account for lexical properties does yield comparable results across languages. It may however not be sensitive enough to capture early stages of language shift.

The results are in accordance with usage-based theories of language and language acquisition. The dissertation contributes with a new measure of lexical development and new knowledge about lexical effects within and across languages.

Sammendrag

Alle ord har iboende egenskaper knyttet til form, betydning og bruksmønster som påvirker når barn lærer dem og hvor lette de er å prosessere. På grunn av forskjeller mellom ulike språk og kulturer vil ord med ekvivalente betydninger kunne tilegnes ved forskjellig alder innen ulike språk. Tverrspråklig forskning og kartlegging må ta høyde for slike forskjeller; dette er kanskje spesielt viktig for en gyldig kartlegging på tvers av språk hos flerspråklige barn. Barns forutsetninger, individuelle preferanser og språklige og sosiokulturelle miljø vil også påvirke språktilegnelsen deres.

Denne avhandlinga spør hvordan språklige faktorer kan gjøre rede for orda i ordforrådet til enspråklige og flerspråklige barn, og undersøker om vi kan forvente at et verktøy som konstrueres på bakgrunn av språklige faktorer vil gi sammenlignbare resultater hos ulike grupper flerspråklige barn. Den utforsker data om leksikalsk utvikling og tester to nye kartleggingsverktøy konstruert for å gi en representativ vurdering av de språklige ferdighetene til flerspråklige barn; det ene brukes også til å profilere barnas språkbakgrunn (input og bruk).

Avhandlinga avdekker både tverrspråklige mønstre og tverrspråklige forskjeller i barns første ord. Den viser at enhver kartlegging av ordforrådet som søker å være sammenlignbar på tvers av språk må ta hensyn til egenskaper ved orda. Videre bekrefter den at type- og tegnfrekvens spiller en viktig rolle for ordforrådet, og den understreker at både studier av frekvenseffekter og kartleggingsverktøy som søker å ta høyde for slike effekter, må være oppmerksomme på hvor frekvensdataene kommer fra. Avhandlinga bekrefter at et verktøy som bygger på ords egenskaper kan gi sammenlignbare resultater på tvers av språk, men funnene indikerer at dette verktøyet muligens ikke er sensitivt nok til å fange opp et språkskifte i emning.

Resultatene stemmer overens med en bruksbasert tilnærming til språk og språktilegnelse. Avhandlinga bidrar med et nytt mål på leksikalsk utvikling og ny kunnskap om leksikalske effekter innenfor og på tvers av språk.

In memory of a pioneer and inspirer:

Professor Inger Moen (1940–2015)

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Oslo, December 2016

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Paper II: Hansen, P. (2017). What makes a word easy to acquire? The effects of word class, frequency, imageability and phonological neighbourhood density on lexical development. *First Language*, *37*(2), 205–225. doi:10.1177/0142723716679956

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Part I

Synopsis

1 Introduction

This dissertation is an investigation of lexical development in infants, toddlers and preschoolers acquiring one or two languages. It takes a usage-based perspective on language acquisition, and asks how properties related to form, meaning and input may account for children's acquisition of words. The project is also motivated by an important issue for applied linguistics in general and clinical linguistics in particular: How can we validly assess the vocabularies of children acquiring more than one language?

Below, I will argue for my choice of the lexicon as the object of study (1.1), and point to some implications of usage-based linguistics on lexical development (1.2 and 1.3). Next, I turn to current practices regarding language assessment of children exposed to more than one language, highlighting problems for a valid assessment (1.4), before I formulate the aims of this PhD project (1.5), and provide an outline of the dissertation (1.6).

1.1 Why the lexicon?

Given its theoretical foundation, this dissertation assumes a practically unlimited memory holding *every token* of language that we encounter in a mental network organised on the basis of perceived similarities in form, meaning and the connection between the two (Langacker, 1987; Bybee, 2010, 2001; Tomasello, 2003). Morphology and syntax are seen as generalisations over these rich lexical representations (Langacker, 1987; Bybee, 2010, 2001).

If grammar emerges from the lexicon, we must assume that children's grammatical skills will

develop proportionally to their lexical skills. This claim is indeed supported by data from parental reports, for typically developing children acquiring a single language (Bates & Goodman, 1997; Devescovi et al., 2005; Dixon & Marchman, 2007; Maital, Dromi, Sagi & Bornstein, 2000; Thordardottir, Weismer & Evans, 2002) or two languages simultaneously (Conboy & Thal, 2006) or sequentially (Kohnert, Kan & Conboy, 2010),[1] as well as for atypical populations such as late talkers, children with expressive language deficits and children with Down syndrome (Bates & Goodman, 1997; Thordardottir et al., 2002). Hence, as stated by Gathercole, Thomas and Hughes (2008, p. 681), 'vocabulary knowledge is a good indicator of overall ability in a language, and can, therefore, be used for a wide range of purposes in research and in education'.

A delayed lexical development may imply that a child has *specific language impairment* (SLI), defined as a deficit primarily in language that is not related to hearing loss, neurological problems, low oral functions, non-verbal intelligence or emotional or behavioural problems (Armon-Lotem & de Jong, 2015; Bishop, 2006; Leonard, 2014).[2] However, language development is subject to large individual variation (Bates, Dale & Thal, 1995; Bleses et al., 2008; Fenson et al., 1994), and children who lag behind their peers at one point may later catch up (Huttenlocher, Haight, Bryk, Seltzer & Lyons, 1991; Rescorla, Mirak & Singh, 2000). Due to the large variation among typically developing children, the task of detecting SLI requires assessment tools sensitive enough to identify children with an impairment, yet specific enough to avoid overdiagnosis. To ensure specificity, such tools should strive to take other sources of variation into account.

Many different factors have been found to contribute to the large variation in lexical acquisition among typically developing children. Some of these factors are (largely) biological, such as gender (Fenson et al., 1994; Simonsen, Kristoffersen, Bleses, Wehberg & Jørgensen, 2014) and phonological short term memory (Paradis, 2011; Hoff, Core & Bridges, 2008). However, the presence of cross-linguistic and cross-cultural differences in the pace of children's lexical development (Bleses et al., 2008; de Boysson-Bardies & Vihman, 1991; Haman et al., 2017) as well as the composition of their lexicons (Vihman & Croft, 2007; Tardif, 2006, 1996; Gopnik & Choi, 1990, 1995; de León, 1999) imply that linguistic properties and cultural practices impact lexical development. Particularly interesting areas from a usage-based point of view, are properties related to the form and meaning of linguistic units, and properties of the language input.

[1] Different scholars operate with somewhat different classifications of children acquiring more than one language (e.g. De Houwer, 2009; Kohnert et al., 2010; Meisel, 2004); the issue is discussed in chapter 4.

[2] Note that deficits in non-linguistic processing have been documented (Kohnert & Windsor, 2004), and the deficits in language may be caused by general problems with memory and processing (Kohnert, Windsor & Ebert, 2009). Thus, the impairment may not be as specific to language as the term implies.

1.2 The form and meaning of linguistic units

One possible source of cross-linguistic variation is phonology: The phonological properties of a language could impact how the input is segmented and processed by young children. Children's first words share many phonological characteristics with babbling (Vihman, Macken, Miller, Simmons & Miller, 1985). Some of these characteristics may be individual, others language-specific, whereas yet others hold across languages. For instance, comparative studies of spontaneous speech indicate that a high proportion of word-initial bilabials may be a universal trait, whereas properties of the ambient language appear to be crucial to the number of syllables in the words in children's lexicons (de Boysson-Bardies & Vihman, 1991; MacNeilage, Davis & Matyear, 1997; MacNeilage & Davis, 2000a, 2000b; Velleman & Vihman, 2006; Vihman & Croft, 2007). These cross-linguistic comparisons of the phonology of children's first words have so far been based on spontaneous speech, with relatively few participants from each language; noone has so far carried out comparative studies by drawing on data from larger numbers of children.

In line with the findings on initial consonants, phonological properties could affect how easy a language is to acquire: Young children exposed to a language with few bilabials or few stops could potentially acquire words at a slower pace than children exposed to a more 'infant-friendly' language. There is some evidence that children exposed to Danish (Bleses et al., 2008) or Japanese (de Boysson-Bardies & Vihman, 1991) are indeed acquiring words at a slower pace than peers acquiring other languages, and for both languages, phonology has been posited as a possible explanation (de Boysson-Bardies & Vihman, 1991; Bleses et al., 2008; Bleses & Trecca, 2016).

Regarding semantics, large-scale studies from a variety of languages indicate that the first words tend to be connected to social interaction (such as names for people and words primarily used in routines) (Caselli et al., 1995; Eriksson & Berglund, 1999; Maital et al., 2000; Wehberg et al., 2007), and nouns tend to be more numerous than verbs in young children's vocabularies (Au, Dapretto & Song, 1994; Bates et al., 1994; Bornstein et al., 2004; Caselli et al., 1995; Eriksson & Berglund, 1999; Gentner, 1982; Maital et al., 2000; Schults, Tulviste & Konstabel, 2012; Stolt, Haataja, Lapinleimu & Lehtonen, 2008; Wehberg et al., 2007). Children acquiring languages argued to be particularly 'verb-friendly' due to morphological and/or syntactic properties have been reported to have a higher proportion of verbs in their vocabularies than children aquiring less verb-friendly langauges such as English (Mandarin: Tardif, 1996, 2006; Tardif, Shatz & Naigles, 1997, 2008; Korean: Gopnik & Choi, 1990, 1995; Tzotzil: de León, 1999; but see also Au et al., 1994; Bornstein et al., 2004; Gentner, 1982; Gentner & Boroditsky, 2001; Kim, McGregor & Thompson, 2000).

It is possible that these cross-linguistic differences are related to semantic properties rather than morphosyntax: According to Ma, Golinkoff, Hirsh-Pasek, McDonough and Tardif (2009),

the cross-linguistic difference in early verb acquisition between Mandarin and English can be accounted for by differences in *imageability*, a semantic property related, but not identical, to concreteness and familiarity (Paivio, Yuille & Madigan, 1968). However, as I will return to in chapter 3, imageability is associated with other factors known to affect children's early vocabularies, phonological as well usage-related (Reilly & Kean, 2007). Thus, one may need to investigate multiple factors together to assess the relative contribution of each.

1.3 Language input and lexical development

A strong relationship has been documented between frequency in the input and children's vocabularies: Within a given lexical category (e.g. common nouns), words are acquired earlier by children the more frequent they are in CDS (Goodman, Dale & Li, 2008). Usage patterns also affect children's lexicons in more complex ways; according to Tomasello (2003, p. 49), 'children learn words most readily in situations in which it is easiest to read the adult's communicative intentions'. Thus, the reason why nouns tend to be acquired before verbs may be that they tend to be used in more transparent situations (Tomasello, 2003).

The language input does not only affect which words children acquire, but also the pace of vocabulary growth, as exemplified by the effects of socio-economic status (SES) on language development: High-SES mothers speak more to their children than low-SES mothers, with longer utterances, more word types and fewer directives; as a result, high-SES children's vocabularies grow faster than the vocabularies of low-SES children (Arriaga, Fenson, Cronan & Pethick, 1998; Hoff, Laursen, Tardif & Bornstein, 2002; Hoff, 2003, 2013; Rowe & Goldin-Meadow, 2009; Pan, Rowe, Singer & Snow, 2005). Children acquiring more than one language are interesting in this context: Since their language input is divided between two or more languages, studies of their language development may add to our insight into the relationship between language input and acquisition (De Houwer, 1995; Lanza, 2004).

1.3.1 Input and bilingual lexical development

Studies of bilingual children indeed underline the role of language input: Pearson, Fernández, Lewedeg and Oller (1997), who studied the lexical development and language input patterns of young children in Miami (0;8–2;6)[3] acquiring Spanish and English from birth, found strong correlations between the ratio of Spanish to English in the children's vocabularies and the corresponding ratio in the children's environment, arguing for a direct connection between quantity of input and vocabulary size (Pearson et al., 1997). For children acquiring the majority language as a second language (L2), the length of exposure to this language has been found to predict vocabulary size (Paradis, 2011; Tuller, 2015).

[3] Age given as years;months.

Bilingualism is dynamic (Grosjean, 2008). An individual may be exposed to a minority language in a monolingual setting from birth, acquire a majority language in school and become a monolingual majority language speaker as an adult, and hence go through a language shift (Fishman, 1991). At any given time, each language will have its own functions and usage patterns, so to fully capture the language development of children acquiring more than one language, one must study all their languages (De Houwer, 2009; Grosjean, 2008; Pearson, 2010; Simon-Cereijido & Gutiérrez-Clellen, 2009). This point is important for clinical purposes: Whereas slow development in one of a child's languages may be attributable to the language environment (Paradis, Emmerzael & Duncan, 2010; Pearson et al., 1997), children with SLI will show atypical patterns across their languages (Paradis, 2016; Kohnert, 2010; Armon-Lotem & Walters, 2011).

Nevertheless, it is common practice, in research as well as for clinical purposes, to only assess the majority language (Bialystok, Luk, Peets & Yang, 2010; Melby-Lervåg & Lervåg, 2011; Paradis et al., 2010; Lervåg & Aukrust, 2010; Bedore & Peña, 2008). Children with limited exposure to the majority language hence risk misdiagnosis with SLI (de Jong, Çavuş & Baker, 2010; Armon-Lotem & de Jong, 2015; Bedore & Peña, 2008; Kohnert, 2010; Leonard, 2014; Paradis, 2016). However, a lack of adequate tools currently stands in the way of a better practice (Peña, 2007; Armon-Lotem & de Jong, 2015). Below, I will elaborate on this this obstacle and discuss how we may pass it.

1.4 The road to valid assessment across languages

Assessment of bilingual children typically relies on tools created for monolingual children. Some tools have indeed been developed specifically for bilingual children, but so far only for particular groups, such as US children acquiring Spanish and English (Peña, Gutierrez-Clellen, Iglesias, Goldstein & Bedore, 2014) or children in Wales acquiring Welsh and English (Gathercole et al., 2008). For other language combinations, researchers and clinicians typically have two options: To translate a tool available in one of the languages, or to find one available in all of them. Some of the existing tools currently available across a wide variety of languages are themselves direct translations. For instance, the Norwegian version (Lyster, Horn & Rygvold, 2010) of British Picture Vocabulary Scale (BPVS) is largely a direct translation of the English original (L. M. Dunn & Dunn, 2009).

Translated tools pose challenges to the validity of cross-linguistic assessment of an individual because the 'same' items may not be equally difficult across languages (Peña, 2007). To ensure cross-linguistic *equivalence*, Peña (2007) argues that one must account for item difficulty, for instance by means of data on frequency or *age of acquisition* (AoA), that is, when a word is acquired (see chapter 3). Interesting in this respect is the new lexical assessment tool Cross-linguistic Lexical Tasks (CLT) (Haman, Łuniewska & Pomiechowska, 2015) emerging from the recent COST Action IS0804 (2009–2013), which aimed to improve assessment of children

speaking more than one language, and in particular children from immigrant populations.[4] To ensure cross-linguistic comparability, each language version of CLT is created individually, with the target words selected based on AoA and a compound measure aiming to account for words' overall complexity.

CLT has so far been constructed for more than 25 different languages,[5] but the tool is not ready for clinical use, as norms are not yet available for any language or language combination. Bilingual norms must take (potentially shifting) patterns of language input into account (De Houwer, 2009; Gathercole et al., 2008; Pearson et al., 1997), and the question of how to create them is thus not trivial; it is also beyond the scope of this dissertation. However, a first step towards this goal is to ascertain whether the factors underlying the tool construction can account for item difficulty. It is also important to investigate if the tool does indeed yield comparable results across the languages that it as so far been constructed for. Another important question is how CLT results compare to other measures of language development. Furthermore, analyses of CLT results across different groups of bilingual children may inform on the variation that may be expected among typically developing children, and data from children with SLI are crucial to make the tool ready for clinical use.

A number of papers recently published, in press or in progress have taken on different pieces of this puzzle. In a forthcoming special issue of *Clinical Linguistics & Phonetics* devoted to CLT, Haman et al. (2017) carry out a comparative study across 17 different languages, Gatt, Attard, Łuniewska and Haman (2017) study the relationship between bilingual children's language dominance and their CLT results, Kapalková and Slančová (2017) and Khoury Aouad Saliby, dos Santos, Kouba-Hreich and Messarra (2017) compare results from children with SLI to their typically developing peers, and Altman, Goldstein and Armon-Lotem (2017) and Hansen et al. (2017) investigate whether the factors underlying the tool construction affects children's results. Outside of this special issue we find a comparison of mono- bi- and trilinguals in South Africa in Potgieter and Southwood (2016), and a further discussion of the findings in Haman et al. (2017) in Łuniewska, Haman and Hansen (2016).

1.5 The aims of this dissertation

This dissertation aims to explore how lexical acquisition is connected to various factors related to form, meaning and usage patterns. As discussed briefly above and in more detail in chapter 2, these topics are interesting from the point of view of usage-based linguistics, as they can help shed light on how children acquire language, as well as on what language is. I ask the following research questions:

[4] See http://bi-sli.org/.

[5] See http://psychologia.pl/clts/.

1. How can factors related to form, meaning and usage account for the composition of children's lexicons?

   (a) Which factors are connected to the ambient language, and which are typical to children's lexicons?

   (b) Can factors related to form, meaning and/or usage predict lexical development?

   (c) Can a lexical assessment tool ensure cross-linguistic equivalence by means of factors related to form, meaning and/or usage?

2. Can we expect cross-linguistically equivalent tools to yield comparable results in different groups of typically developing bilingual children?

The dissertation presents an overarching PhD project consisting of two separate studies. Study A addresses research questions 1a and 1b, and it is primarily concerned with data from monolingual children (0;8–3;0) assessed with the CDI (Fenson et al., 2007), a parental report tool yielding valid and reliable measures of lexical development (for a review, see Law & Roy, 2008). The recently published Norwegian CDI norms lend themselves well to studies of vocabulary composition as they are among the largest to date (Simonsen et al., 2014; Kristoffersen & Simonsen, 2012). Study B emerged from the recent network COST Action IS0804 (2009–2013), and in particular from close collaboration between members at the University of Oslo and the University of Warsaw. It addresses questions 1c and 2 and builds on data from monolingual and bilingual children (3;6–5;9) assessed with CLT and pilot versions of the background questionnaire *Parents of Bilingual Children Questionnaire* (PABIQ) (COST Action IS0804, 2011; Tuller, 2015) (see chapter 4).

1.6 Outline of the dissertation

The dissertation consists of this synopsis and four papers written for scientific publication, each targeting one of the four research questions proposed in the previous section.

Paper I (Garmann et al., in press) approached question 1a by investigating two hypotheses: that a high proportion of initial bilabials in children's first words is a characteristic of children's speech, and that patterns of word length (in syllables) in the first words corresponds to word length in the ambient language. The paper analysed CDI-based lists of Danish, English, Italian, Norwegian and Swedish children's first words, spontaneous speech from Norwegian children and adults, and short speech samples from each of the five languages. Both hypotheses were supported, although children appear to target shorter words than adults do. The paper will appear in a forthcoming book edited by Florence Chenu, Sophie Kern and Frederic Gayraud, published by Cambridge Scholar publishing.

Paper II (Hansen, 2017) targeted question 1b, asking how well word class, imageability, phonological neighbourhood density and frequency may account for Norwegian children's early lexical development. AoA calculated from CDI data was compared to a novel measure based on vocabulary size rather than age, and individual and joint effects of the four factors were assessed through regression models. The novel *vocabulary size of acquisition* (VSoA) was more evenly distributed and more sensitive to lexical effects than AoA, and frequency in CDS and imageability were the most important predictors of lexical development. The paper has been published with *First Language*.

Paper III (Hansen et al., 2017) sought to validate the psycholinguistic aspects of the CLT construction procedure, in line with question 1c above. The paper asked whether the language-specific properties underlying CLT can predict mono- and bilingual children's performance on CLT, and how these factors compare to CDS frequency and imageability. AoA was found to reliably predict performance within all subparts of the tool, and within both mono- and bilingual children. The complexity index created for the CLT construction did not reliably predict children's performance. CDS frequency had a significant effect within all groups, whereas imageability effects were overshadowed by word class. The paper is included in an issue of *Clinical Linguistics & Phonetics* devoted to CLT.

Paper IV (Hansen et al., in press) was devoted to research question 2. The paper investigated the full language competence of children of Polish immigrants to Norway and the UK, asking how CLT results compared to parental judgment of these children's skills in their two languages. The two measures correlated, and the CLT results were remarkably similar across the two groups, with far higher results in Polish than in the majority language (Norwegian and English, respectively). However, the parents in the UK still judged their children as less proficient in Polish than the parents in Norway did, indicating that there may be differences between these two groups that CLT is not sensitive enough to pick up. The version of the paper included in this dissertation was submitted to *International Journal of Bilingualism* in November 2016; a revision was submitted in July 2017 and accepted in August 2017.

This synopsis will provide a context for the papers and bring together the conclusions presented in each of them. In addition to the present introduction, the synopsis consists of five chapters. In chapter 2, the overall theoretical approach is described. Chapter 3 introduces relevant previous research on factors affecting lexical development, and elaborates on the above discussion about valid assessment of children's lexical development. Chapter 4 outlines the methods applied and the materials analysed in the four papers, and chapter 5 presents the main findings and conclusions from each paper. Finally, chapter 6 provides a discussion of the findings in relation to the research questions proposed here, and considers the theoretical and practical implications of these findings.

[T]he child does not begin with words and morphemes and glue them together with contentless rules; rather, she starts with already constructed pieces of language of various shapes, sizes, and degrees of abstraction (and whose internal complexities she may control to varying degrees), and then 'cuts and pastes' these together in a way appropriate to the current communicative situation.

(Tomasello, 2003, p. 310)

2

Theoretical framework

As stated at the beginning of this dissertation, I take a cognitive, usage-based view on language (Bybee, 2001, 2010; Langacker, 1987; Taylor, 2002), language acquisition (Tomasello, 2003; Vihman & Croft, 2007) and bilingualism (De Houwer, 1995; Grosjean, 1989, 2008, 1997; Pavlenko, 2009; Vihman, 2014). Generative theories that presuppose a language device tend to push the lexicon into the periphery of linguistics, assuming it is sparse and mainly includes information that cannot be derived from rules (e.g. Chomsky, 1957, 1965; Pinker, 1995; Ullman, 2001). In contrast, usage-based theories of language place the lexicon at the very core: Regularities that according to generative theories originate from rules, are within usage-based theories assumed to emerge as generalisations (abstractions) over rich lexical representations (Bybee, 2010).

In this chapter, I will discuss the implications of this theoretical framework for language in general (section 2.1) and language acquisition in particular (section 2.2). I will elaborate on the view on organisation, processing and acquisition of words (section 2.3) as well as on implications for the bilingual lexicon and bilingual lexical acquisition (section 2.4).

2.1 A usage-based theory of language

According to Joan Bybee (2001, 2010), our mental representations of language emerge from language use. They are individual and dynamic, as each of us encounters new tokens of language every day. These tokens – words, chunks of words, or even whole utterances or sections of writ-

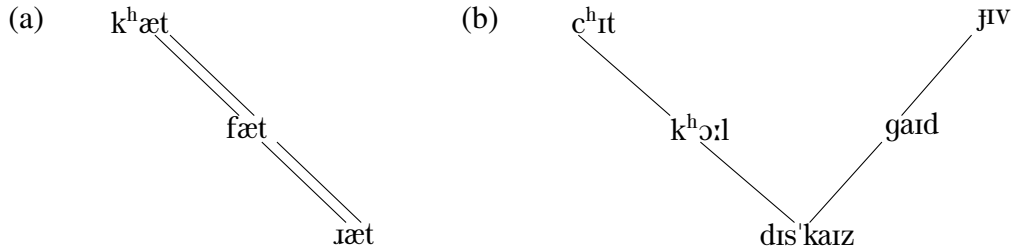

Figure 2.1: Phonological connections for [æt] in *cat*, *fat* and *rat* (a), and for the dorsal stops in *kit*, *call*, *disguise*, *guide* and *give* (b). Figure inspired by Bybee (2001).

ten text – are stored as detailed *exemplars* in a rich mental network, organised by their *form*, their *meaning* and the connection between the two. Connection lines are formed between exemplars that we perceive as phonetically or grammatically similar, giving rise to generalisations on different levels of abstraction.

Bybee (2010) presupposes a practically unlimited memory, and argues that *every token* of language is stored. A token that is regarded as similar in both form and meaning to an existing exemplar is mapped to it, strengthening its representation (*entrenching* it), but also leading the way to processes of phonetic and semantic reduction (Bybee, 2010). Perceived similarities in form or meaning between exemplars give rise to hierarchical relationships between general *schemas* and their more specific *instances* (Bybee, 2010; Langacker, 1987; Taylor, 2002; Tomasello, 2003).

2.1.1 Schematicity in form

Perceived similarities in phonology give rise to mental representations of phonological units on various levels – phonemes, syllables, words, and word- and utterance-level patterns in stress or prosody (Bybee, 2001, 2010). When we perceive the three words *cat*, *fat* and *rat* as similar in form, this is due to phonological connections between the three words, as demonstrated in figure 2.1a. These phonological connections give rise to generalisations on different levels: They may contribute to phonemic representations of /æ/ and /t/, and to a generalisation like '[æt] is a possible syllable rhyme in English'. They may also contribute to categories, or *schemas*, on more abstract levels, such as [STOP] and [FRICATIVE], or [CONSONANT] and [VOWEL]. With representations of consonants and vowels, we may, based on the words in figure 2.1a, generalise [CVC] as a salient schema for syllables as well as whole words.

The borders between phonemes may be fuzzy: As shown in figure 2.1b, phonological connections between the unvoiced dorsal stops in *kit*, *call* and *disguise* may give rise to a phonemic representation of /k/; the allophones [kʰ], [cʰ] and [k] are likely to be perceived as similar by speakers of English, even though the exact position of the oral closure may vary with the following vowel, and the first two are aspirated, in contrast to the latter. However, the unvoiced,

unaspirated [k] may also be seen as an allophone of /g/, together with voiced, unaspirated dorsals such as [g] in *guide* and [ɟ] in *give*. The equivocal categorisation of the unaspirated, unvoiced stop becomes evident in pairs like *pirate's crate* and *that's great*: With identical pronunciations of the last syllable, that is, as [skɹɛɪt], our intuition may still lean towards /k/ for the former and towards /g/ for the latter.

Bybee (2001, p. 53) defines phonemes as 'sets of phonetically similar variants', arguing that 'these variants, or allophones, are clustered in groups, such that what we analyze as allophones constitute salient contextually determined prototypes'. Thus, within a usage-based approach, we may argue that in English, [k] is the prototypical variant of both /k/ *and* /g/ in the context [s_], and our perception of it depends on the phonological and semantic connections: The chunk *pirate's crate* will be closely connected to *pirate's* and *crate*, connecting the dorsal stop to /k/, whereas the chunk *that's great* may be connected to *that's* and *great*, potentially leading to a generalisation of the dorsal stop as an instance of /g/.

2.1.2 Schematicity in meaning

According to Ronald Langacker (1987), perceived similarities in meaning give rise to categorisation of exemplars varying in size and complexity – from morphemes to whole utterances. Semantic connections between exemplars of words may for instance give rise to the partly overlapping taxonomies of pets and mammals shown in figure 2.2 on the following page. With a base in zoology, the schema [MAMMAL] is a large and diverse, but simultaneously quite strict category, denoting a group of animals with the same origin, sharing a set of biological traits, such as mammary glands. Many of its instances share other traits too; for instance, a majority of the mammals in figure 2.2 are covered with fur and feed their offspring milk through nipples.

The overlapping schema [PET] is more flexible: To be instances of the schema, exemplars simply need to denote animals living with a human (by choice of the human). However, some instances, such as [CAT] and [DOG], are more frequent than others, leading to more *entrenched* (stronger) representations. These may be seen as more *prototypical* ('better') members of the category, as indicated by the thickness of the lines in figure 2.2 on the next page. The exemplar [HEDGEHOG] may be seen as a rather peripheral instance of both [PET] and [MAMMAL], differing in many ways from the more prototypical members. Unlike prototypical mammals, hedgehogs have no nipples and are covered with spines, and unlike prototypical pets, they are more common in the wild than indoors.

Someone who is shown a picture of an animal and asked to name it is most likely to use a word on the mid level in figure 2.2 (Rosch & Mervis, 1975). This level is often called the *basic level*, and according to Taylor (2002, p. 132), these concepts are more *salient* as they are 'maximally contrastive, and maximally informative'. That is, concepts above this level are too abstract to form a mental image of, whereas concepts below it may be easily imageable provided

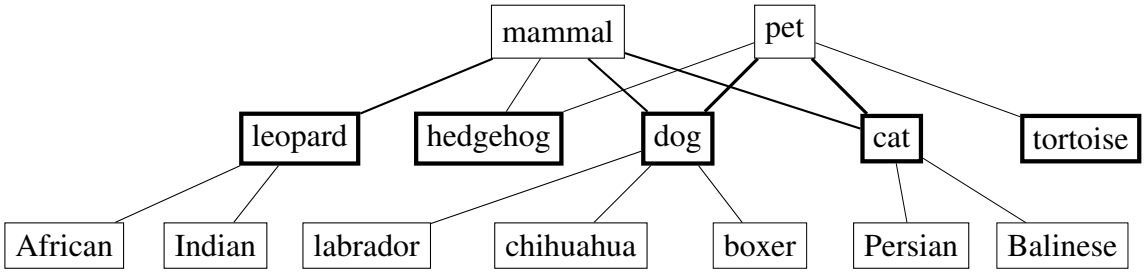

Figure 2.2: Overlapping taxonomies of animal kinds. Figure inspired by Taylor (2002).

that we know them (they tend to be less entrenched), but the extra information they carry may often be seen as irrelevant to the context.

An important point illustrated in figure 2.2 is that the same concept may be a member of multiple taxonomies: For instance, [CAT] is an instance not only of [PET] and [MAMMAL], but also of [CAT'] (i.e. the family Felidae), [CARNIVORE] and [LIVESTOCK]. On a more abstract level, every instance of [PET], [MAMMAL], [CARNIVORE] or [LIVESTOCK] denotes a living organism. Together with a wide variety of other exemplars, they may give rise to a schema of physical entities. Such abstract generalisations are assumed to give rise to grammatical categories such as *noun*, *verb*, *adjective* and *adverb*. The semantic foundations for grammatical categories will be further elaborated in section 2.3.1.

2.1.3 Grammar from schematicity in form and meaning

Bybee (2001, 2010) and Langacker (1987) assume that morphosyntax is mentally represented as schemas over similarities in form *and* function. The abstraction of morphosyntactic representations may be exemplified by English plural morphology: By analogy, the exemplar *cat* is phonologically and semantically connected to *cats* the same way as *loop* is to *loops* and *pot* is to *pots*: The exemplars within each pair have very similar forms and denote the same type of entity, but the second member differs from the first in form by a word-final [-s], and in function by denoting multiple entities. There is also a more abstract phonological similarity between the first member of each pair: The final phoneme is unvoiced. This pattern may give rise to two different schemas: the notion of [LEMMA] as a cluster of exemplars seen as instances of the same word, and the generalisation of a plural schema, [...$C_{unvoiced}$][s], as illustrated in figure 2.3 on the next page.

Similarly, *judge* relates to *judges* the same way as *niche* to *niches*; and *dog* relates to *dogs* the same way as *dream* to *dreams*. Such exemplars may give rise to two other plural schemas: [...$C_{sibilant}$][ɪz] and [...C_{voiced}][z]. The variation between these three schemas is related to phonological patterns, and these variants may be seen as instances of a more abstract schema associating the semantic structure [NOUN][PL] with the phonological structure [...][s]; this phonological structure is more abstract, specifying only what is common to its instances, that is,

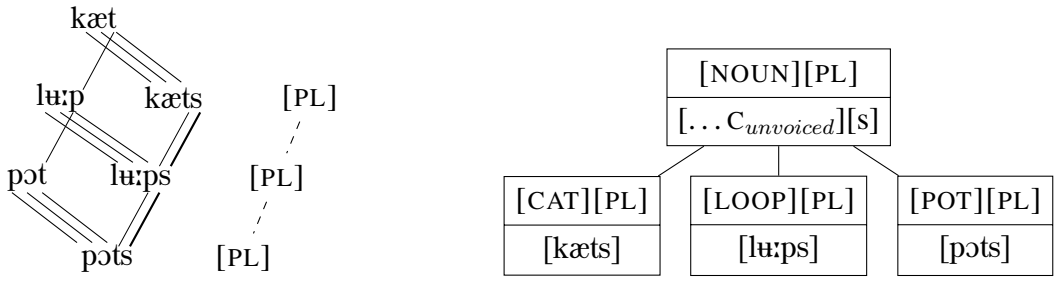

Figure 2.3: The emergence of a plural suffix [-s] schema from connections between *cats*, *loops* and *pots*. Visualisations inspired by Bybee (2010) (left) and Taylor (2002) (right).

an apico-alveolar fricative.

However, the landscape is slightly more complex, giving rise to a multitude of other schemas alongside this general, abstract schema: To exemplify, *tooth* relates to *teeth* the same way as *goose* to *geese*, *thesis* relates to *theses* the same way as *hypothesis* to *hypotheses*, *syllabus* relates to *syllabi* the same way as *emeritus* to *emeriti*, and *corpus* relates to *corpora* the same way as *genus* to *genera*. Plural forms may be subject to variation: The plural of *cactus* could be *cactus*, *cacti* or *cactuses*, and the plural of *computer mouse* may be either *computer mice* or *computer mouses*.

The variation is not random, but based on the specificity and type frequency of the various schemas, as well as the token frequency of their instances (Bybee, 2010; Taylor, 2002). The schema [NOUN][PL] / [. . .][S] is general (any word fits) and highly entrenched (the type frequency is high, and many of its instances have a relatively low token frequency). The connection between *mouse* and *mice*, on the other hand, has no true analogy in English, and since it takes at least two instances to abstract one, we may have no schema at all here, only an entrenched connection.

Alternatively, the connection might, together with exemplars like *foot* and *goose*, give rise to a more abstract schema connecting [NOUN] / [. . . V$_{rounded}$. . .] with [NOUN][PL] / [. . . V$_{unrounded}$. . .]. The entrenchment is still low: The instances are few and have a high token frequency, and the large number of potential instances that fit the schema, but do not follow it (e.g. *moose* and *house*) *pre-empts* the attraction of new exemplars. Thus, if *computer mouse* is analysed as a chunk rather than as an instance of [MOUSE], the general and highly entrenched plural schema wins the competition.

Generalisations over word chunks, phrases, sentences and utterances give rise to multi-word constructions. Consider examples 1–5 on the following page:

(1) The dog ran away

(2) She ran towards him

(3) Tears ran down her cheeks

(4) He saw them

(5) Santa gave them presents

Examples 1–3 may for instance give rise to a semantic schema of someone or something (*the dog*, *she* or *tears*) moving quickly along a path (*away*, *towards him* or *down her cheeks*): [NP ran PATH]. They may also be instances of more abstract schemas, such as [NP V ADV]. By analogy, example 4 may contribute to a schema like [NP V DO], and example 5 may contribute to a schema like [NP V IO DO]. Together with a variety of other schemas based on a wide range of exemplars, these three abstract schemas may in turn give rise to generalisations about English as a language with a [NP V . . .] word order.

Importantly, exemplars may give rise to schemas of many different sizes and levels of abstraction simultaneously. Thus, the four examples below give rise not only to sentence-level schemas such as those discussed above, but also to schemas of individual sounds, phonemes, words and word chunks. Hence, the abstracted notions of noun phrases, verbs, adverbials and direct and indirect objects are themselves schemas, emerging from the very same utterance-level exemplars as schemas that build on these notions.

2.1.4 Speech recognition and speech production

In order to understand tokens of language spoken to us, we must successfully map those tokens to existing exemplars in our lexicon. In the words of Luce and Pisoni (1998, p. 17), 'the process of word identification involves discriminating among lexical items in memory that are activated on the basis of stimulus input'. In their *Neighbourhood Activation Model* of spoken word recognition, which tallies with the current framework, all words that are similar in form to the stimulus input will be activated, but high-frequency words more so than low-frequency words (Luce & Pisoni, 1998). Thus, exemplars will be recognised more easily (and faster) the higher their entrenchment, and the fewer phonological connections they have.

We may also see the task of retrieving a linguistic unit from the lexicon for speech production as a process of activation of exemplars. As in speech recognition, we can assume that highly entrenched (highly frequent) exemplars will be more activated than less entrenched exemplars (Dell, 1990). Aligning with a usage-based view on the mental lexicon, Dell (1986) assumes a mechanism of spreading activation, in which semantic and phonological connections are used to arrive at the destination node of the network, that is, the target exemplar. This mechanism assumes two steps: First, to map a 'concept-to-be-lexicalized' to 'an abstract symbol representing the selected word as a semantic-syntactic entity' (Dell & O'Seaghdha, 1992, p. 288), primarily

through semantic activation, and second, to access the phonological form of this abstract symbol, primarily through phonological activation (Dell, 1986; Dell & O'Seaghdha, 1992).

An exemplar will be retrieved more easily (and faster) the more connections it has to other exemplars in the lexicon, with the potential consequence of retrieving an inappropriate, but highly connected, exemplar instead of a less connected target exemplar (Vitevitch, 1997). Importantly, this two-step process is not seen as modular and non-overlapping (e.g. Levelt, 2001), but as interactive and continuous (Dell & O'Seaghdha, 1992). Thus, we are more likely to select an exemplar with phonological *as well as* semantic connections to the destination exemplar, than one that shares *either* phonological *or* semantic connections with it (Dell & O'Seaghdha, 1992).

2.2 A usage-based view of language acquisition

If our mental representation of language is individual, dynamic and rooted in language use, we may expect young children to have mental representations that are quite different from those of adults, as they have far fewer tokens of language to abstract from. We would also expect a close correspondence between the amount of exemplars and the degree of abstraction of their schemas, or in other words, between the size of their lexicon and their mastery of morphology and syntax. As noted in the introduction, a strong link has indeed been found between lexicon and grammar in young children, and these findings have been held by many authors, in particular by Elizabeth Bates and her colleagues, as evidence for a usage-based connectionist approach to language and language acquisition (Bates & Carnevale, 1993; Bates & Goodman, 1997; Dixon & Marchman, 2007; Devescovi et al., 2005; Elman et al., 1996).

Michael Tomasello (2003) proposes a social-cognitive approach to language acquisition. This approach is closely connected to the approaches of Bybee (2001, 2010) and Langacker (1987) presented above, but has a stronger focus on the social aspects of language use: Tomasello proposes that children acquire language by combining general cognitive mechanisms with general *social-cognitive* processes, such as joint attention and intention-reading. He offers support for the connectionist approach of Bates and colleagues as well, but argues that they do not acknowledge the importance of communicative intentions and communicative function (Tomasello, 2003, p. 324): 'Admittedly, they do seem to be able to simulate many aspects of language acquisition simply by looking at patterns in the surface distribution of forms. But this is not the way children do it.'

Rather, within a social-cognitive view, we may assume that children attempt to read other people's intentions through their utterances, storing each concrete utterance in their memories. In line with the processes described above, schemas may then be abstracted from categorising and drawing analogies from the form and the meaning[1] of all stored utterances. This process

[1] Whereas Langacker and Bybee use the term *meaning*, Tomasello talks about *function*, emphasising his focus on the social functions of language. For consistency, I adhere to *meaning* throughout the dissertation.

gives rise to linguistic representations of many shapes and sizes. Children may then use these representations in many different ways to reach their communicative intentions.

A phonological model that fits well with the current view is Vihman and Croft's (2007) *Templatic Phonology*. In short, the model poses that children 'select' their early words based on existing vocal patterns shaped by input, motoric control and individual phonological preferences (Vihman, 2014; Vihman & Croft, 2007). These early vocal patterns may be described as an 'articulatory filter' that the first words must pass through (Vihman, 1993). Schemas on various levels of abstraction are generalised from these first exemplars,[2] and used to expand the lexicon more rapidly: Children can now acquire new words with unfamiliar phonological patterns by *adapting* them to already established schemas, while they simultaneously gradually overcome 'the constraints on articulation, speech production planning and memory for speech forms that limit word learning for the first several months or years of word production' (Vihman, 2014, p. 313). Gradually and hand in hand, their exemplars and phonological schemas then become more and more adult-like.

The focus on joint attention and intention-reading implies that children may acquire *any portion of language* as long as they are exposed to it in a context where it has a clear social intent. Interestingly, this aligns with findings presented in the introduction: Children's first words, according to CDI results, are typically words and phrases used in social interaction (e.g. Caselli et al., 1995; Wehberg et al., 2007). However, young children also tend to acquire more nouns than verbs (e.g. Caselli et al., 1995; Gentner, 1982). Tomasello's (2003) account for this tendency is closely related to the notions of nouns and verbs within a usage-based approach, which I will describe in the next section.

2.3 The word

From one perspective, words are nothing special in a usage-based approach to language: If every token of language is stored in a practically unlimited lexicon, and the same language-general processes are used to categorise sounds, words, word chunks, sentences and longer sections of text or speech, there is no reason to see the word as more fundamental than any other larger or smaller portion of language.

Taking a different perspective, several authors have argued that words may be important building blocks: Bybee (2001, p. 30) argues that the word is nevertheless a plausible cognitive entity due to its *cognitive autonomy*, as it is 'both phonologically and pragmatically appropriate in isolation'. Similarly, Vihman and Croft (2007, p. 715) argue that a word is 'the smallest linguistic unit encountered in language use'.

[2] Vihman and Croft (2007) use the term *templates* for these phonological schemas.

2.3.1 Word classes

Bybee's definition of a word as an autonomous entity is interesting in light of Langacker's (1987) account of what separates nouns, verbs, adjectives and adverbs: He argues that grammatical categories are semantically definable by their *conceptual autonomy*. According to Langacker (1987) a noun designates a *thing*,[3] that is, an entity that may be described as a *region that is bounded within a domain*. As he exemplifies, a *beep* is a bounded region in time (being relatively short) and pitch (having a clear tone). In the case of concrete or abstract mass nouns, like *furniture* or *pain*, the region is bounded by *effective homogeneity*; there may be internal variability (chairs are different from lamps), but we may nevertheless *construe* the mass as homogeneous as long as the variability is not seen as important or relevant. Being a bounded region, a noun is thus *conceptually autonomous*; it can be conceptualised by itself.

This property sets nouns apart from verbs, adjectives and adverbs: A verb is an entity that designates a [PROCESS], defined as a relation with a positive temporal profile (Langacker, 1987). An adjective or adverb designates an [ATEMPORAL RELATIONSHIP]; adjectives relate to *things*, whereas adverbs relate to other relations (i.e. to a verb, an adjective or another adverb). Processes and atemporal relationships are hence both characterised by *conceptual dependence*: '[O]ne cannot conceptualize interconnections without also conceptualizing the entities that they interconnect' (Langacker, 1987, p. 215). For instance, when we conceptualise *throw*, we also conceptualise the [THING] throwing and the [THING] being thrown, and even our understanding of a colour term such as *red* will depend on the [THING] it relates to – a red apple has a different colour than red hair.

A process may in turn be profiled as a [PERFECTIVE PROCESS], one that changes through time (e.g. *break*) or as an [IMPERFECTIVE PROCESS], one that stays constant through time (e.g. *meditate*). These two sub-schemas (instances) share a temporal profile, as they both profile a series of component states scanned in a sequential fashion (Langacker, 1987). As a metaphor, we may think of actions in terms of a cartoon of the component states making up the process: In the case of a perfective process, the picture in the cartoon are profiled as differing from each other, but in the case of an imperfective process, all pictures are profiled as identical.

Langacker (1987, p. 249) suggests a taxonomy of word classes based on these schemas for the semantic pole of nouns, verbs, adjectives and adverbs. Here, processes (verbs) and atemporal relationships, are seen as instances of the schema [RELATION], given their relational profile. Together with the schema [THING] for nouns, [RELATION] then gives rise to the superschema [ENTITY] (see figure 2.4 on the following page).

[3] Langacker's *noun* category is wide, covering both nouns, noun phrases, proper names and pronouns, as any of these may be said to profile a *thing* (Taylor, 2002, p. 345).

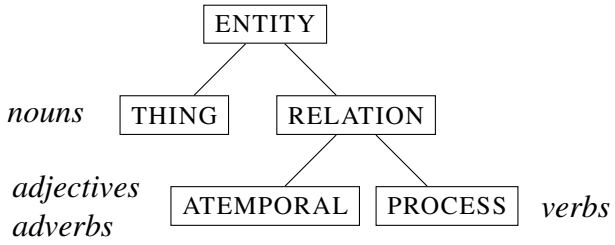

Figure 2.4: Schematic hierarchy of basic classes. Adapted from Langacker (1987, p. 249).

2.3.2 Children's acquisition of word classes

From the categorisation in figure 2.4, we may then posit that children may acquire nouns easily, as they are conceptually autonomous, whereas verbs and adjectives will be harder to acquire as their semantics are dependent on other words. Gentner (1982) suggests a related, but slightly different account, stated as *the Natural Partitions Hypothesis*: She posits that nouns prototypically denote concrete objects, whereas verbs prototypically denote abstract and transient events. Due to *perceptual-conceptual properties*, concrete objects are more likely to be perceived as entities than transient and abstract events are.

As a result of these properties, then, the word–meaning (or word-to-world) mapping is more transparent for nouns than for verbs. Gentner and Boroditsky (2001) add function words to the equation, and suggest a gradient scale of transparency: At the transparent end, we find proper nouns, which show a strong cognitive dominance, as their primary function is to denote unique entities in the real world. At the opaque end, we find function words like *the* and *and*, which show a strong linguistic dominance, as their meanings depend on the linguistic context. Verbs and adjectives are then somewhere in the middle.

Tomasello leans on Langacker's (1987) word-class schemas as well as on the Natural Partitions Hypothesis of Gentner (1982) and Gentner and Boroditsky (2001). However, with his focus on the social aspect of language acquisition, he argues that the differences between word classes may not primarily relate to what words children are able to acquire – after all, many of their first words are social terms, not nouns. Rather, he suggests a social-pragmatic modification to Gentner's hypothesis:

> The modified hypothesis is that children learn words most readily in situations in which it is easiest to read the adult's communicative intentions. Thus, in the right situation they can learn event-type nouns such as *breakfast*, performatives such as *no*, and some verbs and other relational words. But concrete nouns, with perceptible referents, are often used in pragmatically simple situations, in which the adult's communicative intentions are especially clear – for example, in handling objects or pointing out new objects for shared inspection. (Tomasello, 2003, p. 49)

2.4 The bilingual lexicon

Following François Grosjean (2013, p. 5), I define bilingualism as 'the use of two or more languages (or dialects) in everyday life'. Since this definition is functional and based on usage (rather than fluency), it fits well within the current theoretical framework. Grosjean's definition entails that bilingualism is a dynamic state; language dominance may shift, and an individual can become or cease to be bilingual. So can a language community: A monolingual migrant community may retain their own minority language at the expense of the majority language, but they may also maintain their own heritage language alongside a (to them) new majority language, and hence become bilingual (Fishman, 1991). Bilingualism may be an intermittent state: The community may undergo a process of language shift if the heritage language is not transmitted to the next generation, and thus again become monolingual, but this time in the majority language (Fishman, 1991; De Houwer, 2007; Gal, 1979; Saltarelli & Gonzo, 1977).

Like Tomasello (2003), Grosjean (1997, 2008, 2013) and Fishman (1991) emphasise the social functions of language. As stated by the *Complementarity Principle* (Grosjean, 1997), bilinguals use different languages for different purposes, with different people, and within different domains of their everyday lives (Grosjean, 1997). Since bilinguals thus acquire and use their languages in different contexts, their linguistic competence will also be *complementary*; for many words in language α, a speaker may not know meaning equivalents in language β, simply because these are not relevant for that language's communicative functions.

As underlined by Pavlenko (2009) and de Groot (2013), true meaning equivalents are rare:[4] A word in language α may not translate to language β at all (resulting in non-equivalence), or entities may be categorised differently in the two languages (resulting in partial equivalence). Pavlenko (2009, p. 140) exemplifies the first by the English *privacy*, which lacks a Russian meaning equivalent; the latter may be illustrated by Hjelmslev's (1943) textbook example of German, Danish and French partial equivalents for the English *tree*, *wood*, *woods* and *forest*, shown in table 2.1 on the following page. Furthermore, if meaning is abstracted from instances of use (Bybee, 2010; Langacker, 1987), two words from two different languages may have similar (prototypical) meanings, but a complete overlap is exceedingly unlikely. Even then, they would not be completely equivalent, as their phonological connections and entrenchment would not be identical (Peña, 2007; see also section 3). This point does not preclude that we may *perceive* two exemplars as similar, giving rise to a notion (or schema) of equivalence, and allowing for translation between languages.

A model of the bilingual lexicon that harmonises with the current theoretical framework is the *Modified Hierarchical Model* proposed by Pavlenko (2009). This model incorporates the

[4] Pavlenko (2009, p. 132) uses the term *conceptual equivalence*. She defines *lexical concepts* as linguistic categories that develop through socialisation. In essence, what Pavlenko refers to as a lexical concept relates to Langacker's *semantic pole*, or generally what is referred to as *meaning* in this chapter. For consistency, I will adhere to *meaning equivalence* here (following de Groot, 2013).

Table 2.1: Partial cross-linguistic equivalence. Adapted from Hjelmslev (1943, p. 50).

German	Danish	French
Baum	træ	arbre
Holz		bois
	skov	
Wald		forêt

notion that many exemplars may be profiled as partly or (practically) fully equivalent across languages, but that some meanings are language-specific. Perceived cross-linguistic equivalence may give rise to shared conceptual representations. One the one hand, profiling exemplars as cross-linguistically equivalent may facilitate L2 acquisition, as new exemplars in a new language may be conceptualised by leaning on the established semantic connections of the L1, resulting in what may be characterised as positive transfer. On the other hand, the same process may lead to representations that do not coincide with monolinguals' representations – a Danish L2 user of French (or vice versa) may perceive *bois* as equivalent in meaning to *træ*, although a highly proficient user of both languages may not (as illustrated in table 2.1).

According to the Modified Hierarchical Model, the main goal in L2 acquisition is 'conceptual restructuring and development of target-like linguistic categories' (Pavlenko, 2009, p. 150): restructuring in the case of partial equivalence, and development in the case of non-equivalence. The latter involves mapping new words (new meanings) onto real-world referents, and Pavlenko (2009, p. 153) notes that this mapping 'may be easier in the case of new objects and more challenging in the case of abstract or emotion categories'. Pavlenko's model aligns with Langacker's (1987) and Gentner's (1982) understandings of what differentiates word classes, but also with Tomasello's (2003) social-pragmatic modification to Gentner's hypothesis.

2.4.1 Bilingual lexical acquisition

Within the current framework, we must assume that regardless of the number of languages that are involved, children acquire language through general cognitive processes such as categorisation, analogy and a practically unlimited memory (Bybee, 2001, 2010; Langacker, 1987), in combination with social-cognitive processes like joint attention and intention-reading (Tomasello, 2003). If the instances of use to and from the child are divided between two (or more) languages, we must assume that two (or more) systems of linguistic representation emerge from these instances (Lanza, 2004; Paradis & Genesee, 1996). However, there is no reason to assume that phonological and semantic connections are not formed across languages, for instance giving rise to the notion of *cognates*, that is, words from different languages that are similar in form as

well as meaning. Hence, we may postulate that a child acquiring two languages has two separate, but *interacting*, networks (De Houwer, 1995; Pavlenko, 2009; Vihman, 2014), with schemas emerging *within* each language, primarily based on the experience with that language.

Children who are exposed to two languages at the same time will then construct two systems in parallel, abstracting schemas from the instances of each language. In contrast, those who begin their lives as monolinguals and acquire a second language later on, on the other hand, may, through analogy, draw on schemas already in place for their first language when acquiring their second. Generalising from schemas established in your first language(s) could either accelerate or delay development, depending on the similarities and differences between the languages involved; either way, these children may follow developmental paths different from those of children acquiring two languages simultaneously (Meisel, 1989).

We may thus want to draw a line between *bilingual first language acquisition* and *early second language acquisition* (or *bilingual second language acquisition*), and expect children who experience the latter to resemble those experiencing the former in some ways, but also to share traits with adults acquiring a second language (De Houwer, 1995, 2009; Meisel, 1989). Since children show signs of understanding words already at three months (Friedrich & Friederici, 2017), we must assume that at this point, some schemas have already emerged. Thus, from a usage-based point of view, we may follow De Houwer (2009) in a quite strict definition of bilingual first language acquisition, only including cases where children receive significant amounts of input in two or more languages from birth or shortly thereafter.

3

Previous research

From the theoretical framework presented in the previous chapter, we would expect children's lexical development to be affected by properties of phonology, semantics and entrenchment. There may be several reasons for such lexical influences. Some effects may be tightly connected to general cognitive, motoric and social-cognitive abilities, giving rise to more or less universal tendencies in children's lexical development; other effects may rise from language-specific patterns. In addition, children's individual experiences may lead to considerable individual variation; we would expect a close connection between a bilingual child's experience with each of his or her languages and the lexical development *in that language*.

This chapter gives an overview of theoretically interesting properties previously found to affect the path and pace of children's lexical development and lexical processing. As indicated above, I will present findings on properties related to *form* in section 3.1, to *meaning* in section 3.2, and to *entrenchment* in section 3.3. Turning to the implications for language assessment, section 3.4 discusses how factors such as those described in sections 3.1–3.3 may be utilised to create cross-linguistically equivalent lexical assessment tools, and elaborates on one recent attempt, namely the new lexical tool CLT, presented briefly in the introduction. Finally, section 3.5 summarises the chapter, and identifies gaps in the previous research.

3.1 Form

3.1.1 The word-initial consonant

A consonant may be defined by its *place* and *manner* of articulation. Regarding the place of articulation, a number of studies have reported a tendency towards a high proportion of bilabials in children's early words. In a CDI-based study of Danish children's first 50 words, Wehberg et al. (2007) saw that 45 per cent of the words started with a bilabial. Analysing French CDI results, Gayraud and Kern (2007) found early nouns to resemble babbling, with initial bilabials and open syllables; over time, this pattern weakened, and the children began producing nouns with a variety of different initial sounds. These two studies are based on CDI norms from a large number of children. Several other studies have investigated cross-linguistic tendencies through analyses of spontaneous speech from smaller groups of children. These studies have found some general patterns in the phonology of children's early words. For instance, de Boysson-Bardies and Vihman (1991) found large proportions of bilabials, especially word-initially, in the target words of children aged 0;9–1;7 acquiring American English, French, Swedish or Japanese. Also MacNeilage et al. (1997) and MacNeilage and Davis (2000a, 2000b) reported a cross-linguistic tendency towards syllable-initial bilabials in a set of studies involving a variety of languages.

Regarding the manner of articulation of word-initial consonants, nasals and stops are cross-linguistically far more common in babbling and early words than fricatives, affricates and liquids (de Boysson-Bardies & Vihman, 1991; MacNeilage & Davis, 2000a; Velleman & Vihman, 2006). For instance, stops constituted more than 60 per cent of the targets' word-initial consonants in the four languages investigated by de Boysson-Bardies and Vihman (1991), whereas words with initial fricatives constituted just above 10 per cent of the children's targets. Like the high proportion of bilabials, this low proportion of fricatives may be related to motoric abilities, according to de Boysson-Bardies and Vihman (1991). They hold that fricatives (and liquids) require more precise articulation than the relatively simple ballistic movements of stops.

The Japanese children de Boysson-Bardies and Vihman (1991) investigated had a higher proportion of target words with an initial fricative or affricate than the American, French and Swedish children in their study. This difference may be caused by type frequency and salience: de Boysson-Bardies and Vihman (1991) note that these sounds are more frequent in Japanese than in the other languages, and furthermore argue that they are more emphasised in the Japanese children's input because fricatives are often produced as affricates in Japanese CDS. Note that affricates may also be motorically easier to produce than fricatives, as they can be produced by targeting stops and releasing the oral closure until the point of frication rather than aiming for the frication itself. However, cognitive and motoric maturity may also contribute to this cross-linguistic difference: de Boysson-Bardies and Vihman (1991) selected data points based on four lexical milestones (0, 4, 15 and 25 word types produced during a half-hour session), and the

Japanese children were 2–3 months older than the other groups when these milestones were reached. They might thus have produced more words with an initial fricative because they were older and had better motoric control (de Boysson-Bardies & Vihman, 1991).

3.1.2 Overall word shape

Cross-linguistically, words targeted by young children tend to be mono- or disyllabic, and the most common sound patterns are CVCV, VCV and CVC (Vihman & Croft, 2007); words with more than two syllables or consonant clusters are more rare in young children's lexicons. These general properties of children's early words imply that memory, processing capacity, and motoric control and planning may pose restrictions on the overall phonological structure of children's first words.

Nevertheless, there appears to be cross-linguistic differences in the overall phonological structure of the words in children's lexicons. Investigating word length in diary studies and spontaneous speech data across 13 languages, Vihman and Croft (2007) found disyllables to be more common than mono- or polysyllables in the early words of children acquiring Estonian, Finnish, French, Greek, Hebrew, Hindi, Italian, Japanese, Spanish, Swedish or Welsh. Within German, Dutch and English, on the other hand, they found a predominance of monosyllabic words. Wehberg et al. (2007) commented that in addition to a high proportion of bilabials (see the section above), Danish children also had a predominance of monosyllables; 'of the 50 most frequent first words (...), only 4 are decidedly polysyllabic (disregarding a final neutral vowel, which is often dropped)' (Wehberg et al., 2007, p. 370).[1] They furthermore noted a pattern of reduplication in these four longer words: *mormor* 'maternal grandmother', *farfar* 'paternal grandfather', *kykliky* (rooster sound) and *banan* 'banana'.[2]

Properties of the ambient language thus appear to play an important role for the overall structure of children's first words. However, as the studies presented above did not compare their child language data with data from adult speakers, we do not know exactly how the cross-linguistic differences in children's words are related to the phonological properties of their input. In fact, the question of how phonological characteristics differ between languages has received little attention from researchers so far. Hence, we may *assume* that the Germanic languages English, Danish, Dutch and German have more short words than many other languages, and that this tendency is the reason for the observed predominance of monosyllables in children's speech, but for a *conclusion*, research on comparable samples of adult speech is needed.

[1] Note that Wehberg et al. (2007) use only two categories, *monosyllabic* and *polysyllabic* words; the latter thus includes disyllables.

[2] Phonetic transcriptions can be found in Wehberg et al. (2007, pp. 368–369).

3.1.3 Phonological neighbourhood density

Phonological neighbourhood density (PND) is a measure of how phonetically similar a word is to other words in the lexicon. A word's phonological neighbourhood consists of all words that differ from the given word by one and only one segment, through deletion, addition or substitution (Luce & Pisoni, 1998). To exemplify, figure 3.1 on the facing page illustrates parts of the neighbourhood of the word *cat*, which is a neighbour to *cats* and *scat* by deletion, to *at* by addition, and to a number of words by substitution, for instance *cap*; these four neighbours of *cat* are however not neighbours to each other.

In three different studies, Stokes and colleagues investigated whether children with small vocabularies appear to rely more on PND than children with large vocabularies (UK English: Stokes, 2010; French: Stokes, Kern & dos Santos, 2012; Danish: Stokes, Bleses, Basbøll & Lambertsen, 2012). Through analyses of CDI norms, they reported that the words known by children with small vocabularies tend to reside in denser phonological neighbourhoods than the words known by age-matched peers with larger vocabularies; Stokes, Bleses et al. (2012) argued that this effect could be related to poor short-term memory skills among the children with small vocabularies. In other words, these children may struggle more to expand their vocabularies because their abilities to abstract new (phonological) schemas are limited.

Analysing the same type of data as Stokes and colleagues, but with a slightly different approach, Storkel (2004) investigated the effect of PND on the age of acquisition (AoA) of nouns, in interaction with three other factors: word length, word class and frequency. She applied two different measures of AoA: First, following Fenson et al. (1994), the original American English CDI norms were used to calculate each CDI word's *objective* or *CDI-based* AoA, defined as the earliest age (in months) when at least 50 per cent of the children in the data set were reported to know a word. Second, she used *subjective* AoA ratings based on adults' subjective self-ratings, downloaded from two online databases. Storkel (2004) found nouns from dense phonological neighbourhoods to be acquired earlier (by both AoA measures) than nouns from sparse neighbourhoods; this effect was robust for short words, but not for long words. She found no evident PND effect within high-frequency words.

As discussed in section 2.1.1, Bybee (2001, 2010) assumes that phonological similarities like those between *cat* and its neighbours form the basis of lexical connections used by speakers to form generalisations, such as '[æt] is a possible syllable rhyme' for the left part of figure 3.1.[3] The PND effect found by Storkel (2004) may, then, be seen as a result of the number of phonological connections in the mental lexicon. Dense phonological neighbourhoods represent common phonological patterns in the ambient language; these patterns are thus likely to form the basis for children's first phonological schemas (or *word templates* in the model proposed by Vihman and Croft (2007)). Words that fit with these early schemas will then be easier for young

[3] See figure 2.1 on page 12.

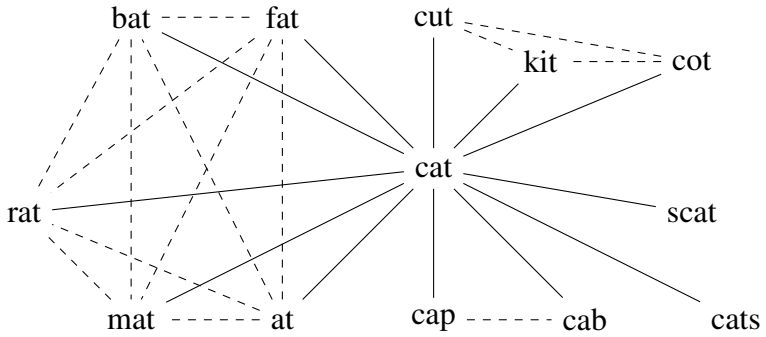

Figure 3.1: Twelve phonological neighbours of *cat* (solid lines). Some of these are also in each other's phonological neighbourhoods (dashed lines).

children to acquire than words with deviating phonological patterns, as they more easily pass through the child's *articulatory filter* (see section 2.2).

3.2 Meaning

3.2.1 Word class

Cross-linguistic research has revealed strikingly similar patterns in the compositions of young children's vocabularies across a range of languages: The first 20–50 words are typically sound effects, names for people or words related to social interaction (Caselli et al., 1995; Eriksson & Berglund, 1999; Maital et al., 2000; Wehberg et al., 2007), but beyond these very first words, common nouns tend to dominate young children's vocabularies; verbs and adjectives are scarce, and closed-class items even more so (Danish: Wehberg et al., 2007; American English: Bates et al., 1994; Fenson et al., 1994; American English and Italian: Caselli et al., 1995; English, German, Kaluli, Japanese, Mandarin Chinese and Turkish: Gentner, 1982; Estonian: Schults et al., 2012; Finnish: Stolt et al., 2008; French: Kern, 2007; Hebrew: Maital et al., 2000; Swedish: Eriksson & Berglund, 1999).

Gentner's (1982) *Natural Partitions Hypothesis* discussed in section 2.3.2 entails that nouns should outnumber verbs regardless of the language acquired. This claim is not uncontroversial, and her hypothesis has been the subject of a long-standing dispute, especially in the cases of Korean (Au et al., 1994; Bornstein et al., 2004; Gopnik & Choi, 1995; Kim et al., 2000; Gentner & Boroditsky, 2001) and Mandarin Chinese (Gentner, 1982; Tardif, 1996, 2006; Tardif et al., 1997, 2008; Gentner & Boroditsky, 2001), where conflicting findings have been reported. The conflicting findings may partly be explained by methodological differences (Caselli, Casadio & Bates, 1999): Primarily basing their research on experiments or recordings of spontaneous speech, Gopnik, Choi and Tardif (and colleagues) have argued that verbs dominate nouns among young children acquiring these languages. On the other hand, a set of CDI-based studies have

concluded that nouns outnumber verbs also in these languages (Au et al., 1994; Bornstein et al., 2004; Kim et al., 2000; Tardif et al., 2008). Tardif et al. (2008) noted that even though there are in fact more nouns than verbs among children's first ten words in both Mandarin and Cantonese, verbs are far more common (and common nouns far more scarce) in both these Chinese languages than in American English. Some languages (e.g. Cantonese, Mandarin and Korean) may thus be more 'verb friendly' than others, indicating that the morphosyntactic and semantic properties of a language may influence how easily words within a word class are acquired within that language. However, the findings above indicate that nouns are cross-linguistically easier to acquire than verbs, whether that is because nouns prototypically denote concrete objects (Gentner, 1982), because they are conceptualised as *things* (Langacker, 1987) or because they tend to occur in pragmatically simple situations (Tomasello, 2003).

3.2.2 Imageability

Several studies have found words to be acquired earlier the more imageable they are (Bird, Franklin & Howard, 2001; Gilhooly & Logie, 1980; Ma et al., 2009; McDonough, Song, Hirsh-Pasek, Golinkoff & Lannon, 2011),that is, the more easily they give rise to a mental image, such as a picture, a sound or a smell (Paivio et al., 1968).[4] In addition, Gillette, Gleitman, Gleitman and Lederer (1999) found adult speakers to be better at identifying an unknown word camouflaged by a beep in child-mother interaction the higher the imageability of this unknown word. Regarding the cross-linguistic differences discussed in section 3.2.1, Ma et al. (2009) demonstrated that imageability may explain why verbs are more common in early lexicons in Mandarin than in English (as documented by Tardif et al., 2008); they found no difference in the imageability between Mandarin and English CDI nouns, but Mandarin CDI verbs were significantly more imageable than their English counterparts.

This effect of imageability on lexical acquisition is intertwined with the word-class effect discussed above: Nouns are not only generally acquired before verbs, they are also more imageable; a significant imageability difference between word classes has been documented within a variety of languages (English: Bird et al., 2001; Chiarello, Shears & Lund, 1999; Cortese & Fugett, 2004; Gillette et al., 1999; Masterson & Druks, 1998; English and Mandarin: Ma et al., 2009; Italian: Luzzatti et al., 2002; Norwegian: Simonsen, Lind, Hansen, Holm & Mevik, 2013). When included, adjectives and function words, which are generally acquired later, have been found to be less imageable than both nouns and verbs (Bird et al., 2001; Simonsen et al., 2013). These differences between the word classes align with a usage-based view on language: Profiled as *things*, nouns are conceptually autonomous, whereas verbs, adjectives and function words are all profiled as relations, and cannot be conceptualised without also conceptualising the entities they relate to (Langacker, 1987). However, the imageability effect on lexical acquisition

[4] Paivio et al. (1968) named the measure *imagery*, but the other studies cited here have used *imageability*.

cannot entirely be attributed to word-class differences: On the basis of widely different studies of English nouns and verbs, both Gillette et al. (1999) and McDonough et al. (2011) concluded that imageability accounts for differences in acquisition not only overall, but also *within* each word class. An interesting question, then, is whether this finding holds across languages.

3.3 Entrenchment

The frequency of an exemplar – be it a sound, a suffix, a word form or a sentence-level construction – is crucial within a usage-based approach to language (Bybee, 2010): Any portion of language should be easier to acquire and be more entrenched in the lexicon the more frequent it is. Studies have indeed documented that frequent words are acquired earlier than infrequent words (Goodman et al., 2008; Ma et al., 2009); frequency also facilitates lexical retrieval among children as well as adults (Burani, Arduino & Barca, 2007; D'Amico, Devescovi & Bates, 2001). However, frequency interacts with a variety of other factors, including word length (Bybee, 2001), imageability (Simonsen et al., 2013; Reilly & Kean, 2007) and word class (Gentner, 1982; Goodman et al., 2008). Thus, when Goodman et al. (2008) investigated how CDI-based AoA (for American English) correlated with lemma frequency, they found a positive correlation between frequency and AoA – the earlier a word was acquired, the lower was its frequency. Their explanation for these seemingly unexpected findings was that word-class effects overshadowed the frequency effects in early lexical development: Languages typically have more unique nouns than verbs, and only a small set of closed-class words; as a result a closed-class word will be more frequent than the average verb, which in turn will be more frequent than the average noun (Gentner, 1982; Goodman et al., 2008). In a two-dimensional spectrum we then find common nouns in one corner (infrequent, but acquired early), and closed-class words in the opposite (highly frequent, but acquired late). Goodman et al. (2008) showed that *within a word class*, highly frequent words were indeed acquired before less frequent words, as expected within a usage-based approach to language (see figure 3.2 on the following page).

Goodman et al. (2008) divided words into word classes based on the organisation of the CDI itself, and analysed frequency effects within the CDI category *words for people* and broader categories common nouns, verbs, adjectives and closed-class items (i.e. function words), as well as the left-over category *other* (which included a variety of items, such as words for events and locations and words commonly used in social routines). They compared the performance of three different frequency lists. Kučera–Francis (Francis & Kučera, 1967) and Thorndike–Lorge (Thorndike & Lorge, 1944), both quite old and based on written language, were contrasted with a new frequency list compiled from the CDS uttered in 28 different CHILDES corpora (MacWhinney, 2000). They found CDS frequency to correlate with AoA within all lexical categories, whereas correlations were found only within common nouns for the two written-language frequency lists. It is well known that CDS differs from speech between adults (e.g. Snow, 1972), but

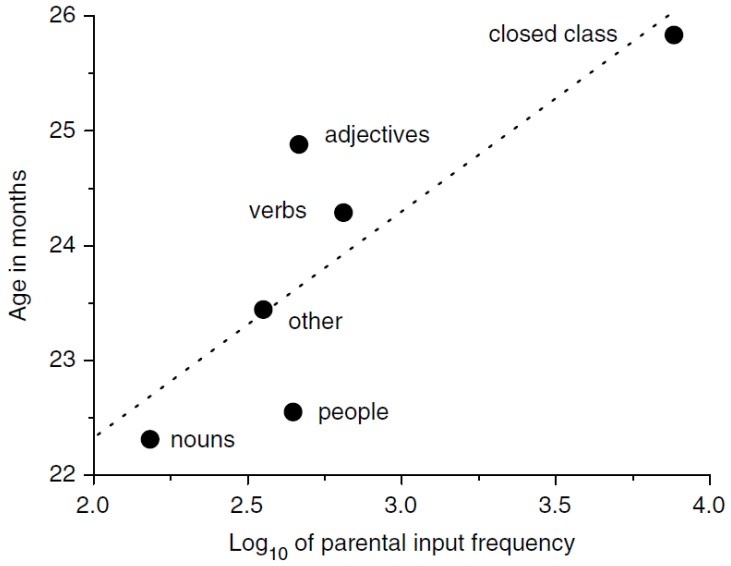

Figure 3.2: Mean frequency in CDS and mean (CDI-based) age of acquisition for common nouns, people words, verbs, adjectives, closed class words and other words. The figure is reprinted from Goodman, Dale and Li (2008, p. 523).

also that speech differs from written language (e.g. Chafe & Tannen, 1987; Brysbaert & New, 2009). Both Kučera–Francis and Thorndike–Lorge are based on quite old language data, and as demonstrated by Brysbaert and New (2009), frequency measures based on internet discussion groups or TV and film subtitles may be more relevant for psycholinguistic research. It would thus be interesting to compare CDS frequency with freque based on newer corpora of more informal genres.

3.4 Consequences for cross-linguistic assessment

A tool that aims to yield comparable results across languages, either for cross-linguistic comparisons of monolinguals or full assessment of children aquiring more than one language, must find ways to account for factors such as those described above. In the words of Peña (2007), using tools that are directly translated between languages is a threath to the test validity:

> Items may not be equally difficult across languages even if the target concept or question occurs in both languages. Some types of items may be rendered more or less complex when translated; words selected in the translation may have different frequencies of occurrence and influence difficulty. (Peña, 2007, p. 1262)

Translations of a lexical assessment tool may achieve *linguistic equivalence*, given that the adaptors make certain that instructions and target items are 'the same' across languages. However, linguistic equivalence does not ensure *functional equivalence* – that the procedure elicits

similar responses and the tested items have roughly the same meaning across languages (or in Peña's words, fill the same *function*). Furthermore, a tool based on translation may fail to meet *metrical* and *cultural* equivalence (Peña, 2007). Metrical equivalence relates to difficulty – a word in language α may be harder to acquire or retrieve from memory than a word denoting the same entity in language β (due to patterns of phonology, morphosyntax or usage). For instance, the Polish noun *zjeżdżalnia* 'slide' is longer and has more consonant clusters than its English translation equivalent, and it *could* thus be acquired later. Cultural equivalence relates to salience – a word may be more salient in language α than its linguistic and functional equivalent in language β for cultural and historical reasons. For instance, the Norwegian noun *hatt* has a more specific meaning than its English linguistic equivalent *hat*; the Norwegian word denotes hats with brims, but not caps or beanies. Both may be basic-level words, but the Norwegian word is in competition with *lue* 'beanie' and *caps* 'cap', both of which may be more common in children's wardrobes as well as in their linguistic input. As a result, *hatt* may be less salient than its English counterpart *hat*.

Researchers or practitioners wanting to assess bilingual children's lexical skills have so far generally been obliged to use tools originally created for the monolingual population. Several authors have argued that for children up to age 3, combining different language adaptations of the CDI may be a valid methodology to get a full picture of bilingual lexical development (Conboy & Thal, 2006; De Houwer, Bornstein & Putnick, 2014; Gatt, O'Toole & Haman, 2015; Pearson, Fernandez & Oller, 1993). For older bilingual preschoolers, many researchers have turned to PPVT or its British adaptation, the *British Picture Vocabulary Scale* (BPVS) (L. M. Dunn & Dunn, 2009), by combining different language versions (e.g. Bialystok, 1988; Diaz, 1985; Oller & Eilers, 2002; Umbel, Pearson, Fernández & Oller, 1992) or by investigating the majority language only (e.g. Bialystok et al., 2010; Golberg, Paradis & Crago, 2008; Melby-Lervåg & Lervåg, 2011).

Both the original CDI and PPVT were based on existing language data for American English. However, there is an important difference between the CDI on the one hand and PPVT and BPVS on the other, regarding how new language versions are made. The CDI Advisory Board (2015) does not authorise direct translations; rather, they aim for *cross-linguistic equivalence* through adaptations based on a common overall structure (see section 4.3), but with individual items customised to the ambient language and culture. PPVT and BPVS are, on the other hand, essentially translated between languages; single items identified as problematic in pilot testing may be replaced, and results are to be interpreted on the basis of norms from the given language, but overall, various language versions are practically identical (e.g. L. M. Dunn, Padilla, Lugo & Dunn, 1986; Lyster et al., 2010).

Efforts have been made to accommodate to bilingual children by creating assessment tools specifically targeted towards them (e.g. Gathercole et al., 2008; Peña et al., 2014). An example within the domain of vocabulary acquisition is the Prawf Geirfa Cymraeg (PGC – the Welsh

Vocabulary Test) (Gathercole & Thomas, 2007) designed for Welsh–English children in the age range 7–11. They rejected a direct translation of BPVS to Welsh based on arguments similar to Peña's (2007), and based their novel receptive vocabulary test on frequency in Welsh CHILDES data as well as in written texts (Gathercole et al., 2008). Loanwords from English and cognates with English were avoided; so were dialect-specific words (for validity across Wales) and words that were hard to depict (Gathercole et al., 2008). Taking input factors into consideration, they assessed children's home-language environments, and established three sets of *bilingual norms*, depending on whether the children were exposed to only Welsh, only English, or both Welsh and English at home. In order to assess Welsh–English children in both their languages, Rhys and Thomas (2013) combined PGC with BPVS (for English).

One of the aims of the recent COST Action IS0804 was to improve the language assessment of bilingual children, especially in the immigrant population. One of the outcomes was the LITMUS battery (Armon-Lotem, de Jong & Meir, 2015), a collection of ten new tools specifically aimed at assessing bilingual children across their languages.[5] The LITMUS battery includes one new lexical assessment tool, the Cross-linguistic Lexical Tasks (CLT) (Haman et al., 2015). In line with Gathercole et al. (2008) and Peña (2007), the rationale behind Cross-linguistic Lexical Tasks (CLT) is that for metrical and cultural equivalence across languages, a lexical assessment tool must be constructed on the basis of language-specific properties.

In contrast to PGC, CLT was developed for a multitude of languages simultaneously; the aim was not a tool that could be combined with existing tools such as PPVT or BPVS, or one that could be used for a specific language pair, but one that would assess both languages of bilingual children across a variety of language combinations in a directly comparable way. As with the CDI, every language version is based on the same general principles and has the same overall structure, but every language version will nevertheless have its own, unique composition of items. The construction procedure devised to ensure cross-linguistic and cross-cultural comparability is laid out in the next section.

3.4.1 Cross-linguistic Lexical Tasks

To facilitate cross-linguistic equivalence as well as clinical applicability, the network of researchers behind CLT decided that the tool should assess both receptive and expressive knowledge of nouns and verbs through a picture-based test (Haman, 2010). To ensure cultural equivalence, 93 participants representing 34 different languages were shown 1,024 pictures representing an object or action. They were asked to perform four tasks for each picture:

1. To judge how easily the picture evoked a word (on a five-point scale).

[5] In addition, the LITMUS battery also contains recommendations on how different adaptations of the CDI may be used to assess bilingual children.

2. To list the first word they could think of, and an English translation of it.

3. To indicate how well the picture represented this entity (on a four-point scale).

4. To evaluate if the picture style would suit children in their country (on a four-point scale).

Based on the responses on the first two tasks, the 1,024 words were reduced to a set of 300 words that reliably evoked a single word with the same English equivalent across the 34 languages. Pictures were drawn for each of these words in line with the responses on the last two tasks. The procedures are described in more detail by Haman et al. (2015). CLT consists of four parts (comprehension and production of both nouns and verbs), each with 32 target words. Each language version of CLT draws its target words from this common pool of 300 words. To ensure metric equivalence, this selection process is based on two language-specific measures – subjective AoA and a compound measure of complexity – as detailed in paper III. The two measures are described in the following sections.

A point worth noting is that unlike PGC (Gathercole & Thomas, 2007), CLT does not attempt to exclude cognates across the bilingual children's languages. Avoiding cognates may be challenging, but executable when a language assessment tool is created for a specific language pair. However, CLT was developed within many different languages in parallel, and aimed to be useful not for one, but for a multitude of different language combinations (Haman et al., 2015). If all target words that are cognates across any of these language combinations were to be removed from the list of 300 words found to be culturally equivalent, there may not be very many words left to design a tool from.

3.4.1.1 Age of acquisition

In the early planning of CLT, contributors considered basing the selection of words on child language or CDS data (Haman, 2010; Haman, Szewczyk, Łuniewska & Pomiechowska, 2011). Eventually, this approach was abandoned due to difficulties with obtaining comparable data across the 34 languages involved from the beginning, and subjective age of acquisition was included as a substitute; a robust AoA effect has been documented in a vast amount of studies on children as well as adults, across a wide variety of lexical tasks (for a review, see Juhasz, 2005), and subjective AoA has been found to correlate with frequency (D'Amico et al., 2001).

Subjective AoA was assessed by asking at least 20 native speakers of each language to rate how old they thought they were when they acquired (defined as when they could understand) each of the 300 words included in the CLT construction process. Participants judged each word on a scale from 0 years (i.e. before they turned 1) to 18 years (i.e. at age 18 or later). The study is described in more detail by Łuniewska, Haman, Armon-Lotem et al. (2016), who compared results across 25 languages, and reported the methodology to be reliable, as ratings corresponded across languages, and valid, since AoA ratings correlated with CDI norms within six languages. The

correlation with CDI norms has also been confirmed for Norwegian (Lind, Simonsen, Hansen, Holm & Mevik, 2015), through comparison between the CDI-based AoA calculated in paper II and subjective AoA collected for about 1,600 words (including the 300 words included in the CLT construction process).

For the CLT construction process, nouns and verbs were divided into two equally large groups: early (level 1) and late (level 2). Target words and distractors for the tasks were selected based on their level of AoA as well as on their complexity, as described below. Since AoA was primarily included as a proxy for child language or CDS data, it would be interesting to see how this measure compares to CDS frequency in languages where such data are available.

3.4.1.2 Complexity index

A novel composite measure called the complexity index (CI) was created as part of the development of CLT. The motivation behind CI was to account for cross-linguistic differences in phonological and morphological complexity, exposure and etymology. CI is composed of a phonological, a morphological, an exposure-related component and an etymological component, with a total of ten factors, selected as a result of discussions among researchers involved in the development of the tool. The rationale behind the selection of factors is given in Haman et al. (2015). Like with AoA above, the CI score is used to divide the words in each word class into two: low (level 1) and high (level 2).

The phonological component includes four characteristics: First, the word length is normalised using the following formula:

$$\text{normalised length} = \frac{\text{word length} - \text{mean word length within word class}}{\text{standard deviation of word length within word class}}$$

The normalised length is then doubled 'in order to emphasize the impact of this factor on overall complexity' (Haman et al., 2015, p. 226). Words then receive one complexity point if there is a word-initial frication, one point if they contain a word-initial consonant cluster, and one point if they contain one or more word-medial consonant clusters.

The morphological component consists of three parts: Words receive one complexity point per word stem, one more point if they are a derivation, and additional points if they have affixes (one point for prefixes and one for suffixes).

The exposure-related component is based on two closed-ended questions: First, *is the object/action available to direct experience in your country?* If the answer is *no*, the word receives a complexity point. Second, *how often would preschool children in your country have access to the object/activity?* The options are *not at all* (1 point), *quite often* (½ point) and *often* (0 points).

Finally, the etymological component consists of one factor only, namely whether the word is a recent loanword, in which case it receives one complexity point. The judgements are made by L1 speakers of the language with a background in linguistics or a related field.

An example of the CI calculation can be summed up as follows: The Norwegian noun *løk* 'onion' is a short word with its three phonemes. The mean word length for Norwegian nouns is 4.87 phonemes, with a standard deviation of 1.81 phonemes, giving *løk* a normalised word length of $\frac{3-4.87}{1.81} = -1.03$. There is no initial frication, initial or medial consonant cluster. The word has one stem only (1 point), is not a derivation, and has no prefixes or suffixes. Onions were judged as available to direct experience in the Norwegian society, and were judged as accessible quite often for preschool children (½ points). Finally, *løk* is not a recent loanword. Its complexity may then be calculated as follows: $2 \cdot -1.03 + 1 + 0.5 = -0.56$.

Since this compound measure is new, and not previously tested, an important empirical question is whether the CI level can actually predict children's performance on CLT, or alternatively, whether any of its components can. It may also be interesting to compare the exposure-related component included here to AoA and CDS frequency, as these three different measures are all related to experience. Furthermore, it is worth noting that no language-specific semantic measure was included in the CLT construction.

3.5 Summary

The findings regarding form, function and entrenchment discussed in sections 3.1–3.3 identify some gaps in previous research. Below, I will briefly summarise and comment on a few of these. I will also touch upon a few questions that may be particularly interesting to pursue regarding the new assessment tool presented in section 3.4.

Findings from analyses of spontaneous speech from young children have indicated that a high proportion of word-initial bilabials may be a cross-linguistic trait of children's first words, whereas the word length in syllables appears to be connected to patterns in the ambient language (de Boysson-Bardies & Vihman, 1991; Gayraud & Kern, 2007; Wehberg et al., 2007; MacNeilage et al., 1997; MacNeilage & Davis, 2000a, 2000b; Velleman & Vihman, 2006; Vihman & Croft, 2007). A majority of these studies have investigated spontaneous speech results from a few (less than ten) children for each language. Two of the studies (Wehberg et al., 2007; Gayraud & Kern, 2007) were based on CDI norms from a large number of children, but neither compared results across languages.

A cross-linguistic comparison of CDI data may contribute to our understanding of these two phonological characteristics. The CDI is a standardised tool demonstrated to be comparable across languages (Reilly & Kean, 2007). CDI norms can not offer the phonological detail that spontaneous speech samples contribute with, but they build on data from a large amount of children, and CDI-based analyses of children's first words may be used to validate the findings from spontaneous speech from relatively few participants. As mentioned in section 3.1, direct comparisons between child and adult language data on the two phonological characteristics are needed to assess whether a high proportion of word-initial bilabials is indeed characteristic to

children's speech, and whether the word length in syllables in children's first words does in fact depend on properties of the ambient language.

Many of the studies presented above have based their investigations of lexical effects on AoA calculated from CDI results (Fenson et al., 1994; Storkel, 2004; Ma et al., 2009; McDonough et al., 2011; Goodman et al., 2008). However, as previously noted, there is a large variation in children's lexical development (e.g. Fenson et al., 1994; Caselli et al., 1995), and the general language development appears to be more tightly connected to the size of children's lexicons than to their age (e.g. Bates & Goodman, 1997; Caselli et al., 1995). It would thus be interesting to compare the much used measure AoA to a measure based on vocabulary size rather than age. A new measure that builds on this idea is presented in section 4.3.

The relationships between word-related factors such as word length, PND, word class, imageability and frequency underline the need for studies that investigate the effects of multiple factors in connection to each other. As an example, the findings of Ma et al. (2009) and McDonough et al. (2011) indicate that imageability may account for word class effects on lexical development in Mandarin Chinese and American English. Research on how vocabulary acquisition relates to word class and imageability within other languages could contribute to our understanding of the connection between these two factors.

Regarding the new assessment tool CLT, research is needed to assess the tool itself. To ensure a comparable assessment across a wide variety of languages, at least one of the two factors underlying the tool should be able to predict some of the variation in children's performance on the tasks. Furthermore, comparing CLT results from populations with different linguistic contexts would inform on the cross-linguistic and cross-cultural applicability of the tool.

4 Methods

Any study of the mental lexicon faces the challenge that our object of study cannot be directly observed; we do not know how many words we know. Studies of vocabulary acquisition will thus have to rely on observations of language in use. This PhD project consists of two parts, study A (paper I and II) and study B (paper III and IV). Both studies made use of methodological triangulation (Jick, 1979) by combining different methods to investigate children's lexical development. The methods are described in detail in the individual papers; this chapter discusses methodological considerations regarding measurements of children's lexicon (section 4.1) and sample size (section 4.2), before outlining study A (section 4.3) and study B (section 4.4). Finally, issues concerning the statistical analyses in the four papers are discussed (section 4.5).

4.1 Measuring children's lexicons

Young children acquire language through social interaction, and the most reliable source of information regarding their very first words may be their caregivers. Many large-scale studies in recent years have drawn on parents' knowledge about their own children by means of questionnaires (e.g. Fenson et al., 1994, 2007; Paradis et al., 2010; Paradis, 2011; Restrepo, 1998). One much used questionnaire mentioned in the previous chapter is the MacArthur-Bates CDI (Fenson et al., 2007), which was constructed to capture reliable, precise and generalisable information about children's early communicative development (Fenson et al., 1994). The vocabulary section of the CDI is designed as a fixed checklist of several hundred words, adapted for each language

version around a common skeleton of lexical categories. The rigour limits variability (Stiles, 1994; Fenson et al., 1994), yielding valid and reliable measures of lexical development even across languages (Law & Roy, 2008).

However, the CDI vocabulary checklist has three critical limitations. First, if a child may acquire *any* word given the right communicative situation (Tomasello, 2003), a fixed list cannot realistically cover children's full vocabularies; the checklist must hence be seen as 'an index of a given child's vocabulary knowledge rather than as an exhaustive atlas' (Fenson et al., 1994, p. 14). Second, the CDI does not assess details such as how often children use the words they know, what they use them to denote or how they pronounce them; parents are specifically asked to mark words even if their child uses a different pronunciation (Fenson et al., 2007). Third, as children grow older, parents may not be able to keep score of their constantly expanding vocabularies (Fenson et al., 1994).

Another way to make use of parents' knowledge that may also work with older children, is to ask more general questions about their children's language skills in comparison to other children of the same age. One example of this approach is the The Alberta Language Development Questionnaire (ALDeQ) developed by Paradis et al. (2010). This questionnaire includes questions about early milestones (e.g. producing a first words), current language skills, behavioral patterns (to uncover developmental disorders) and the family history of language or learning difficulties. Testing the questionnaire on children (aged 4;10-9;1) in immigrant families, they demonstrated that ALDeQ total scores were good discriminators between typical language development and language impairment. Paradis et al. (2010, p. 486) did not investigate the validity of the parental reports; this was seen as impossible 'given the diversity of the L1 backgrounds'; valid direct measures that could be used for comparison were not available across the languages involved (Paradis et al., 2010).

As discussed by Paradis et al. (2010), children's language background must be taken into account in the interpretation of measures of language skills for clinical purposes. The parents' majority language proficiency and the status of each language will influence both the input children receive and their own language use, and as a consequence, their skills. A new interesting addition in this respect is the Parents of Bilingual Children Questionnaire (PABIQ) (COST Action IS0804, 2011; Tuller, 2015). This tool was in part built on Paradis et al. (2010), but also incorporated points from the Alberta Language Environment Questionnaire (ALEQ) (Paradis, 2011), a questionnaire developed to gather information regarding bilingual children's language environments.

An alternative to indirect assessment by means of parental questionnaires is to collect spontaneous speech between children and their caregivers. Providing information on language in use, this data type has the advantage of ecological validity. Compared to the indirect measures above, spontaneous speech can offer data on which words children use without the rigour of the CDI checklist. In addition, this data type can provide detailed information on phonology as well as

usage patterns. However, collecting and transcribing spontaneous speech is time-consuming, and which words that occur in a session of spontaneous speech will depend on which situations are captured on tape. Hence, without recording large portions of a child's first years (see D. Roy et al., 2006; D. Roy, 2009), there is no guarantee that the data are representative of that child's language use.

Yet another option is direct assessment through a vocabulary test with target words of varying difficulty, the most widely used being the PPVT (L. M. Dunn & Dunn, 1981; L. M. Dunn & Dunn, 2012) and its British counterpart, the BPVS (L. M. Dunn & Dunn, 2009). These tools and issues related to their cross-linguistic equivalence are presented in chapter 3. However, they have one more limitation worth mentioning: They only measure receptive language skills. In contrast, the new direct lexical assessment tool CLT (also presented in the previous chapter) assesses both receptive and expressive lexical skills. There are both theoretical and practical arguments in favour of the latter approach.

Regarding the theoretical arguments, we must, from the discussion in chapter 2, assume that retrieving a linguistic unit for speech production requires somewhat different cognitive processes than recognising a word spoken to us (Luce & Pisoni, 1998; Dell, 1986). Since communication relies on mastering both aspects, we may argue that 'the best way to gauge the child's access to meanings of single words' is to assess both receptive and expressive lexical skills (Haman et al., 2015, p. 204). When it comes to the practical use of lexical assessment tools in clinical settings, there are clear advantages to both task types. Picture identification does not rely on pronunciation skills or confidence, and may as such be viewed as an accurate measure of lexical knowledge (Haman et al., 2015; Clark, 2009). Picture naming tasks are more demanding and more liable to interfering variables, but may differentiate better between typical language development and SLI (Haman et al., 2015; Messer & Dockrell, 2006). Study B (section 4.4) contributes to the development of CLT by examining the effects of the linguistic factors underlying the tool on both comprehension and production tasks and by testing the tool on two different bilingual populations.

4.2 Sample size and homogeneity

Methodological choices will necessarily have implications for the sample size. The CDI is well suited for large-scale studies, as data collection requires relatively little attention from the researcher. As a result, the CDI and its adaptations to more than 60 other languages have been used to collect data from thousands of young children.[1] This dissertation analysed data from the Norwegian CDI study (Kristoffersen & Simonsen, 2012; Simonsen et al., 2014), which is one of the largest to date, resulting in norms based on 6,500 monolingual children aged 0;8–3;0.

[1] See http://mb-cdi.stanford.edu/adaptations.html and http://wordbank.stanford.edu/.

Participants were randomly selected by Statistics Norway to ensure a sample representative of monolingual children growing up in Norway; even so, there is a bias towards high education among their parents (Simonsen et al., 2014).

Recording and transcribing spontaneous speech requires far more resources, and as a result, most child language corpora include data from only a few children.[2] As discussed above, the situations captured in a recording may not be representative of that child's language use; another issue is that results from a few children may not be generalisable to a larger population. This dissertation analysed speech from four children selected from the corpus Norwegian–Garmann (Garmann, 2016; Garmann et al., in press); all of them grew up in Oslo, and the parents may be more highly educated than the average. As such, they do not necessarily represent Norwegian children as a whole. However, given their similar background and the fact that speech samples were selected based on vocabulary size (see paper I), these four children should constitute a homogeneous group; differences between them should thus not be attributable to dialectal variation or differences in lexical development.

Assessment by means of a structured tool is a method that may take less time per participant than collecting and transcribing spontaneous speech, but more time than distributing a questionnaire. Thus, it should be feasible to collect data from more than a handful participants, although assessing thousands may not be practically possible. Emerging from the recent COST Action IS0804, study B tested the new tools CLT and PABIQ by using them on four groups of children: monolingual children acquiring either Norwegian or Polish, and children acquiring Polish from birth and either Norwegian or UK English as an early second language. The choice of monolingual participants was linked to the choice of bilingual participants, which was in turn motivated by recent changes in migration patterns since the 2004 EU enlargement (Friberg, 2012; Kaczmarczyk, 2010); the number of Polish citizens has since multiplied in several Western countries, making them the largest immigrant group in both Norway and the UK (Statistics Norway, 2016; Office for National Statistics, 2016). Although children of Polish immigrants to Western countries constitute a large and still growing group, little has so far been done to investigate their language development. The large number of Polish immigrants should facilitate recruitment, it turned out to be harder than expected. Logistics was a complicating factor in both countries: Assessment took time because the participants were scattered geographically, and some of the families willing to participate were excluded due to the travel distances.[3] The reason for the logistical challenges may be that in contrast to many other groups, Polish immigrants tend to settle down dispersed rather than concentrated (Østby, 2015).

In total, 30 Polish–English bilinguals, 33 Polish–Norwegian bilinguals, 35 Norwegian monolinguals and 64 Polish monolinguals participated. The participants in the UK and Poland were

[2] See e.g. http://childes.talkbank.org/.

[3] For a discussion on the data collection from bilinguals in the UK, see Haman, Wodniecka, Kołak, Łuniewska and Mieszkowska (2014).

overall slightly older than the participants in Norway. In the two papers in this dissertation building on these data, several of the participants were excluded, as homogeneity between the groups was seen as more important than sample size. In particular, care was taken to ensure similar age ranges across groups, and to exclude participants who were at risk of language impairment;[4] in paper IV, children with only one Polish parent were excluded to further restrain group differences. As a result, the participants in paper III were 32 Polish–Norwegian bilinguals, 34 Norwegian monolinguals and 36 Polish monolinguals, whereas paper IV was based on analyses of data from 18 Polish–Norwegian and 18 Polish–English bilinguals.

4.3 An overview of study A

In this dissertation, the advantages of CDI data were exploited in two different ways. First, for paper I, a list of Norwegian children's first 50 words following was created following the procedure of Caselli et al. (1995). This was done to carry out comparisons of the phonological characteristics of the first words in Danish, American English, Italian, Norwegian and Swedish. Since CDI data cannot offer phonetic detail, the Norwegian data was supplemented with 30-minutes sessions of speech data from two girls and two boys from the corpus Garmann-Norwegian (Garmann, 2016). For phonological analyses of CDS, we extracted speech from the parents of each of these four children,[5] and a sample of adult-directed speech (ADS) was taken from the corpus NoTa–Oslo (Hagen & Simonsen, 2014; University of Oslo, 2013). Since comparing children's first words and adults' speech within *one language only* would not be sufficient to validate whether word length in syllables in children's first words corresponds to word length in the ambient language, the study was supplemented with Danish, American English, Italian, Norwegian and Swedish samples of the Aesop's fable *The north wind and the sun* (Grønnum, 2013; Ladefoged, 1999; Rogers & d'Arcangeli, 2004; Engstrand, 1999).[6]

Second, for paper II, the sizeable CDI norms available for Norwegian were used to calculate a word's CDI-based AoA (see section 3.1.3) and a new, parallel measure, *vocabulary size of acquisition*, defined as the smallest vocabulary size for which at least 50 per cent of the children in the sample were reported to produce a given word. The motivation for this new measure came from the strong connection between vocabulary size and grammatical development noted in the preceding chapters; both measures were used to investigate the competing and interacting effects of word class, imageability, word length, PND and frequency on lexical development. For these

[4]These children are clearly interesting to study further, but there were too few of them to carry out comparisons with the other participants.

[5]For the children, we selected sessions corresponding to when the children produced at least 50 words, according to CDI responses. For three of these sessions, only the child's utterances are so far transcribed, and the CDS was instead extracted from the first session in which transcriptions of adult utterances were available.

[6]This approach was chosen after pursuits of relevant comparative studies or corpora allowing for cross-linguistic comparisons left us empty-handed. I will return to whether these samples are suitable for the purpose in the next chapters (see also paper I).

analyses, the words were categorised into broad lexical categories (word classes) using the structure of the CDI itself (Bates et al., 1994; Caselli et al., 1995). Data on imageability, frequency and PND were downloaded from the psycholinguistic database *Norwegian Words* (Lind et al., 2015).[7] The Text Laboratory at the University of Oslo used an automatic tagger to create a CDS frequency list (Hansen, 2016) from all parental utterances in the two CHILDES corpora Simonsen (2009, 1990) and Garmann–Norwegian (Garmann, 2016; Garmann et al., in press). There is one more Norwegian corpus in CHILDES (Ringstad, 2016; Larsen, 2014), and a fourth corpus (Anderssen, 2005) was made available for the current project. However, these two corpora were transcribed orthographically in local dialects instead of following an official written standard, and they could hence not be processed by the automatic tagger.

4.4 An overview of study B

The focus of study B was to test the new assessment tool CLT, on the one hand through validating the construction procedure (paper III), and on the other hand by comparing CLT results with another measure of current language skills, across different bilingual populations (paper IV). Regarding the first purpose, we tested the cross-lingustic equivalence of CLT by comparing results from age-matched groups of Norwegian and Polish monolinguals, and investigated the effects of the underlying factors (see section 3.4.1) as well as the task type (comprehension/production) on the CLT performance of these two groups as well as Polish–Norwegian bilinguals. Concerning the second purpose, Polish–Norwegian bilinguals were compared to Polish–English bilinguals growing up in the UK. Regarding the bilingual group, none of their parents were L1 speakers of the majority language, and none of the children had received considerable input in the majority language early in life; they are thus seen as going through early second language acquisition of the majority language, following the classification of De Houwer (2009).

Both monolingual and bilingual children were assessed with CLT in their own day care (Norway and Poland) or school (the UK), and the parents were asked to fill in a pilot version of the background questionnaire PABIQ (COST Action IS0804, 2011; Tuller, 2015), a LITMUS tool (Armon-Lotem et al., 2015) developed through the same network as CLT. The parental reports were used to exclude children with a high risk of language impairment. For the bilingual participants, we also used data from the questionnaire to get an independent measure of the children's current skills in both their languages, based on parents' subjective judgments, and furthermore to paint a picture of their linguistic backgrounds. The Polish version used to assess the bilingual participants, Kwestionariusz Rozwoju Językowego (KRJ) [Questionnaire on Language Development] (Kuś, Otwinowska, Banasik & Kiebzak-Mandera, 2012), and its English counterpart can be found in attachment A (page 201). The assessment in Poland and the UK was organised by

[7] *Norwegian Words* used the corpus NoWaC (Guevara, 2010) for frequency data; I used this corpus to look up frequencies for CDI words not included in the database.

the University of Warsaw, and approved by the Committee for Research Ethics at the Faculty of Psychology, University of Warsaw. The assessment in Norway was organised by a team at the University of Oslo, and the approval from the Norwegian Social Science Data Services for this part of the study can be found in attachment B (page 218).

The target words for the three language versions of CLT used here are listed in appendix C (page 222). For all three languages, a computer version of CLT was used. The computer program collects responses by means of a touch screen and scores these responses automatically. Production responses cannot be scored automatically; instead, audio-recordings are made for later transcription and coding. Due to the differences in objectives between paper III and IV, the production responses were categorised slightly differently in the two studies, in line with a scoring system agreed upon by members of COST Action IS0804's working group on lexical and phonological assessment involved in the early testing of CLT (see table 4.1). Paper III investigated how word difficulty could be predicted by lexical factors related to the target words. Here, only responses involving the stem of the target word were considered correct. In contrast, paper IV focused on differences in lexical skills between participant groups, not in responses on specific words. For this paper, responses were scored as correct if they included an adequate synonym or regional variant. Responses considered as errors by both classifications were divided into 39 different categories based on their relation to the target word.

Table 4.1: Two different systems for scoring CLT production responses

Response type	Example	Paper III	Paper IV
correct answer	pig	Correct	Correct
mispronunciation	[pɪd]		
unexpected inflection	pigs		
incorrect inflection	pigses		
derivation	piglet		
innovation	pigthing		
correct root + L_β inflection	pig*en*		
regional variant	grice	Wrong	Correct
synonym	swine		
any other response	animal	Wrong	Wrong
	oink!		
	farm		

4.5 Statistical analyses

> Essentially, all models are wrong, but some are useful.
>
> (Box and Draper, 1987, p. 424)

For the investigation of phonological characteristics in study A, statistical methods were used to compare proportions between languages – Danish, American English, Italian, Norwegian and Swedish – and between data types – children's first words, spontaneous speech from children, adult speech directed towards children, speech between adults and transcriptions of a short fable. The sample sizes varied from 29 words altogether in the Italian and Norwegian versions of *The north wind and the sun* to 873 word tokens in Norwegian ADS. As is reported in paper I, polysyllabic words were very uncommon in all child language data apart from the Italian first words; the statistical analyses of word-length differences thus focused on the proportion of monosyllables versus the proportion of di- and polysyllables. The various proportions were compared with chi-square (χ^2) tests of independence, with one exception: Due to low expectation values, the cross-linguistic comparison of word-initial bilabials in the fable samples was carried out with a Fisher's exact test.

The research questions asked in papers II and III pertained to how various variables, continuous as well as categorical, could account for lexical development, not only on their own, but also in interaction. As such, these questions demanded more complex statistical methods. Previous studies have often used ordinary least squares (OLS) regression for such purposes, and this was attempted also in the current studies. However, OLS regression (and other classic parametric statistical tests) are built on certain assumptions, such as homoscedasticity (meaning that the error term has the same variance in each observation); White tests indicated that this assumption was in fact not met in the current preliminary OLS regression models, possibly due to skewness and ties in the data.

Applying classic parametric statistical tests on data that violate the basic assumptions may cause loss of power and can even lead to the wrong conclusions: The null hypothesis may be falsely rejected, or not rejected even when it is in fact false (Erceg-Hurn & Mirosevich, 2008, p. 592; Wilcox, 2012). Thus, in papers II and III, the data were analysed through robust regression using the *robust* package (Wang et al., 2014) for the R programming language (R Core Team, 2015). Standardised beta (β) coefficients allowing for comparisons of relative predictive power were calculated by running regression models with continuous variables centred through robust standardised values, calculated by subtracting the median from each value and dividing the difference on the median absolute deviation.

In paper IV, the statistical analyses were, due to the limited number of participants, confined to group comparisons and tests of correlation between the two measures of language skills. Shapiro-Wilk tests indicated significant deviations from normal distributions for both measures analysed in the paper; correlations were thus investigated with Kendall's rank correlation tau, and group comparisons carried out with Wilcoxon rank sum tests.

5

Main features of the papers

Chapter 4 presented the methods used in the four papers constituting this dissertation. In this chapter, each of the papers will be briefly summarised, focusing on the main findings from each paper. After the presentation of each individual paper, I will comment on methodological issues and directions for future research. The implications of the findings presented here will be discussed in chapter 6.

5.1 Paper I

'Phonological characteristics of children's first words'

Paper I (Garmann et al., in press) aimed to test two hypotheses regarding the phonological properties of children's first words: First, that a high proportion of initial bilabials is a property of children's speech that does not correspond to the ambient language, and second, that word length in syllables corresponds to the ambient language, and is not a property of children's speech as such.

To test these hypotheses, three sets of analyses were performed. First, already published CDI-based lists of children's first 50 words were gathered for Danish (from Wehberg et al., 2007), American English and Italian (both from Caselli et al., 1995), and Swedish (from Eriksson & Berglund, 1999), and a comparable list was compiled from the Norwegian CDI norms, operationalising the first 50 words as those most frequently checked as produced in WG forms

(Caselli et al., 1995). Second, for Norwegian, four different data sets were compared: the list of the first 50 words, spontaneous speech from four children, CDS from these four children's parents and ADS from one adult. Finally, the first 50 words in each language were compared to to phonetic transcriptions of the Aesop's fable *The north wind and the sun*, using the fable as a gauge of the phonological properties of each of the five languages.

We found high proportions of initial bilabials in the first words within all five languages (29–44 per cent), with no significant cross-linguistic differences. Word length, on the other hand, differed between the languages, with a large proportion of monosyllables in Danish, a balance between mono- and disyllabic words in American English, Swedish and Norwegian and a large proportion of di- and polysyllabic words in Italian. The Norwegian first words corresponded to children's actual productions with respect to both phonological characteristics, although there was large variation between the four children, indicating that children are affected not only by their input, but also by individual phonological preferences (see Vihman & Croft, 2007). Norwegian CDS and ADS had longer words and a markedly lower proportion of bilabials than the two sets of Norwegian child language data, with CDS falling in between ADS and children's words with respect to both measures. Hence, it appears that when adults speak to children, they adapt to them phonologically. Comparing the first words in each of the five languages to samples of *The north wind and the sun*, we found substantially higher proportions of initial bilabials in the former. Regarding word length, the two data sets corresponded within all languages apart from Danish, where the strong bias towards monosyllables found among the first words was not reflected in the fable.

Overall, these results support the two hypotheses the paper set out to test. However, the results from the in-depth comparison of Norwegian data pointed towards a revision of the second hypothesis: The ambient language does indeed appear to affect the word length in syllables of children's first words, but children's words are consistently shorter than adults' words, indicating that internal factors such as working memory appear to also play a role.

5.1.1 Comments to paper I

The study set out to investigate cross-linguistic patterns in children's first words based on CDI norms, as a contribution to the literature so far based on spontaneous speech from fewer than ten children from each language. We judged the previously published lists of first words of Caselli et al. (1995), Eriksson and Berglund (1999), Wehberg et al. (2007) as a good starting point; at the time, comparable lists had not been published for any other languages, and the CDI norming data were not publicly available. Regarding the use of the Aesop's fable as a gauge for a language's phonological properties, this text sample may be too short to give a reliable representation of a language. However, comparable corpora were not available across the languages investigated. Thus, the method was rigorous, but the analyses were limited by the available data.

The CDI data used to make these lists have since been published in the database WordBank (Frank, Braginsky, Yurovsky & Marchman, 2017),[1] accompanied by six other languages (British Sign Language, Spanish, Russian, Croatian, Hebrew, Turkish). Three of these (British Sign Language, Hebrew and Turkish) differ typologically from each other as well as the five languages studied in paper I; a comparative study of these data could thus shed further light on the two hypotheses discussed in the paper. Note that whereas paper I was confined to the data that were available at the time (lists of children's first words derived from CDI norms), future studies have the full data sets at their disposal, and could analyse phonological effects within and across languages on the basis of data from thousands of children. For instance, the large norms may be used to select children acquiring their very first words, following the approach of Tardif et al. (2008).

5.2 Paper II

'What makes a word easy to acquire?'

Paper II (Hansen, 2017) had two aims: The first aim was to compare the much used measure age of acquisition (AoA) as calculated from CDI norms (Fenson et al., 1994), to VSoA, a new measure based on children's vocabulary size rather than their age. The invention of this measure was motivated by the finding that vocabulary size is a better indicator of general language development (and future vocabulary skills) than age (see e.g. Bates & Goodman, 1997). The second aim was to assess how well word class, imageability, phonological neighbourhood density (PND) and frequency, separately and in interaction, can predict lexical development.

The Norwegian CDI norms based on data from about 6,500 children were used to calculate two measures of lexical development: AoA and VSoA.[2] A high correlation between AoA and VSoA indicated that the order of acquisition of the CDI words is essentially the same according to both measures. Although AoA ranged from 8 to 36 months, half of the words had an AoA between 23 and 28 months. Since VSoA builds on vocabulary size, not age, this spurt is not evident in the words' VSoA – rather the words are evenly distributed according to this measure. Possibly as a result of this difference in distribution, the novel VSoA is more sensitive to subtle lexical effects than AoA.

Data on imageability, PND and frequency were downloaded from the database *Norwegian Words* (Lind et al., 2015), and supplemented with additional frequency data from the corpus NoWaC based on the .no internet domain (Guevara, 2010) and a CDS frequency list compiled from two CHILDES corpora. Frequency in child-directed speech (CDS) was the most important predictor of lexical development, whether measured by AoA or VSoA – within each word class,

[1] Available at http://wordbank.stanford.edu/.

[2] See section 4.3.

words were acquired earlier the higher their frequency. The effect was particularly strong within nominals. Frequency in CDS outperformed frequency in the NoWaC, although the latter still accounted for more of the variation than did the written language corpora used by Goodman et al. (2008) for English.

Imageability and word length were also significant predictors: Words were acquired earlier the more imageable they were, and the fewer phonemes they had. In coherence with previous research, social words were acquired before nominals, nominals before predicates, and predicates before function words. In line with McDonough et al. (2011), imageability accounted for the difference *between* nominals and predicates (the only word classes for which imageability was available) as well as variation *within* each word class. PND had a limited effect on lexical development, holding only within nominals when acquisition was measured by VSoA.

5.2.1 Comments to paper II

The study is limited to words that are acquired early in life – for words acquired later, other methods of data collection must be employed. Imageability ratings are available for a majority of the CDI nominals and predicates, but not for the social words or function words. Investigating whether imageability may account for the acquisition of the latter categories was thus not possible with the current data set. To some extent, the study is also limited by the database *Norwegian Words* (Lind et al., 2015); it was not feasible to include other properties that would require a study of their own, such as familiarity or concreteness, and, as discussed in the paper, the PND measure in the database has a crucial weakness: It is based on a large dictionary, with no weighting of a potential phonological neighbour's likeliness to occur in a child's vocabulary (see Storkel, 2004), or of frequency (see Luce & Pisoni, 1998).

Paper II asked what makes a word easy to acquire. Since the data was gathered through parental reports, it is possible that what the paper actually illuminates is what makes words produced by children easy to remember for their parents, or alternatively, what affects parents' interpretations of their children. After all, the factors investigated here may all affect processing in adults (e.g. Bates, Burani, D'Amico & Barca, 2001; Juhasz, 2005; Luce & Pisoni, 1998).[3] For instance, words with a high CDS frequency may be more salient to parents, and thus easier to remember, and children's productions that are heavily influenced by individual phonological preferences may be easier for parents to understand if the words are highly imageable. A relevant point in this context is that the *CDI-based* AoA used in paper II does appear to be less 'contaminated' than the *subjective* AoA used in paper III, at least when it comes to the effect of frequency (D'Amico et al., 2001). In other words, parents asked whether their children use a given word will be less swayed by this words' frequency than adults asked how old they were when they acquired it.

[3] I would like to thank an anonymous reviewer of this paper for pointing out this caveat.

5.3 Paper III

'Validating the psycholinguistic aspects of LITMUS-CLT'

The aim of paper III (Hansen et al., 2017)[4] was to evaluate the CLT's construction procedure. It asked how well mono- and bilingual children's CLT performance was predicted by the two language-specific properties underlying the tool (subjective AoA and complexity index (CI)), comparing these to the two most important factors in paper II, namely CDS frequency and imageability. Furthermore, it investigated whether children scored higher on nouns than on verbs and higher on comprehension tasks than on production tasks, as expected from previous research (e.g. Gentner, 1982; Bornstein et al., 2004; Messer & Dockrell, 2006; Hansen, 2017).

As a measure of each CLT target word's difficulty, results from 34 Norwegian and 36 Polish monolinguals as well as 32 Polish-Norwegian bilinguals were used to calculate the proportions of correct answers for each word within each group. Regression analyses were used to assess the potential effects on CLT results from language, word class (nouns and verbs), task type (comprehension and production), subjective AoA (early and late), CI (low and high), frequency (normalised within each language) and imageability (for Norwegian only), as well as any two-factor interaction.

The children generally scored higher on nouns than on verbs, and higher on comprehension than on production. No language difference was found among the monolinguals, and as expected from the background information, the bilinguals scored higher in Polish than in Norwegian. AoA and CDS frequency could predict variation in children's CLT performance, whereas CI could not, and imageability was overshadowed by word class effects. As CI is a compound measure, we investigated the contribution of the subcomponents phonology, morphology, exposure and etymology (loanword status), finding limited effects from two of these four components: For the monolinguals, the morphologically complex words in the production tasks were harder than the morphologically simple words, and low-exposure verbs were generally harder than high-exposure verbs. Exposure had the same effect within the bilinguals' production responses.

Based on these results, we concluded that CLT appears to yield comparable results across languages, possibly due to the inclusion of AoA in the tool construction. Analyses across more languages are required to ascertain whether this goal has in fact been met; so far, cross-linguistic comparisons of monolingual data have indicated similar results across 16 different languages, although there are still notable cross-linguistic differences (Haman et al., 2017), potentially connected to linguistic as well as cultural factors (Łuniewska, Haman & Hansen, 2016).

[4] A small change was made just before printing, adding 'LITMUS-' to the former title 'Validating the psycholinguistic aspects of CLT'.

5.3.1 Comments to paper III

One limitation to the current study is the ceiling effect, particularly within nouns and on comprehension tasks. The effect is more prominent among the monolinguals, but also visible in the bilingual children's scores in Polish. This bias towards high scores is an issue for the statistical analyses, and may explain why significant effects for several of the investigated factors were found only within *harder* items, such as among production targets, verbs or high-AoA words. Hence, we cannot completely preclude that CI has an effect on children's performance on the basis of the current data. The computer version of CLT used to assess the participants in this study also records reaction time for the comprehension tasks, and investigating processing speed for correct answers could be a way around the issues caused by the high comprehension scores.

It is worth to note that the ceiling effects among typically developing children in their L1 is not necessarily a problem for CLT as a tool. The motivation behind CLT was to create a tool that could identify (or indicate) SLI in bi- and multilingual children (Haman et al., 2015); these children are likely to score far lower on the tasks than the typically developing children studied here. In cooperation with Statped (the Norwegian national service for special needs), data have been gathered from some children diagnosed with SLI (Bjerkan, Ribu, Hansen & Simonsen, 2013), but too few for quantitative analyses. Note that two recent papers which have used the CLT to compare children with SLI with typically developing children have detected significant differences between the groups (Khoury Aouad Saliby et al., 2017; Kapalková & Slančová, 2017).

5.4 Paper IV

'Picture-based vocabulary assessment vs. parental questionnaires'

Paper IV (Hansen et al., in press)[5] investigated the language development in two groups of migrant children with Polish as the primary home language, one group growing up in Norway and the other in the UK. The study set out to compare these two groups on two different measures, CLT results and parental reports of current skills (overall and lexical), and to assess whether the direct (experimental) and indirect measures correlated within and across groups.

The CLT and a Polish pilot version of the background questionnaire PABIQ were used to assess 18 children in Norway and 18 children in the UK, all of whom mainly spoke Polish at home and had two Polish parents. The questionnaire included nine questions about current language skills, all rated on a four-point scale, and the paper combined these for a compound measure of overall language skills. One specifically concerned lexical knowledge, and this question was used to divide the children into those reported to know fewer words than other children of the

[5] Attached as paper IV is the version originally submitted for publication, titled 'Do indirect and direct measures of children's language skills correspond?'. The title was changed in the revision process.

same age, and those who reportedly knew as many or more words than them. Background information revealed no differences between the groups in the home language environment or the length of exposure to Polish (which all acquired from birth) or the majority language. Unsurprisingly, given the global status of English, the UK parents reported their own proficiency in English as higher than the parents in Norway did for Norwegian.

Overall, the CLT results correlated with the parental judgments of the children's skills in each of their two languages. The CLT results differed between the languages within both groups, with higher scores in Polish than in the majority language. We found no differences between the groups in neither Polish skills nor majority language skills, as measured by CLT. When it comes to the results from the questionnaire, there was no between-group difference in the children's overall skills in the majority language, but the parents in the UK reported their children as significantly less proficient in Polish than the parents in Norway reported theirs to be. Only one child in each group reportedly knew fewer words in Polish than children of the same age; for the majority language, the same was true for most of the children in both groups. The incongruity between the CLT results and the indirect overall measure of skills is interesting, and could on the one hand indicate that the parents in the UK group may set higher benchmarks for their children's skills in the home language than the parents in Norway do. On the other hand, it is possible that the parental reports reflect early stages of attrition of Polish among the children in the UK that CLT is not sensitive enough to detect, as it only includes concrete objects and actions.

5.4.1 Comments to paper IV

The participants in this study were similar in several respects. They all had two Polish parents, and Polish was, according to the parental reports, the most used language in the home. Furthermore, all attend school or daycare in the majority language. While this uniformity means that we cannot generalise the results to other groups of bi- and multilinguals, it is also an advantage, as it allows us to say something about a group of relatively few participants. The limited number of participants does however call for caution. While the questionnaire used here offers information on a variety of factors that may or may not affect children's performance on a lexical test such as CLT, more data are needed to compare the potential effects of these factors.

With two sources of diverging results, such as in this study, we cannot determine which of the sources to trust. Introducing a third tool could tip the scale. While the children studied here were not assessed with any additional tools, there are projects that have combined the tools used here with other tools from the LITMUS battery (Armon-Lotem et al., 2015), and investigations into these results could resolve whether we should trust the CLT results in that both groups of children are Polish-dominant in terms of their lexical knowledge, or rather rely on the parental judgments that indicate a balance between the languages among the UK children.

As argued when it comes to the ceiling effects observed in paper III, if CLT is indeed in-

sensitive to the first steps of a language shift towards the majority language among the children growing up in the UK, this is an issue to paper IV, but not necessarily to CLT as an assessment tool. CLT was designed to distinguish bi- and multilingual children with language impairment from their typically developing peers. Studies of presumably typically developing children from different populations are needed to establish what we may expect from typically developing children, but at the same time, gathering CLT results from children with SLI is crucial to the clinical applicability of the tool.

6

General discussion

In the beginning of this dissertation, I posed two general research questions. First, how can factors related to form, meaning and usage account for the composition of children's lexicons? And second, can we expect cross-linguistically equivalent tools to yield comparable results in different groups of typically developing bilingual children? In this chapter, I will lay out findings relevant to these two questions, and discuss to which extent my four papers can offer answers to them. The first question is explored in section 6.1, and the second in section 6.2. Finally, in section 6.3, I will point to the key points and main new findings of this dissertation, offer some thoughts on limitations, and suggest some directions for future research.

6.1 Linguistic factors

The first general question was refined into three more detailed questions: Which factors are connected to the ambient language, and which are typical to children's lexicons? Can factors related to form, meaning and/or usage predict lexical development? And finally, can a lexical assessment tool ensure cross-linguistic equivalence by means of factors related to form, meaning and/or usage? These three questions are reviewed one by one in sections 6.1.1–6.1.3 below.

6.1.1 Language-specific or specific to children?

The first detailed question was most directly targeted in the first paper in this dissertation, which investigated phonological properties, more specifically word-initial place of articulation and word length in syllables, across five languages. The study included CDI data from Danish, American English, Italian, Norwegian and Swedish, spontaneous speech from Norwegian children and adults, and short speech samples for comparisons with the cross-linguistic CDI data (see section 4.3). High proportions of initial bilabials in the CDI data were observed across all five languages; no other place of articulation was more common in any of them. Correspondingly high proportions were found in Norwegian children's spontaneous speech. Initial bilabials were significantly less common in the Norwegian CDS, and even less so in Norwegian adult-directed speech (ADS); they were also far less common in the cross-linguistic samples of the Aesop's fable *The north wind and the sun* than in the cross-linguistic CDI data. These findings are compatible with the previous research presented in section 3.1.1, and imply that there is indeed a high proportion of initial bilabials in children's early words compared to their language input, as suggested by Gayraud and Kern (2007) and Wehberg et al. (2007). Note that based on the current paper alone, we cannot conclude that this is a universal pattern, as Danish, American English, Norwegian and Swedish are all Germanic languages, and all five languages are Indo-European. However, the findings concur with de Boysson-Bardies and Vihman (1991), who found high proportions in spontaneous speech not only for the Germanic languages French, English and Swedish, but also for the Japonic language Japanese, indicating that this may in fact be a more universal pattern.

An affinity towards initial bilabials may be an attribute of vision, nervous system or motoric control: Regarding vision, a lip closure is a stronger visual cue than a coronal or dorsal closure, giving children a better opportunity to see how the sound is produced (de Boysson-Bardies & Vihman, 1991). Concerning the nervous system, McCune and Vihman (2001) argue that feedback from the lips is easier to interpret than the feedback from the palate and tongue; the articulation of labial consonants may thus be easier to feel than coronal and dorsal consonants. Finally, when it comes to motoric control, children may have better control over the lips and jaw than over the different parts of the tongue (McCune & Vihman, 2001; see also MacNeilage et al., 1997). If visual, sensory and motoric factors influence the very first words, the schemas abstracted from these words may in turn influence the words acquired later: If a new word fits an existing schema, that should make it easier to acquire, also as the child gradually gains motoric control and becomes less dependent of visual cues and nervous feedback (Vihman, 1993, 2014; Vihman & Croft, 2007)

When it comes to word length in syllables, the comparison of CDI data indicated cross-linguistic differences: monosyllables were significantly more common in Danish than in the four other languages, and Italian stood out from the other languages with a high proportion

of polysyllables. With a prevalence of disyllables in Swedish and Italian, and a bias towards monosyllables in American English, our results concur with Vihman and Croft (2007). However, in contrast to Vihman and Croft (2007), we did not observe a significant difference between Swedish and American English in the proportion of monosyllables. The generally low proportion of polysyllables among children's early words concurs with the findings of Gayraud and Kern (2007), who found no polysyllabic nouns among French children until age 2;6 (years;months) – and only small numbers until age 3;10. Concerning the Norwegian speech samples, the children's speech contained fewer monosyllables than the Norwegian CDI data, and the adult speech even fewer. As observed above for initial bilabials, the CDS resembled the children's speech more than the ADS did, with more monosyllables and fewer polysyllables.

With regards to the short samples of *The north wind and the sun*, about half of the words in the Danish, American English, Norwegian and Swedish versions were monosyllabic. The Italian version of the fable was dominated by di- and polysyllabic words, in line with previous findings for Italian CDS (Keren-Portnoy, Majorano & Vihman, 2008). Comparisons between CDI data and fable samples indicated that adults use longer words than young children; beyond this difference, the two data sets followed each other within all languages apart from Danish, where the words were longer in the fable than expected from the CDI-based list of children's first words. A study indicating that the Danish fable transcription is not fully representative of Danish adult speech is that of Hilton, Schüppert and Gooskens (2011); studying speech from radio news and a data set of read sentences, they reported far more syllable-reduction in Danish than in Swedish and Norwegian.

Overall, the comparisons indicate that young children are attentive to the phonological patterns in the languages they are exposed to, but still, possibly due to age-related limitations in working memory, have an affinity towards short words (Gayraud & Kern, 2007). Note that the Norwegian version of the fable had significantly more monosyllables than the sample of Norwegian ADS, indicating that the fable is not a fully representative language sample; admittedly, the fable is short, with only about 30 content words per language, and the genre may not be representative for adults' spontaneous speech.

Significant variation was noted in the four Norwegian children's speech, and in particular in the children's productions: For instance, one of the girls, Iben, produced over half of her words with an initial bilabial, whereas the other, Johanna, began only one in twelve words with a bilabial. The individual differences suggest that children's productions are heavily influenced by personal phonological preferences. Following Vihman (1993, 2014) and Vihman and Croft (2007), we may assume that Iben expanded her lexicon by adapting words to phonological schemas that included an initial bilabial, whereas Johanna had specialised on schemas that did not.

Detailed comparisons between each of the children and their parents could inform on whether these differences stem from different preferences or individual differences in language input. However, as noted in chapter 4, the children's speech and the CDS analysed here do not stem

from the same sessions, as the adults' utterances are so far only transcribed in a few of the sessions in the corpus Garmann-Norwegian (Garmann, 2016). Thus, comparisons on an individual level must either await an expansion of the corpus or build on other corpora. A study that has carried out such a comparison, is that of Vihman, Kay, de Boysson-Bardies, Durand and Sundberg (1994); on the basis of 15 infant-mother dyads across three different languages, they concluded that 'there is little support for the idea that children differ in their production choices because the specific input speech to which they are exposed, within the home or family, biases them toward a particular path' (Vihman et al., 1994, p. 660).

Moving on from phonology, both papers II and III contribute with insight relevant to the question of which *semantic* factors are typical to children's lexicons. Paper III found monolingual and bilingual preschoolers to score higher on nouns than on verbs in receptive as well as expressive lexical assessment. Paper II documented that Norwegian children, according to CDI norms, generally acquire nominals (nouns) before predicates (verbs and adjectives). Moreover, the paper found that words typically used in social interaction are generally acquired earlier than nouns, and that closed-class items (function words) are acquired even later than predicates. These findings are in accordance with previous research across a wide range of languages (see section 3.2.1), indicating that there are cross-linguistic similarities in the semantic properties of children's early words.

As I will return to in the next section, paper II also documented a strong effect of imageability on young Norwegian children's lexical development. This result is in accordance with findings from Mandarin Chinese (Ma et al., 2009) and American English (Ma et al., 2009; McDonough et al., 2011), and indicates that young children may have a cross-linguistic affinity for highly imageable words. Nouns are overall more imageable than verbs and adjectives, and as discussed by McDonough et al. (2011) as well as in paper II, imageability could account for the word class patterns in early lexical development.

6.1.2 Predicting when a word is acquired

The second more detailed research question regarded the relationship between different factors that have been shown to affect children's lexicons. This question was targeted by paper II and III. Paper II investigated the potential effects on Norwegian lexical development from word class, imageability, frequency, word length in phonemes and phonological neighbourhood density (PND). Lexical development was measured by age of acquisition (AoA) and vocabulary size of acquisition (VSoA), both calculated from the Norwegian CDI norms (see section4.3). Paper III investigated the effects of word class, frequency, imagebility, *subjective* AoA and the compound measure complexity index (CI) on Polish and Norwegian CLT scores from monolingual and bilingual preschoolers; Polish imageability data are on the stocks,[1] but were not available for the

[1] M. Łuniewska, personal communication, September 21, 2016.

current investigation.

Both these two papers documented significant effects of CDS frequency. In paper II a new CDS frequency list from two Norwegian corpora (Hansen, 2016) was contrasted to frequency in the corpus NoWaC, based on the .no internet domain (Guevara, 2010). CDS frequency correlated with AoA and VSoA within all word classes (social words, common nouns, other nominals, verbs, adjectives and closed-class items) whereas frequency in NoWaC only correlated with the acquisition measures within common nouns and verbs. Regression models indicated that CDS frequency was by far the most important predictor of both AoA and VSoA. The findings in paper III corroborated these results, as frequency predicted performance on word production tasks among monolingual as well as bilingual children. The theoretical implications of these results will be further discussed in section 6.3.2.

In paper II, word length was found to have a significant effect on both AoA and VSoA; words were acquired later the longer they are. This result may seem at odds with paper I finding the first words in Norwegian to be balanced between mono- and disyllabic words. However, these findings do in fact not contradict each other, as they deal with different stages and measures. Whereas paper I sets out to investigate the very first words, none of which exceed two syllables, paper II goes beyond this scope, dealing with both three- and four-syllable words. The word length effect found in paper II could be an attribute of these longer words being acquired late. Regarding the measures, word length in syllables (paper I) may correlate with the number of phonemes (paper II), but there is no absolute correspondence between the two: A monosyllabic word with two consonant clusters may consist of more phonemes than a disyllabic word with no consonant clusters and open syllables.

PND did not significantly affect a words' AoA when word length was controlled for, but a significant effect on VSoA was observed among nominals, with words being acquired earlier the denser their phonological neighbourhoods. Significant effects were expected also when acquisition was measured by AoA (see Storkel, 2004). As mentioned in paper II, the reason for this lacking effect could be the way the Norwegian PND measure is designed: Although paper II and Storkel (2004) assume the same general definition of a phonological neighbourhood, Storkel (2004) filtered words by familiarity to better gauge children's lexical networks: Only words with a familiarity rating of six or more on a seven-point scale counted towards a words' PND. This approach was not possible for paper II, as familiarity ratings are not available for Norwegian; a possible substitute is imageability, but this property is only available for about 1600 words (Lind et al., 2015). Another approach is to weight phonological neighbourhoods by frequency (Luce & Pisoni, 1998), diminishing the influence of obscure words. This approach is possible for Norwegian and would be interesting from a usage-based point of view: Taking the strength of each exemplar into account should improve the model of our mental lexicon. Following this train of thought, the best solution for research on lexical development may be to weight PND by frequency in CDS.

Regarding word class, paper II aligns with previous research; the first words were tightly connected to social interaction, nominals were acquired before predicates, and closed-class items were the latest acquired. There was overlap between the word classes. To exemplify, while some nouns were among the very first words, others were among the very last. This overlap aligns with with Tomasello's (2003) claim that *any word* may be acquired given the right social setting. Paper III corresponded with paper II, as both monolingual and bilingual preschoolers generally scored higher on the CLT noun tasks than on the verb tasks, with an overlap between the two word classes in item difficulty.

Imageability was also studied in both these papers, but with somewhat conflicting results. On the one hand, paper II found that when the potential effects of word class and imageability were analysed through a regression model, only imageability had a significant effect on acquisition (with words being easier to acquire the more imageable they are). On the other hand, in paper III, word class seems to overshadow imageability, which only affected the performance of monolinguals, not bilinguals, and only within the more difficult tasks, that is, within production tasks, among verbs, and within late acquired words. The paper noted that ceiling effects could be the reason for the lack of imageability effects within the easier tasks, but this cannot explain why imageability did not have an impact on the bilingual children's CLT performance, since there was in fact less of a ceiling effect in this group.

Why, then, do these two papers come to different conclusions regarding which of these two factors is the most important predictor of lexical development? In addition to the ceiling effect noted for CLT, I can see three potential explanations, concerning age range, data size and tool design. The age range was 0–3 for paper II and 3;5–5;11 for paper III, and the reason for the differing conclusions could hence be that imageability plays a more important role in the very beginning of lexical development than for older preschoolers. However, note that imageability effects has been reported beyond the scope of early language development, for instance in picture-naming tasks (Bates et al., 2001) and word learning simulations (Gillette et al., 1999) involving adult participants. Thus, we would indeed expect imageability to affect CLT results. Concerning the data size, the investigation of imageability effects in paper II included data from 6500 children and imageability scores on 447 nouns, verbs and adjectives, while that in paper III involved 66 children and imageability scores on 128 nouns and verbs, divided between two task types (comprehension and production). Hence, paper II allowed for a far more thorough investigation of the relationship between imageability, word class and acquisition than paper III.

Regarding the design of the tools involved, any word may be included in a checklist, whereas a picture-based tool is by necessity biased towards words of which meanings can easily be depicted; in the development of CLT, a cross-linguistic naming study was used to ensure that the target words are easy to elicitate from pictures (Haman et al., 2015). Thus, the lack of a robust imageability effect in paper III may be a result of a strong bias towards highly imageable target words. As I will return to in the next section, the choice of a picture-based design may also

contribute to the observed differences in performance between nouns and verbs. To sum up, it is plausible that imageability does in fact influence 3–5-year-olds' performance on picture-based lexical assessment tools, but that this influence is not detectable in paper III, due to ceiling effects, insufficient data, high imageability values among the CLT target words, or a combination thereof.

There are several reasons to expect imageability to influence lexical development and processing. As mentioned in section 2.1.2, Taylor (2002) suggests that one of the properties that separate words on the *basic level* in a taxonomy from words above this level, is that they are highly imageable. Thus, many highly imageable words may be easily acquired in virtue of being basic level words. Gillette et al. (1999) observed that the most readily identified nouns in their experiment were indeed basic level whole objects. Importantly, though, Gillette et al. (1999) argued that the imageability effect is not a result of how words are conceptualised in the mental lexicon, but an attribute of the communicative situation, along the lines of Tomasello's (2003) social-pragmatic approach:

> The child word learner at the earliest stages of language exposure is limited to the information provided by the observeable extralinguistic contingencies. If observation provides the sole information base, then nouns labelling concrete nominal categories should be easiest to acquire. Moreover, verbs like throw and come will be easier to acquire than want and know even if the learner has equal conceptual access to physical-action categories and mental-state categories.
>
> (Gillette et al., 1999, p. 154)

6.1.3 Predicting word difficulty across languages

The third detailed research question was: Can a lexical assessment tool ensure cross-linguistic equivalence by means of factors related to form, meaning and/or usage? This question was central for paper III, which aimed to validate the psycholinguistic aspects of the lexical assessment tool CLT. To sum up the CLT construction procedure (described in more depth in paper II), target words are selected based on subjective age of acquisition (AoA) and complexity index (CI): Within each part of CLT (noun comprehension, verb comprehension, noun production and verb production), half of the words are low in complexity and half are high, and early and late acquired words are equally represented within both the low-complexity and the high-complexity words. The assumption behind the procedure was that together, these measures should ensure metric equivalence across languages (Haman et al., 2015).

Subjective AoA was selected as an underlying variable for CLT as a substitute for data on child language or child-directed speech. Speech data were considered in the early planning of CLT (Haman, 2010), but abandoned because it was judged as infeasible to collect comparable data across the more than 30 languages included in the construction process. However, CDS

frequency lists are available for some of the languages involved, including Polish (Haman, Etenkowski et al., 2011) and Norwegian (Hansen, 2016); these two lists were exploited in paper III to to assess the validity of using subjective AoA as a substitute for frequency.

In paper III, the effects of subjective AoA, CI, CDS frequency, word class (nouns and verbs) and task type (comprehension and production) were investigated within Polish and Norwegian for CLT results from monolingual as well as bilingual participants. In accordance with a wide body of research (Bornstein, Tal & Tamis-LeMonda, 1991; Gentner, 1982; Caselli et al., 1995; Wehberg et al., 2007), both groups scored higher on nouns than on verbs. However, since CLT is a picture-based assessment tool, the higher scores for nouns could be an attribute of the design itself rather than a reflection of children's lexicons: Typically denoting concrete objects (Gentner, 1982; Langacker, 1987), nouns may be easier to draw pictures of and easier for children to interpret from pictures than verbs, which typically denote transient and more abstract events (Gentner, 1982; Langacker, 1987). CLT results from a language argued to be 'verb-friendly' (see chapter 3) could help isolate the effect of the task design from real differences in acquisition or lexical retrieval, but CLT has not yet been constructed for any of these languages.[2]

Regarding CLT's use of AoA as a gauge of frequency, there was a correspondence between these two measures within both languages, with the low-AoA CLT words being significantly more frequent than high-AoA words, and subjective AoA did in fact have a stronger and more robust effect on CLT performance than CDS frequency. These findings imply that the selection of subjective AoA as an underlying variable for CLT is indeed justified. As discussed in paper III, there are at least three possible explanations for the main effect of subjective AoA. First, subjective AoA might be a good measure of which of the words the children have acquired. Lind et al. (2015) reported strong correlations between the *subjective AoA* ratings collected for the Norwegian CLT and the *CDI-based* AoA calculated in paper II. In addition, Łuniewska, Haman, Armon-Lotem et al. (2016) reported correlations between subjective AoA and CDI norms within nine languages. Hence, the participants in paper III could score low on high-AoA CLT target words (i.e. words estimated as acquired late) simply because they had not acquired them yet.

However, a vast amount of studies have found robust AoA effects not only on children's lexical skills, but also on lexical processing in adults (for a review, see Juhasz, 2005). This brings us to the second explanation for the AoA effect: How early in life a word (or word chunk or phrase) is acquired could affect the strength of its lexical representation. From a cognitive-linguistic point of view, we may assume that early acquired words are more entrenched than the words acquired later because of their accumulative frequency (Ellis & Lambon Ralph, 2000). Furthermore, if our mental representations of language are abstractions over rich exemplars (Bybee, 2010), and new exemplars are understood and categorised by their similarities in form and function to exemplars already stored in the lexicon (Dąbrowska, 2009), we may assume that exemplars acquired early in life are more entrenched than later words because there are more phonological and semantic

[2]For a list of available versions, see psychologia.pl/clts/.

connections to them (Brysbaert, Van Wijnendaele & De Deyne, 2000).

Third, the AoA effect on lexical skills and processing could be an attribute of 'contamination' from other factors (D'Amico et al., 2001). Subjective AoA ratings are collected by asking adults when they think they acquired a word. Thus, a caveat to the accounts presented above is that lexical strength may very well have affected the ratings: Adults may be more likely to think they acquired a word early if it is high in imageability or frequency, or if it is a basic level word (see section 2.1.2).[3] To exemplify this point, the relationship between subjective AoA and CDS frequency found in paper III could naturally be accounted for as frequency effects on lexical development (as concluded in paper II based on *CDI-based* AoA), but the reason for this association could also be that token frequency has affected the adult AoA ratings. D'Amico et al. (2001) reported a relationship between (adult) frequency and *subjective* AoA, but not between (adult) frequency and *CDI-based* AoA. They suggested that 'subjective ratings of AoA are "contaminated" by frequency to an extent that is not true for our objective CDI measure' (D'Amico et al., 2001, p. 86). Bates et al. (2001) found AoA effects when assessing Italian adults with word reading tasks as well as picture naming tasks; they demonstrated that the effects from subjective AoA on the reading tasks could be accounted for as frequency effects, while the effects on picture naming appeared to depend on frequency effects and words' semantic-conceptual properties. The reason for the success of AoA as a predictor of CLT results could hence also be connected to underlying semantic factors.

CI could not account for children's overall CLT performance, although there was a weak tendency towards a higher performance on low-CI (i.e. simple) words in Polish (but not in Norwegian). Since this measure of complexity is a compound of several measures related to phonology, morphology, exposure and etymology, we also investigated whether any of these components could predict children's CLT performance. We found limited effects from two of these four components: Within the CLT production tasks, monolinguals scored lower on morphologically complex words than on simple words, and bilinguals scored lower on low-exposure words than on high-exposure words. There was also an effect of the exposure-related CI component among verbs. The monolinguals scored lower on low-exposure verbs than on high-exposure verbs. It is worth noting that there was a significant correspondence between the target words' exposure-related CI component and their AoA. Thus, the paper concluded that the CI components either do not work or overlap with AoA. The measure may need to be revised, or it could be removed from the CLT construction procedure, as AoA by itself was a strong predictor of CLT performance among monolinguals as well as bilinguals, and appeared to ensure metric equivalence across Polish and Norwegian.

The lacking effect of CI and most of its components is unfortunate, but not very surprising;

[3] As discussed in section 5.2.1, the CDI-based AoA measure is also encompassed by this caveat: The CDI is a parental report tool, and we cannot rule out that lexical factors influence how well parents remember (or understand) the words produced by their children.

as discussed in paper III, it is not clear that all the factors included in the compound measure should affect difficulty in the direction proposed by its creators. For instance, loanwords were expected to be harder than non-loanwords, but as many loanwords may also be cognates, such as the Polish *żyrafa* and the Norwegian *sjiraff* 'giraffe', they may instead be easier for bilingual children.[4] Regarding the phonological component, one of the underlying assumptions here is that words are harder for children the longer they are, but in light of paper I, there is reason to believe this is only a partial truth, as the phonological properties of the ambient language will also have an impact. From the discussion in chapter 2, it is furthermore not given that the difficulty of picture identification and picture naming tasks are influenced by phonology in exactly the same way. When it comes to morphology, the index presumes that words will be harder the more morphemes they consist of. However, languages differ vastly in morphology, and evidence from Turkish indicates that a complex morphology may not in itself be difficult for children to acquire as long as it is transparent (Aksu-Koç & Ketrez, 2003). As a result of cross-linguistic differences in phonology as well as morphology, there is a very real possibility that what was attempted with the CI is simply an impossible task (Łuniewska, Haman & Hansen, 2016).

6.2 Comparability across groups

Building on paper III and Haman et al. (2017), which indicates that CLT yields comparable results from monolingual children across languages, the second broad research question was as follows: Can we expect cross-linguistically equivalent tools to yield comparable results in different groups of typically developing bilingual children? This question was the starting point for paper IV. Here, Polish–Norwegian children, largely the same as in paper III, were compared to Polish–English children growing up in the UK. Two measures of language development were contrasted: CLT results and the parents' judgments of their own children, assessed by a Polish pilot version (Kuś et al., 2012) of the background questionnaire PABIQ (COST Action IS0804, 2011; Tuller, 2015) (see chapter 4).

In the questionnaire, parents judged their children on nine questions, one of which concerned vocabulary size. Paper IV devised a compound score comprising all nine questions, but also isolated the parents' judgments of their children's lexicons. The background questionnaire was also used to profile the children's language backgrounds, in terms of current language use, the length of exposure to the majority language (all had heard Polish from birth) and the parents' judgments of their own majority language proficiency (all were L1 speakers of Polish). Regarding language use, three measures were used, following Tuller (2015): *home input* and *home output* and *language richness*. The two groups did not differ in the measures of current language use, nor in the

[4]This example may raise the question of why CLT, in contrast to Gathercole et al. (2008), does not exclude cognates in the task construction. However, for a tool that is created not for one specific language pair, but for any combination of languages, excluding all possible cognates would leave very few words in the test.

length of exposure to the majority language, but the parents in the UK reported to be far more proficient in English than the parents in Norway did for Norwegian.

Children in both countries scored higher on the Polish CLT than on the majority language version of the tool (UK English and Norwegian respectively); neither in Polish nor in the majority language did we detect a significant difference between the groups. The parental judgments of vocabulary skills alone align with the CLT results, as all the participants apart from two (one from each group) were judged to know at least as many Polish words as other children of the same age, whereas a majority of the children (in both groups) reportedly knew fewer words in the majority than other children of the same age. The compound measure of current language skills derived from the questionnaire responses painted a more ambiguous picture. The judgments of the majority language skills did not differ significantly between the two groups, but the judgments of skills in Polish did, such that the reports from the parents in Norway corroborated the CLT results, while the UK parents judged their children's skills in Polish as lower than expected from the CLT results.

To sum up these results in regards to the second research question of this dissertation, it appears that we may expect children from different immigrant populations to perform equally well on cross-linguistically equivalent tools, at least in the case of CLT. This is potentially good news for the tool, as it will simplify the challenging task of creating bilinguals norms for various immigrant populations. However, the contradictory results from the two tools beg the question of whether CLT is sensitive enough: One interpretation of this dissonance is that the UK children are, to a larger extent than their peers in Norway, experiencing a language shift towards the majority language (Fishman, 1991; Gal, 1979; De Houwer, 2007) that CLT fails to detect. This shift may be mediated by the global status of English, leading to a high majority language proficiency among the UK parents, and potentially also to more positive attitudes towards the majority language (Curdt-Christiansen, 2009).

If a shift is indeed taking place, there are at least two possible explanations of why CLT fails to detect it. First, CLT only assesses lexical skills, whereas the compound measure of current skills derived from the questionnaire comprises pronunciation, overall intelligibility, sentence comprehension, the parents' overall satisfaction and the child's frustration with not being understood. Thus, a language shift in other domains than the lexicon may be evident in the parental judgments, but not in CLT. However, from the usage-based framework of this dissertation, we would indeed expect a shift to be apparent also in the lexicon. This brings us to the second account: A language shift affecting all domains of language, including the lexicon, may still not be visible in CLT results. All the target words are quite imageable and acquired fairly early (see paper III), making the tool blind to differences in the knowledge of more abstract words.

To establish whether a language shift is indeed occuring among 3–5-year-olds with Polish parents growing up in the UK, more data are needed. Conclusions cannot be drawn on the basis of the 18 participants in this study alone, and only with results from a third tool can we decide

whether we should trust the parental judgments or the CLT results. To answer the question of whether CLT is sensitive enough, we furthermore need data not only from different populations of typically developing bilinguals, but also from different groups of bilinguals with a (probable) language impairment. So far, noone have used CLT to investigate bilinguals with SLI *across* their languages, but results from monolingual Slovak children with SLI (Kapalková & Slančová, 2017) and bilingual Lebanese children with SLI assessed with CLT in one of their languages (Khoury Aouad Saliby et al., 2017) are promising with regards to the sensitivity of the tool.

6.3 Final remarks

This dissertation comprised two separate studies: Study A primarily investigated CDI data, but also brought in various speech and language corpora; the main findings are described in papers I and II. Study B piloted the new assessment tools CLT (Haman et al., 2015) and PABIQ (COST Action IS0804, 2011; Tuller, 2015) on Polish–Norwegian and Polish–English bilinguals and their monolingual peers, leading to papers III and IV. The four papers offer several new contributions to the field of language acquisition. Paper I created a list of Norwegian children's first 50 words. By its cross-linguistic comparison of CDI data derived from thousands of children, the paper also confirmed cross-linguistic patterns previously only shown in studies of diary and spontaneous speech data from between one and five children per language (de Boysson-Bardies & Vihman, 1991; Vihman & Croft, 2007). The study also brought in cross-linguistically comparable samples of adult speech, and demonstrated phonological differences between child-directed speech and speech between adults.

Paper II launched VSoA, a new CDI-based measure of lexical development, and found this measure to be more evenly distributed and more sensitive to subtle lexical effects than the much used CDI-based AoA. Furthermore, the paper compared the effects on early lexical development from several word-related factors that are tightly connected, but have not previously been studied in relation to one another. The paper found frequency in CDS to be the most important predictor of lexical development, followed by imageability and word length. As expected from McDonough et al. (2011), imageability accounted for word class effects as well as variation in acquisition within a word class.

Paper III found CLT's aim of metrical equivalence across languages to be reached for the Polish and Norwegian versions of the tool, as there were no significant language differences between age-matched monolinguals. The cross-linguistic equivalence was attributed to a significant effect of AoA, one of the language-specific variables underlying the construction of CLT. No previous studies have performed detailed comparisons of different language versions of CLT, and these results are thus important for validating this new assessment tool. Paper IV indicated that combining the new LITMUS tools CLT and PABIQ is a promising methodology for a valid assessment of bilingual children, although the findings underline that creating bilingual norms is

a challenging task.

I will offer three take-home messages based on the findings in the four papers: First, lexical properties must be taken into account in any linguistic assessment that strives for comparability across languages. Second, both researchers studying frequency effects and developers of assessment tools that aim to take frequency into account should pay attention to which language data are used to retrieve information about frequency. Third, valid norms for bilingual children from immigrant families must find ways to take language experience into account. I will elaborate on these three issues in sections 6.3.1–6.3.3 below, before I end this dissertation with a discussion on limitations and directions for future research in section 6.3.4.

6.3.1 Accounting for lexical factors

In line with Langacker (1987), Bybee (2001, 2010) and Tomasello (2003), I assume rich and dynamic mental representations of language that emerge from and change with language use. Perceived similarities in form or meaning give rise to mental representations on different levels of abstraction (Bybee, 2010; Langacker, 1987). For instance, perceived similarities in meaning between a wide variety of nouns may give rise to the notion of the noun schematised as a [THING] (Langacker, 1987), and clusters of exemplars seen as instances of the same entity may give rise to an abstract notion of a lemma. Type and token frequency are both assumed to affect the strength of linguistic representations (Bybee, 2010).

Given this theoretical framework, we would expect properties of phonology, semantics and usage to have an impact on how easily words are acquired, as well as on how strong their mental representations are. Indeed, papers I, II and III documented effects on lexical development from several phonological, semantic and usage-related factors. For instance, paper I demonstrated cross-linguistic variation in the word length in syllables among children's first words, and found indications that these differences are connected to type frequency patterns in their ambient language, and papers II and IV both reported that lemmas with a high frequency in CDS were generally easier to acquire or retrieve. Paper II also found words to be acquired earlier the higher their imageability, whereas paper III found noun tasks to be easier for preschoolers than verb tasks, and words with a low subjective AoA to be easier than words with a high subjective AoA. These findings are generally in accordance with the literature on children's lexical development (see chapter 3), and all these factors have been found to also affect lexical processing among adults (e.g. Bates et al., 2001; D'Amico et al., 2001; Juhasz, 2005).

These findings support the theoretical framework, but also raise a warning for any language assessment that strives for cross-linguistic comparability: Two words from two different languages may be close to equivalent in meaning, but their phonological properties, usage patterns and salience are likely to differ between the two languages (and also between cultures of people speaking what could be defined as the same language). The 'same' lexical item in two transla-

tions of the same assessment tool may then differ in difficulty, or be acquired at different points in language development. This issue poses challenges for cross-linguistic and cross-cultural research as well as for cross-linguistic assessment of bilingual individuals, particularly apparent in, but not restricted to, lexical assessment (Peña, 2007).

A solution for studies and tools that aim for cross-linguistic and cross-cultural equivalence is to construct the linguistic experiment or assessment tool separately for each language based on a common set of underlying properties. As underlined by Lind et al. (2015), data on such properties must be collected independently for each language, as the values associated with them are subject to linguistic and cultural variation. The CLT construction follows this methodology: All language versions select their target words from a list of 300 target words found to reliably evoke a single word with the same English equivalent across the 34 languages (Haman et al., 2015). This selection procedure is based on two underlying properties established separately within each language: subjective AoA and CI. Paper III suggested revising this procedure by changing or removing the CI measure, as only AoA had a clear effect on Polish and Norwegian CLT results. The paper concluded that AoA alone appears to ensure cross-linguistic equivalence, at least in the case of Polish and Norwegian.

Another new development that is interesting in this context is the *Comprehensive Aphasia Test* (CAT) (Swinburn, Porter & Howard, 2004). This tool was originally developed for UK English based on a set of underlying linguistic factors, including phonological factors as well as imageability and frequency (Howard, Swinburn & Porter, 2010). The tool has been adapted to Danish (Frederiksen & Haaber, 2013) and Dutch (Visch-Brink, Vandenborre, de Smet & Mariën, 2014) based on the same properties, and adaptations to Basque, Finnish, Gulf Arabic, Japanese, Mandarin Chinese, Turkish and more than 10 Indo-European languages are under way (Fyndanis et al., 2017). Many of these adaptations are carried out in collaboration between members of the COST Action IS1208 *Collaboration of Aphasia Trialists*.[5]

6.3.2 The importance of the source of frequency data

As discussed above, both token and type frequency are seen as important within the current theoretical framework. Token frequency strengthens individual exemplars. To exemplify, every time we encounter the word *ball*, its representation in the lexicon is strengthened (or entrenched) (Bybee, 2010; Taylor, 2002). Type frequency, on the other hand, strengthens the representation of more abstract schemas. For instance, every time we encounter a disyllabic word, this entrenches our abstract representation of this phonological structure. Importantly, linguistic representations are assumed to be individual, based on our individual experiences with language (Bybee, 2010). Thus, studies of type or token frequency effects should ideally involve observations of each participant's individual language experiences. Several single- or multi-case studies of language

[5] See http://aphasiatrials.org/.

development have indeed followed this approach by recording and comparing various linguistic characteristics in infants' productions and their parents' CDS (Kuhl, 2000; Werker et al., 2007; Naigles & Hoff-Ginsberg, 1998).

The endeavour of estimating frequency from individual language experiences becomes difficult with older participants who divide their time between many different people and activities. Furthermore, for large-scale studies and the construction of cross-linguistically equivalent assessment tools, language experience must be approximated in a more general way, such as by means of language corpora. The two following questions are highly relevant in all these cases: What kind of frequency data can offer the best approximation of actual language experience? What is most important, similarity in genre or data size?

Papers I–III may offer some answers to these questions. Paper I compared proportions of word-initial bilabials as well as proportions of mono- di- and polysyllabic words across four different data types: CDI data, spontaneous speech from children, CDS and ADS. Significant differences were found between the two sets of child language data and the two sets of adult language data for both phonological characteristics, but importantly, the CDS resembled the child language data more than did the ADS within both phonological characterstics (with higher proportions of word-initial bilabials and monosyllabic words). These findings are not surprising, as it is well known that adults adapt their speech in different ways when addressing young children (Cruttenden, 1994; Englund & Behne, 2006; Snow, 1972). Moreover, they imply that corpora of CDS may yield more suitable approximations of type frequency in children's actual language experience than corpora of speech between adults.

When it comes to type frequency effects, psycholinguistic research has often relied on established lemma frequency norms, such as Kučera–Francis (Francis & Kučera, 1967) and Thorndike–Lorge (Thorndike & Lorge, 1944) for English, both quite old norms based exclusively on (even older) written texts (see Brysbaert & New, 2009). Goodman et al. (2008) investigated correlations between lemma frequency and CDI-based AoA, comparing these two established norms with a new CDS frequency list calculated from 28 different CHILDES corpora (MacWhinney, 2000). They found the two written language frequency lists to correlate with AoA within common nouns, but not within any other word classes. In contrast, the new CDS frequency list correlated with AoA within all word classes.

Paper II and III investigated the potential effects on lexical development as measured by CDI norms as well as CLT results, following up on the study of Goodman et al. (2008). In paper II, CDI-based AoA as well as the novel measure VSoA,[6] were used to compare two frequency lists: CDS frequency data generated from only two Norwegian corpora (see section 4.3) and adult frequency data collected from NoWaC (Guevara, 2010), a corpus based on the .no internet domain. NoWaC was created at the same time as the Norwegian CDI norms were collected, and the content is more similar to oral language than the norms investigated by Goodman et al.

[6] See section 4.3.

(2008). Even so, the CDS frequency list was a far better predictor of lexical development than NoWaC; similarly to Goodman et al. (2008), I found significant correlations within all word classes for the CDS frequency list, but not for the NoWaC frequency list.

These results support the hypothesis that CDS-based frequency norms are closer to children's actual input than written language frequency norms, also when the CDS data are limited and the written language norms are contemporary and resemble oral language. Paper III investigated whether a Polish CDS frequency list combined with the Norwegian CDS frequency list developed in paper II could account for the CLT performance of mono- and bilingual preschoolers, finding significant effects on the children's production tasks; the lack of frequency effects within comprehension tasks may be attributed to ceiling effects.

To sum up, the results in this dissertation underline that the source of frequency data is important when investigating relationships between lexical development and type and token frequency. The findings indicate that CDS data, also when available only in relatively small amounts, can offer a better approximation of type and token frequencies than large corpora based on written language or speech between adults.

6.3.3 Accounting for language background in bilingual testing

As discussed in chapter 2, this dissertation follows Grosjean (1997, 2008, 2013), in defining bilingualism in terms of *usage*, not by the level of proficiency,and assumes a close connection between the amount of exposure to a language and the pace of the acquisition of that language (De Houwer, 1995; Pavlenko, 2009; Vihman, 2014). As presented in chapter 1, a direct within-language relationship has indeed been found between the amount of input and lexical development among young children acquiring Spanish and English simultaneously (Pearson et al., 1997). However, the picture is more complex: Qualitative differences in how parents use their languages in interaction with their children will impact children's own use of the same languages (Lanza, 2004), and although sufficient exposure is essential for acquiring a language, it is no guarantee of intergenerational language transmission (Fishman, 1991; De Houwer, 2007).

The bilingual children investigated in papers III and IV represent new groups of bilingual speakers; they are bilingual because their parents migrated from the former Eastern Bloc to Western Europe in the wake of the 2004 EU enlargement. Ongoing research projects may improve the state of affairs,[7] but to date, little is known about these children's language development; retaining Polish at the expense of the (current) majority language, maintaining both languages and shifting towards the majority language are all possible outcomes.

This uncertainty has some important implications for language assessment for clinical (and other) purposes. One is that in order to set a benchmark for what may be considered to be within the normal range of variation among typically developing children in migrant populations, we

[7] See e.g. http://psychologia.pl/clts/#projects.

may need more comparative studies of different minority populations with and without (probable) language impairment assessed with the same set of tools. Another is that it is important to combine direct assessment tools such as CLT with detailed background questionnaires; it may be an advantage if these tap into language attitudes more explicitly than PABIQ does.

CLT is not yet normed for any population. To create valid bilingual norms, we may need to find ways to take children's language experience into account. For Welsh–English bilinguals in Wales, Gathercole et al. (2008) argued for three sets of norms, depending on whether the Welsh, English or both languages were used in the home. This may be a good starting point for norming CLT, but at the same time, the findings of paper IV indicate that this may not be enough for the new migrant populations represented here by children of Polish immigrants to Norway and the UK: As their language dominance may shift, and appears to not rest on family language use alone, identifying a child's dominant language at a given point in time is not a straightforward task. Coming to the aid of this task is the finding that the construction procedure behind CLT does appear to have succeeded in accounting for item difficulty (Haman et al., 2017; Hansen et al., 2017; Altman et al., 2017), and by that hopefully ensuring cross-linguistic equivalence.

6.3.4 Limitations and future directions

Each of the four papers in this dissertation discuss their own limitations, and outline possible directions for future research. Here, I will present three general restrictions in the research presented in this dissertation, and sketch out how future research may address each of these. The three restrictions I address are the following:

1. The need to study language development across languages
2. The necessity of assessing atypical groups to judge a tool's clinical applicability
3. The call for investigating the relationship between lexicon and grammar

The conclusions of any study are limited by the data investigated, and the first limitation I will discuss here relates to the languages covered in this dissertation. To exemplify, paper I compared children's first words according to Danish, American English, Italian and Swedish CDI norms with adult language samples, and found a high proportion of initial bilabials across all five languages. Paper I argued that this pattern may be more universal, given that de Boysson-Bardies and Vihman (1991) reported a high proportion also among Japanese children. However, to conclude on whether or not an affinity towards initial bilabials is indeed a universal trait of children's first words, data from more languages must be included. Along the same lines, paper II adds to the literature as it investigates the effects on Norwegian children's early lexical development from linguistic factors that have so far received little attention beyond a handful of

languages.[8] However, as the analyses are based on Norwegian CDI data alone, the paper cannot judge how universal the findings are. Likewise, paper III concludes that CLT appears to yield comparable results across languages, at least for Polish and Norwegian. This indicates that the aim of metric equivalence has indeed been met. However, results from more languages must be investigated before a more general conclusion can be reached.

The first two papers were both primarily based on CDI data. As noted in section 5.1.1, the CDI norms for the five languages investigated in paper I have since been published on WordBank (Frank et al., 2017), along with WG norms for six other languages, including the Semitic language Hebrew and the Turkic language Turkish. This database gives increased opportunities for cross-linguistic comparisons, particularly because the full data set is available through an R package (Braginsky, 2015). To add to the findings in papers I and II, cross-linguistic data from children are not enough; paper I compared phonological patterns in children's first words and adult speech, and paper II assessed effects of various linguistic factors on lexical development. The findings in these two papers indicated that frequency information from CDS may provide a better approximation of children's actual language experiences than adult speech or written language samples. These findings points towards CHILDES (MacWhinney, 2000) as an important source of data for cross-linguistic comparisons, not only for child language but for child directed speech as well. This database comprises corpora of child language and CDS from a large range of languages, making it very useful for cross-linguistic research. However, note that not all languages are equally well represented – Norwegian is for instance currently represented by three corpora only: Garmann (Garmann, 2016; Garmann et al., in press), Ringstad (Ringstad, 2016; Larsen, 2014) and Simonsen (1990, 2009).

Data on linguistic factors such as those available in the database *Norwegian Words* have been unavailable for many languages up until now, but data on subjective AoA have been gathered for more than 25 languages in connection with the construction of CLT (Łuniewska, Haman, Armon-Lotem et al., 2016), and imageability and frequency data are currently gathered for a large set of languages, as steps towards the adaptation of CAT to new languages (see section 6.3.1). These new developments pave the way for cross-linguistic investigations of linguistic effects on lexical acquisition and processing.

When it comes to the limitation of paper III, namely that results from more languages are needed for a more general conclusion about whether CLT is crosslinguistically equivalent, this issue has been targeted by a large cross-lingustic study (Haman et al., 2017). This paper compared monolingual CLT results from 17 different languages. Monolingual isiXhosa-speaking children scored remarkably low compared to the children acquiring any of the other languages, possibly due to group differences in SES (see e.g. Bornstein & Hendricks, 2012). Within the remaining 16 languages there were only small language differences; further investigations of

[8] There is one exception: The word class distribution in children's early words has been investigated within a large amount of languages (see section 3.2.1).

age- and SES-matched participants are needed to conclude on whether CLT results are directly comparable across languages.

The second limitation I will bring up here concerns the selection of participants for papers III and IV. CLT, PABIQ and the other LITMUS tools (Armon-Lotem et al., 2015) were created to improve the assessment of bilingual children in order to identify language impairment in this population. Data from typically developing children are clearly needed to investigate how well these tools work and to establish norms. However, to be useful in clinical settings, the tools must be sensitive enough to identify children with impairment, yet specific enough to avoid overdiagnosis. To assess whether CLT, PABIQ and the other LITMUS tools meet this requirement, data from children with language impairment must also be investigated. Several recent studies emerging from the COST Action IS0804 have taken up this challenge for various LITMUS tools (Altman, Armon-Lotem, Fichman & Walters, 2016; Kapalková & Slančová, 2017; Khoury Aouad Saliby et al., 2017; Meir, Walters & Armon-Lotem, 2015; Tsimpli, Peristeri & Andreou, 2016; Tuller et al., 2013). An ongoing collaboration between the Center for bilingualism in Society across the Lifespan (MultiLing) and Statped – the Norwegian national service for special needs education – aims to investigate the specificity and sensitivity of CLT by comparing results from monolingual and bilingual children with and without language impairment; however, more data are needed before analyses can be carried out.

The final limitation I will mention here concerns the overall subject of this dissertation. Usage-based theories place the lexicon at the very core of language, assuming that our mental representations of language emerge from rich lexical representations (Bybee, 2010). However, there is more to language than words. On the basis of the current theoretical framework the connections between the different lexical units – words as well as word chunks, phrases and utterances – and the grammatical patterns emerging from them deserve a closer investigation. A large body of research has pointed towards interesting correspondences between the vocabulary and other domains of language (Bates & Goodman, 1997; Kohnert et al., 2010; Melby-Lervåg & Lervåg, 2011; Metsala, 1999; Stoel-Gammon, 2011; Thordardottir et al., 2002). I will point to three interesting future directions related to the topics and methodologies of this dissertation.

First, for children aged between 1;4 and 3;0, the Norwegian CDI norms analysed here contain information not only about children's lexical development, but also about the grammatical complexity in their utterances. Following Bates and Goodman (1997), we would expect close connections between vocabulary size and grammatical complexity, but this relationship has so far not been investigated for Norwegian. Second, future studies of bilingual language development may profit from combining PABIQ and different language versions of CLT with other LITMUS tools or other existing tools such as the Norwegian Past Tense Test (Ragnarsdóttir, Simonsen & Plunkett, 1999). Third, an interesting new development is the CDI III, an upward extension of the CDI.[9] Like the CDI WG (CDI I) and WS (CDI II) forms, this extension is a parental report tool,

[9] See http://mb-cdi.stanford.edu/forms.html.

and just like the WS form, CDI III covers both lexical and grammatical development. A Norwegian adaptation based on the Swedish CDI III (Eriksson, 2016) has been created and piloted on three- and four-year-olds (Garmann et al., 2016). Parallel versions are under development or testing within multiple other languages (Dale & Penfold, 2011; Garcia, Barreña, Ezeizabarrena, N & Barnes, 2014), and the CDI III could thus be a useful tool for assessment of monolingual as well as bilingual preschoolers.

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Part II

Papers

Part III

Appendices

Appendix A: Pilot versions of PABIQ

On the next pages, two questionnaires are reprinted: First, the questionnaire used to assess bilingual participants in study B, Kwestionariusz Rozwoju Językowego (KRJ) [Questionnaire on Language Development] (COST Action IS0804, 2011; Tuller, 2015), and second, the English questionnaire that this was based on, namely a version of the Beirut-Tours Questionnaire from October 2010. These questionnaires were created by COST Action IS0804 members, in part based on Johanne Paradis' ALEQ (Paradis et al., 2010) and ALDeQ (Paradis, 2011) questionnaires. The final English version of the questionnaire, the PaBiQ, can be found in Tuller (2015).

Kwestionariusz rozwoju językowego*

Imię i nazwisko dziecka: _____

1. Ogólne informacje o dziecku

1.1. Data urodzenia: _____

1.2. Płeć dziecka (*proszę zakreślić*): chłopiec / dziewczynka

1.3. Miejsce urodzenia (kraj i miejscowość): _____

1.4. Jeżeli dziecko urodziło się w innym kraju niż ten, w którym obecnie mieszka, proszę podać datę przyjazdu do kraju aktualnego pobytu (miesiąc i rok): _____

1.5. Aktualne miejsce pobytu (kraj, region, miasto) _____

1.6. Kolejność narodzin. Którym z kolei dzieckiem jest dziecko, którego dotyczy kwestionariusz (*proszę zakreślić*):

pierwsze (najstarsze) dziecko / drugie dziecko / trzecie dziecko / czwarte dziecko / piąte dziecko / szóste dziecko

1.7. Rodzeństwo (*jeśli jest*):

imię	data urodzenia	płeć (brat/siostra)

2. Historia rozwoju dziecka (informacje poniżej proszę podawać w miesiącach)

2.1. W jakim mniej więcej **wieku** dziecko zaczęło chodzić? _____

2.2. W jakim mniej więcej **wieku** dziecko wypowiedziało pierwsze słowo? _____

2.3. W jakim mniej więcej **wieku** dziecko zaczęło składać słowa w pierwsze krótkie wypowiedzi? _____
przykład: *jeszcze mleko, daj wodę, Tomek spać*

2.4. Czy rozwój językowy Pani dziecka kiedykolwiek Panią/Pana niepokoił? TAK/NIE

2.4.1. Jeśli tak, proszę wyjaśnić, dlaczego: _____
_____
_____
_____
_____

* Polska adaptacja przygotowanego na potrzeby COST ACTION IS0804 kwestionariusza opartego na ankietach ALEQ i ALDeQ autorstwa J. Paradis' (2007). Kontakt z autorami wersji francuskiej i angielskiej: Laurie Tuller (tuller@univ-tours.fr); Camille Messarra (camille.messarra@usj.edu.lb), kontakt z autorami wersji polskiej: Katarzyna Kuś, bislipl@psych.uw.edu.pl.

2.5. Czy Państwa dziecko kiedykolwiek
- utraciło słuch TAK / NIE
- miało częste infekcje ucha TAK / NIE
- miało wstawione dreny do uchu TAK / NIE
- miało jakikolwiek inny problem ze słuchem (*proszę podać jaki*): _____
_____
_____

2.6. Jakiego języka używa Pani/Pana dziecko? (*proszę zaznaczyć wszystkie języki, którymi dziecko się posługuje*)

Polskiego	angielskiego	norweskiego	innego (*proszę podać*)

2.7. W jakim **języku** dziecko wypowiedziało pierwsze słowo? _____

2.8. W jakim **języku** dziecko zaczęło najpierw składać słowa w pierwsze krótkie wypowiedzi? _____

2.9. Którym językiem według Pani/Pana dziecko posługuje się najlepiej? _____

2.10. Czy przed ukończeniem czterech lat Pani/Pana dziecko miało kontakt z:

	0 nie	**1 rzadko**	**2 Czasami**	**3 często**	**4 wyłącznie**
językiem polskim					
językiem angielskim					
językiem norweskim					
innym (*proszę podać jakim*)					

2.11. W jakim wieku Pani/Pana dziecko miało pierwszy kontakt z danym językiem (*wypisz w tabeli*)?

	Wiek w miesiącach
Polski	
Angielski	
Norweski	
inny (*proszę podać jaki*)	

2.12. W jakich sytuacjach dziecko ma kontakt z każdym z języków (*proszę zaznaczyć wszystkie właściwe odpowiedzi*)?

	polski	**angielski**	**norweski**	**język** ..... (proszę wpisać)
a. rozmowa z matką				
b. rozmowa z ojcem				
c. rozmowa z dziadkami				
d. rozmowa z opiekunką				
e. rozmowa z innymi dorosłymi (proszę podać z kim)				
f. rozmowa z rodzeństwem				
g. żłobek/klubik/przedszkole				
h. czytanie (książki, czasopisma, komiksy, gazety)				
i. komputer				
j. telewizja/filmy/kino				
k. rymowanki/piosenki				

2.13. Czy dziecko gra w gry komputerowe, gry wideo lub używa konsoli do gier? TAK / NIE

2.13.1. Jeśli tak, średnio ile godzin tygodniowo spędza na graniu? _____

2.14. Ile czasu rocznie dziecko spędza w Polsce? _____

2.15. Czy dziecko jest bardziej prawo-, czy bardziej leworęczne (*proszę zakreślić*)? praworęczne / leworęczne / oburęczne

2.16. Czy dziecko ma stwierdzoną wadę wzroku? TAK / NIE

2.16.1. Jeśli tak, to czy nosi okulary lub szkła korekcyjne? TAK / NIE

3. Obecne umiejętności

	polski	**angielski**	**norweski**	**język** ..... (proszę wpisać)
Jak Pani/Pana zdaniem dziecko mówi w każdym ze znanych sobie języków w porównaniu z innymi dziećmi w tym samym wieku? *0 = zdecydowanie gorzej* *1 = trochę gorzej* *2 = bardzo podobnie* *3 = lepiej niż inne dzieci*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3

	polski	**angielski**	**norweski**	**język** ..... (proszę wpisać)
Czy myśli Pani/Pan, że dziecko mówi tak jak rówieśnicy, którzy znają tylko język...? *0 = zdecydowanie gorzej* *1 = trochę gorzej* *2 = bardzo podobnie* *3 = lepiej niż inne dzieci*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Jak Pani/Pana zdaniem dziecko wymawia słowa w danym języku w porównaniu z innym dziećmi w tym samym wieku? *0 = zdecydowanie gorzej* *1 = trochę gorzej* *2 = bardzo podobnie* *3 = lepiej niż inne dzieci*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Ile Pani/Pana dziecko zna słów w danym języku w porównaniu z innymi dziećmi w tym samym wieku? *0 = zdecydowanie mniej* *1 =trochę mniej* *2= tyle samo* *3= więcej niż inne dzieci*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Czy Pani/Pana rodzinie i przyjaciołom łatwo prowadzić rozmowę z dzieckiem w danym języku? Czy zawsze? *0 = bardzo trudno;* *1 = czasem są z tym problemy* *2 = zazwyczaj łatwo/łatwo* *3 =bardzo łatwo/nie ma problemów*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Czy w porównaniu z innymi dziećmi w tym samym wieku Pani/Pana dziecko radzi sobie z tworzeniem poprawnych zdań? *0 = zdecydowanie gorzej* *1 = trochę gorzej* *2 = bardzo podobnie* *3 = lepiej niż inne dzieci*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Czy jest Pani/Pan zawsze zadowolona/zadowolony z tego, jak dziecko rozumie zdania, które wypowiadają do niego inne osoby w danym języku? *0 = zupełnie niezadowolona/niezadowolona* *1 = nie całkiem zadowolona/zadowolony* *2 = raczej zadowolona/zadowolony* *3 = całkowicie zadowolona/zadowolony*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Czy jest Pani/Pan zadowolona/zadowolony z umiejętności mówienia dziecka w danym języku? *0 = zupełnie niezadowolona/zadowolony* *1 = nie całkiem zadowolona/zadowolony* *2 = raczej zadowolona/zadowolony* *3 = całkowicie zadowolona/zadowolony*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Czy dziecko denerwuje się, że nie umie się porozumieć w danym języku? *0 = bardzo /prawie zawsze* *1 = często* *2 = czasami* *3 = prawie nigdy*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3

Jeżeli w powyższej tabeli pojawiają się punkty 0 lub 1:
W jakim wieku zaczęły pojawiać się trudności językowe (*proszę podać wiek w miesiącach*)?_____

Czy myśli Pani/Pan, że dziecko zapomina język polski dlatego, że uczy się języka obcego? TAK / NIE

4. Języki używane w domu (*proszę zaznaczyć*)

4.1. Z rodzicami

matka do dziecka						**dziecko do matki**				
	0 nigdy	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**	**0 nigdy**	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**
polski										
angielski										
norweski										
ojciec do dziecka						**dziecko do ojca**				
	0 nigdy	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**	**0 nigdy**	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**
polski										
angielski										
norweski										

4.2. Czy inny dorosły regularnie opiekuje się dzieckiem (np. babcia, opiekunka, wychowawczyni)? TAK / NIE

babcia/dziadek do dziecka						**dziecko do babci/dziadka**				
	0 nigdy	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**	**0 nigdy**	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**
polski										
angielski										
norweski										

opiekunka do dziecka						**dziecko do opiekunki**				
	0 nigdy	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**	**0 nigdy**	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**
polski										
angielski										
norweski										

4.3. Proszę wypełnić osobną tabelkę dla każdego dziecka w rodzinie (p*roszę użyć dodatkowych tabel w Załączniku, jeśli zajdzie taka potrzeba*).

brat/ siostra 1 do dziecka (proszę wpisać imię brata/ siostry 1).....						**dziecko do brata/siostry 1**				
	0 nigdy	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**	**0 nigdy**	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**
polski										
angielski										
norweski										
Inny										
brat/siostra 2 do dziecka (proszę wpisać imię brata/ siostry 2).....						**dziecko do brata/siostry 2**				
	0 nigdy	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**	**0 nigdy**	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**
polski										
angielski										
norweski										
brat/siostra 3 do dziecka (proszę wpisać imię brata/ siostry 3).....						**dziecko do brata/siostry 3**				
	0 nigdy	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**	**0 nigdy**	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**
polski										
angielski										
norweski										

4.4. W jakim języku / językach rozmawia Pani/Pan ze współmałżonkiem/partnerem?

matka do ojca						**ojciec do matki**				
	0 nigdy	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**	**0 nigdy**	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**
polski										
angielski										
norweski										
inny										

4.5. Jak często i w jakim języku dziecko jest zaangażowane w następujące aktywności?

0 - nigdy lub prawie nigdy
1 - przynajmniej raz w tygodniu
2 – codziennie lub prawie codziennie

	polski			**angielski**			**norweski**			**język ……** (proszę wpisać)		
Aktywności	0	1	2	0	1	2	0	1	2	0	1	2
czytanie (książki, czasopisma, komiksy, gazety)												
granie na komputerze												
oglądanie telewizji/ filmów / chodzenie do kina												
opowiadanie bajek i historyjek												
recytowanie rymowanek, śpiewanie piosenek dziecięcych												

4.6. Czy Pani/Pan ogląda lub oglądał(a) w przeszłości z dzieckiem książeczki z obrazkami i rozmawia z nim o tym, co dzieje się na obrazkach? (*proszę zakreślić a), b) lub c)*)
a) Tak, nadal oglądamy
b) Tak, kiedyś oglądaliśmy, ale teraz już nie
c) Nie, nigdy nie oglądaliśmy

5. Języki używane poza domem

5.1. Do jakiej szkoły obecnie uczęszcza dziecko? _____
(*proszę podać typ szkoły, np. przedszkole, nursery, pre-school, play-group, primary, żłobek, przedszkole*)

Kiedy Państwa dziecko zaczęło chodzić do przedszkola w Norwegii? _____

5.2. Ile czasu w ciągu tygodnia trwają w szkole zajęcia w każdym języków? (*proszę podać, ile godzin lekcyjnych*)

polski	**angielski**	**norweski**	**język ……** (proszę wpisać)

5.3. Czy dziecko uczęszcza na zajęcia pozalekcyjne (proszę uwzględnić zajęcia sobotnio-niedzielne)? TAK / NIE

Jeśli tak, w jakim języku są prowadzone?

	0 prawie nigdy/nigdy	**1 przynajmniej raz w tygodniu**	**2 codziennie**
polski			
angielski			
norweski			
język …… (proszę wpisać)			

5.4. W jakim języku dziecko rozmawia z kolegami/koleżankami, z którymi bawi się regularnie?

dziecko – koledzy/koleżanki					
	0 nigdy	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**
polski					
angielski					
norweski					
język …… (proszę wpisać)					

5.5. W jakim języku dziecko rozmawia z odwiedzającymi Państwa regularnie gośćmi?

	0 nigdy	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**
polskim					
angielskim					
norweskim					
język …… (proszę wpisać)					

5.6. Czy mają Państwo znajomych lub krewnych z Polski lub z innych krajów, którzy Państwa odwiedzają? TAK / NIE

Jeśli TAK, odwiedzający mówią w języku:

	0 nigdy	**1 rzadko**	**2 czasami**	**3 często**	**4 zawsze**
polskim					
angielskim					
norweskim					
język …… (proszę wpisać)					

5.7. Jak często podróżują Państwo wraz z dzieckiem do krajów, w którym głównym językiem jest:

	0 nigdy	1 rzadko	2 czasami	3 często	4 zawsze
Polski					
Angielski					
Norweski					
język …… (proszę wpisać)					

6. Informacje o rodzicach

6.1. Informacje o matce

6.1.1. W jakim kraju urodziła się matka dziecka?

- kraj _____
- województwo/region _____
- miejscowość _____

6.1.2. Czy obecnie matka dziecka pracuje zawodowo? TAK / NIE

Jeśli tak, wykonywany zawód matki: _____

6.1.3. Wykształcenie

	liczba lat kształcenia	dodatkowe informacje
podstawowe		
średnie		
wyższe		
inne zawodowe		

6.1.4. Jak dobrze matka mówi w tych językach?

	0 Zna tylko parę zwrotów	1 Porozumiewa się, ale z trudem	2 Jest w stanie się porozumieć	3 Dobrze	4 Bardzo dobrze
polski					
angielski					
norweski					
język …… proszę wpisać					

6.2. Informacje o ojcu

6.2.1. Gdzie urodził się ojciec dziecka?

- kraj _____
- województwo/region _____
- miejscowość _____

6.2.2. Czy ojciec dziecka obecnie pracuje zawodowo? TAK / NIE.

Jeśli tak, wykonywany zawód ojca: _____

6.2.3. Wykształcenie:

		liczba lat kształcenia	dodatkowe informacje
podstawowe	TAK / NIE		
średnie	TAK / NIE		
wyższe	TAK / NIE		
inne zawodowe	TAK / NIE		
W sumie (liczba lat edukacji)			

6.1.4. Jak dobrze ojciec mówi w tych językach?

	0 Zna tylko parę zwrotów	1 Porozumiewa się, ale z trudem	2 Jest w stanie się porozumieć	3 Dobrze	4 Bardzo dobrze
polski					
angielski					
norweski					
Inny 2					

7. Trudności szkolne w rodzinie

Proszę zaznaczyć TAK *lub* NIE *w każdej kratce*

	brat/siostra 1	brat/siostra 2	brat/siostra 3	matka	ojciec	rodzina ojca	rodzina matki
Trudności w szkole							
Trudności głównie z czytaniem i ortografią							
Powtarzanie jednej lub więcej klas							
Trudności w zrozumieniu, co mówią inni							
Trudności w z mówieniu (wymowa, formułowanie zdań, znajdowanie właściwych słów itp.)							

DALSZY KONTAKT
Czy w ciągu najbliższego roku Państwa dziecko mogłoby być badane w Polsce? TAK/ NIE

Jeśli tak, to czy mogą Państwo podać orientacyjnie, kiedy będą w Polsce i gdzie (proszę podać najbliższe większe miasto)?

_____

Załącznik

Języki używane w kontakcie z dzieckiem
Proszę wypełnić dodatkowe tabele dla każdego dorosłego, który ma regularny kontakt z dzieckiem. Proszę podać kim ona/on jest dla dziecka. (np. dziadek/ babcia etc.)
DOROSŁY 1 = _____ (*proszę podać, kim jest dla dziecka*)
DOROSŁY 2 = _____ (*proszę podać, kim jest dla dziecka*)
DOROSŁY 3 = _____ (*proszę podać, kim jest dla dziecka*)

dorosły 1 do dziecka						dziecko do dorosłego 1				
	0 nigdy	1 rzadko	2 czasami	3 często	4 zawsze	0 nigdy	1 rzadko	2 czasami	3 często	4 zawsze
polski										
angielski										
norweski										

dorosły 2 do dziecka						dziecko do dorosłego 2				
	0 nigdy	1 rzadko	2 czasami	3 często	4 zawsze	0 nigdy	1 rzadko	2 czasami	3 często	4 zawsze
polski										
angielski										
norweski										

dorosły 3 do dziecka						dziecko do dorosłego 3				
	0 nigdy	1 rzadko	2 czasami	3 często	4 zawsze	0 nigdy	1 rzadko	2 czasami	3 często	4 zawsze
polski										
angielski										
norweski										

Języki używane w domu: rodzeństwo
Proszę wypełnić tabele dla innych członków rodziny.

brat/siostra 4 do dziecka (proszę wpisać imię brata/ siostry 4).....						dziecko do brata/siostry 4				
	0 nigdy	1 rzadko	2 czasami	3 często	4 zawsze	0 nigdy	1 rzadko	2 czasami	3 często	4 zawsze
polski										
angielski										
norweski										

brat/siostra 5 do dziecka (proszę wpisać imię brata/ siostry 5).....						dziecko do brat/siostry 5				
	0 nigdy	1 rzadko	2 czasami	3 często	4 zawsze	0 nigdy	1 rzadko	2 czasami	3 często	4 zawsze
polski										
angielski										
norweski										
brat/siostra 6 do dziecka (proszę wpisać imię brata/ siostry 6).....						**dziecko do brat/siostry 6**				
	0 nigdy	1 rzadko	2 czasami	3 często	4 zawsze	0 nigdy	1 rzadko	2 czasami	3 często	4 zawsze
polski										
angielski										
norweski										

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Beirut-Tours Questionnaire

(October 2010)[1]

1. General Information about the Child

1.1 Birth Date: _____

1.2 Place of birth: _____

1.3 If place of birth is not country of residence, date of arrival in country of residence: _____

1.4 Birth order: 1 2 3 4 5 6

1.5 Siblings :

Birth order	First name (brothers/sisters)	Birth date	Sex

2. Child's early history: Language, etc.

2.1 How old was your child when he/she first walked? _____

2.2 How old was your child when he/she spoke his/her first word? _____

2.3 How old was your child when he/she first put words together to make short sentences? _____

Example: *more water* ; *more milk* ; etc.

2.4 Before your child was three or four years old, were you ever concerned about his/her language?

_____

2.5 Has your child ever had any hearing problems?

- Hearing loss: YES or NO
- Frequent ear infections: YES or NO
- Grommets: YES or NO
- Other (specify): _____

2.6 What languages does your child speak now?

Arabic	French	English	Other (specify)

[1] Adaptation of J. Paradis' (2007) ALEQ and ALDeQ questionnaires. Contacts: Laurie Tuller (tuller@univ-tours.fr); Camille Messarra (camille.messarra@usj.edu.lb)

2.7 Which language do you think your child feels the most at home in? _____

2.8 Before your child was four years old, was he/she exposed to:

	0 Never	1 Rarely	2 Sometimes	3 Usually	4 Always
Arabic					
French					
English					
Other (specify)					

	Score/4
Arabic	
French	
English	
Other	

2.9 At what age did this exposure begin?

	Age
Arabic	
French	
English	
Other (specify)	

2.10 In what contexts did this exposure take place? (Check all appropriate cells.)

	Arabic	French	English	Other
a. Exchanges with mother				
b. Exchanges with father				
c. Exchanges with grand parents				
d. Exchanges with babysitter / child minder				
e. Exchanges with other adults (specify)				
f. Exchanges with siblings				
g. Nursery school/day care center / kindergarten				
h. Reading (books, magazines, comic books, newspapers)				
i. Computer				
j. Television/ movies / cinema				
k. Nursery rhymes/songs				
***Total** (1 point per cell)*				
Total by language	*/11*	*/11*	*/11*	*/11*

3. Current Skills

	Arabic	French	English	Other
Compared to other children the same age, how do you think your child expresses him/herself in …? *0 = not very well/not as well as them; 1 = a little less well/a few differences; 2 = (generally) the same; 3 = very well, better*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Do you think that your child speaks like a child the same age who only speaks …..? *0 = not very well/not as well as them; 1 = a little less well/a few differences; 2 = (generally) the same; 3 = very well, better*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Compared to other children the same age, how do you think your child pronounces words in …? *0 = not very well/not as well as them; 1 = a little less well/a few differences; 2 = (generally) the same; 3 = very well, better*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Compared to other children the same age, do you think your child knows as many words in ….? *0 = not as many as them; 1 = not quite as many; 2= as many as them; 3= more than them*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Is it easy for your family and friends to have a conversation with your child in…? Always? *0 = very difficult; 1 = some difficulties/sometimes not easy; 2 = easy enough/generally easy; 3 = very easy/no difficulties*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Compared to other children the same age, do you think your child has difficulties making correct sentences? *0 = not very well/not as well as them; 1 = a little less well/a few differences; 2 = (generally) the same; 3 = very well, better*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Are you satisfied with your child's ability to understanding in …? Always? *0 = not at all satisfied; 1 = not very satisfied; 2 = pretty satisfied/generally satisfied; 3 = very/totally satisfied*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Are you satisfied with your child's ability to express him/herself in …? Always? *0 = not at all satisfied; 1 = not very satisfied; 2 = pretty satisfied/generally satisfied; 3 = very/totally satisfied*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Does your child feel frustrated when he/she can't communicate in …? *0 = very frustrated/almost always frustrated/very often frustrated ; 1 = often frustrated/yes ; 2 = sometimes frustrated, but not often; 3 = (almost) never frustrated/no*	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Total by language	*/24*	*/24*	*/24*	*/24*

If there are any 0 or 1 in the above table, ask the following questions:

Is this due to difficulties your child has had since he was very young? YES or No

Do you think that your child is losing/forgetting language X as he/she is learning language Y? YES or No

4. Languages used at home

4.1 With parents

Mother → Child						**Child → Mother**				
	0 Never	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**	**0 Never**	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**
Arabic										
French										
English										
Other										

Father → Child						**Child → Father**				
	0 Never	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**	**0 Never**	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**
Arabic										
French										
English										
Other										

4.2 Is there another adult who regularly takes care of your child? (Grandparents, babysitter, etc.) YES or No

Grandparent/Babysitter → Child						**Child → Grandparent/Babysitter**				
	0 Never	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**	**0 Never**	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**
Arabic										
French										
English										
Other										

Babysitter → Child						Child → Babysitter				
	0 Never	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**	**0 Never**	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**
Arabic										
French										
English										
Other										

4.3 For each child in the family, complete a separate table (use tables in appendix if necessary)

Sibling 1 → Child						Child → Sibling 1				
	0 Never	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**	**0 Never**	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**
Arabic										
French										
English										
Other										
Sibling 2 → Child						**Child → Sibling 2**				
	0 Never	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**	**0 Never**	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**
Arabic										
French										
English										
Other										
Sibling 3 → Enfant						**Child → Sibling 3**				
	0 Never	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**	**0 Never**	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**
Arabic										
French										
English										
Other										

4.4 What language(s) do you speak with your spouse in?

Mother → Father						Father → Mother				
	0 Never	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**	**0 Never**	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**
Arabic										
French										
English										
Other										

4.5 What language activities does your child do <u>each week</u> and in what language(s)?

	Arabic			**French**			**English/Other**		
Activities	0 Never or almost never	1 At least once a week	2 Every day	0 Never or almost never	1 At least once a week	2 Every day	0 Never or almost never	1 At least once a week	2 Every day
a. Reading (books, magazines, comic books, newspapers)									
b. Computer									
c. Television/ movies / cinema									
d. Storytelling									
e. Nursery rhymes/songs									
Total									
Total by language	*/10*			*/10*			*/10*		

Calculation of the language use score for each language used in the home (Questions 4a to 4d): add the scores and then divide the total by the number of scores multiplied by 4. Do not forget to take into account any further situations mentioned in the appendix.

Example for use of Arabic at home:

Situation	Score	Situation	Score
Mother → Child (question 4.1)	1	Child → Mother (question 4.1)	3
Father → Child (question 4.1)	3	Child → Father (question 4.1)	3
Adult → Child (question 4.2)	--	Child → Adult (question 4.2)	--
Sibling 1 → Child (question 4.3)	3	Child → Sibling 1 (question 4.3)	3
Sibling 2 → Child (question 4.3)	2	Child → Sibling 2 (question 4.3)	2
Sibling 3 → Child (question 4.3)	--	Child → Sibling 3 (question 4.3)	--
Sibling 4 → Child (question 4.3)	--	Child → Sibling 4 (question 4.3)	--
Mother → Father (question 4.4)	1	Father → Mother (question 4.4)	1
Total of use : Sum of scores / (Number of scores x 4)	*10 / 5X4*		*12 / 5x4*
Grand total of use	*10 + 12 / 20 + 20*	*= 22 / 40*	*= 0,55*

5. Languages spoken outside the home

5.1 What school does your child currently attend?

_____

5.2 In this school, how many hours of schooling does your child have in Arabic, French, English, or any other language every week?

Arabic	French	English	Other

5.3 Does your child attend any organized extra-curricular activities? YES or NO

If yes, what language do they take place in?

	0 Almost never/ never	1 At least once a week	2 Every day
Arabic			
French			
English			
Other language (specify) _____			

5.4 What language is spoken between your child and the friends he/she plays with regularly?

Child – Friends	0 Never	1 Rarely	2 Sometimes	3 Usually	4 Always
Arabic					
French					
English					
Other (specify) _____					

5.5 What language is used by family friends who visit you regularly?

	0 Never	1 Rarely	2 Sometimes	3 Usually	4 Always
Arabic					
French					
English					
Other (specify) _____					

5.6 Do you have any friends or family members living abroad who come and visit you?

YES or NO

If YES, those who come regularly speak in:

	0 Never	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**
Arabic					
French					
English					
Other (specify) _____					

5.7 Do you travel to any country where the main language being spoken is:

	0 Never	**1 Rarely**	**2 Sometimes**	**3 Often**	**4 Always**
Arabic					
French					
English					
Other (specify) _____					

Calculation of the Linguistic Richness Score (questions 4.5, 5.3, 5.4, 5.5, 5.6, 5.7)

	Question 4.5 /10	Question 5.3 /2	Question 5.4 /4	Question 5.5 /4	Question 5.6 /4	Question 5.7 /4	**Total /28**
Arabic							
French							
English							
Other (specify) _____							

6. Information about the mother and the father

6.1 Information about the mother

6.1.1 In which country were you born?_____

6.1.2 Are you currently working? YES or NO. If yes, what is your job? Where do you work?

_____

6.1.3 Education:

		Number of years	**Further information**
Primary school	Yes / No		
Secondary school	Yes / No		
University	Yes / No		
Other professional training	Yes / No		

6.1.4 In your opinion, how well do you speak the following languages?

	0 Only a few words	**1 Gets along, but with difficulty**	**2 Basic abilities (gets along)**	**3 Well**	**4 Very well**
Arabic					
Classical Arabic					
French					
English					
Other					

6.2 Information about the father

6.2.1 In which country were you born?_____

6.2.2 Are you currently working? If yes, what is your job? Where do you work?

_____

6.2.3 Education:

		Number of years	Further information
Primary school	Yes / No		
Secondary school	Yes / No		
University	Yes / No		
Other professional training	Yes / No		

6.1.4 In your opinion, how well do you speak the following languages?

	0 Only a few words	1 Gets along, but with difficulty	2 Basic abilities (gets along)	3 Well	4 Very well
Arabic					
Classical Arabic					
French					
English					
Other					

7. Difficulties

In each cell, please indicate YES or NO:

	Brother/ sister	Mother	Father	Father's family	Mother's family
Difficulties at school					
Difficulties mainly with reading and spelling					
Repeated one or more grades in school					
Difficulties understanding others when they speak					
Difficulties expressing oneself orally (pronunciation, forming sentences, finding the right word, etc.)					

Appendix

Language spoken at home: Adults
For any other adult taking care of the child regularly, please specify their relationship to the child (e.g. parents in-law, etc.) and fill in the table.

	Adult 1 → Child					Child → Adult 1				
	0 Never	1 Rarely	2 Sometimes	3 Usually	4 Always	0 Never	1 Rarely	2 Sometimes	3 Usually	4 Always
Arabic										
French										
English										
Other										

	Adult 2 → Child					Child → Adult 2				
	0 Never	1 Rarely	2 Sometimes	3 Usually	4 Always	0 Never	1 Rarely	2 Sometimes	3 Usually	4 Always
Arabic										
French										
English										
Other										

	Adult 3 → Child					Child → Adult 3				
	0 Never	1 Rarely	2 Sometimes	3 Usually	4 Always	0 Never	1 Rarely	2 Sometimes	3 Usually	4 Always
Arabic										
French										
English										
Other										

Language spoken at home: siblings
For any other child of the family, please fill in the table.

Sibling 4 → Child						**Child → Sibling 4**				
	0 Never	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**	**0 Never**	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**
Arabic										
French										
English										
Other										
Sibling 5 → Child						**Child → Sibling 5**				
	0 Never	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**	**0 Never**	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**
Arabic										
French										
English										
Other										
Sibling 6 → Child						**Child → Sibling 6**				
	0 Never	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**	**0 Never**	**1 Rarely**	**2 Sometimes**	**3 Usually**	**4 Always**
Arabic										
French										
English										
Other										

Appendix B: Notification to the data protection official

The data collection in Norway for study B was subject to notification to the Norwegian Social Science Data Services (NSD), who acts as the Norwegian data protection official for research in humanities and social sciences. This attachment contains their feedback regarding the project (in Norwegian). The project was originally set to be completed by December 31, 2013; this deadline was extended twice, first to December 31, 2014 and finally to January 1, 2016.[10]

[10]H. Thorarensen, personal communication, January 10, 2014; Åsne Halskau, personal communication, January 22, 2015.

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Vår dato: 15.10.2012 Vår ref:31767 / 3 / LMR Deres dato: Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 09.10.2012. Meldingen gjelder prosjektet:

31767	*Tospråklige polsk-norske barn - testing av leksikalsk forståelse og produksjon*
Behandlingsansvarlig	*Universitetet i Oslo, ved institusjonens øverste leder*
Daglig ansvarlig	*Hanne Gram Simonsen*

Personvernombudet har vurdert prosjektet, og finner at behandlingen av personopplysninger vil være regulert av § 7-27 i personopplysningsforskriften. Personvernombudet tilrår at prosjektet gjennomføres.

Personvernombudets tilråding forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, eventuelle kommentarer samt personopplysningsloven og helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, http://www.nsd.uib.no/personvern/forsk_stud/skjema.html. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, http://pvo.nsd.no/prosjekt.

Personvernombudet vil ved prosjektets avslutning, 31.12.2013, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Vigdis Namtvedt Kvalheim

Linn-Merethe Rød

Kontaktperson: Linn-Merethe Rød tlf: 55 58 89 11
Vedlegg: Prosjektvurdering

Personvernombudet for forskning

Prosjektvurdering - Kommentar

Prosjektnr: 31767

Prosjektet er et samarbeidsprosjekt mellom Universitetet i Warszawa og Universitetet i Oslo, hvorav Universitetet i Oslo er behandlingsansvarlig institusjon. Personvernombudet anbefaler at behandlings-/ansvarsfordelingen formelt er avklart mellom institusjonene og at det utarbeides en avtale som omfatter ansvarsfordeling, ansvarsstruktur, hvem som initierer prosjektet, bruk av data og eventuelt eierskap.

Utvalget består av 40 tospråklige polsk-norske barn med antatt typisk språkutvikling innenfor aldersspennet 4-5 år. I tillegg foretas det en pilotundersøkelse med 10 norske barn med antatt typisk språkutvikling, i samme aldersspenn. Data samles inn via språktester, samt spørreskjema som foreldrene besvarer.

Førstegangskontakt foretas via barnehager, den katolske kirke og eget nettverk. Det gis skriftlig informasjon til utvalget, og innhentes skriftlig samtykke til deltakelse. Personvernombudet finner informasjonsskrivet av 12.10.2012, tilfredsstillende utformet.

Prosjektet skal avsluttes 31.12.2013. Datamaterialet oppbevares videre med koblingsnøkkel frem til endelig anonymisering ved utgangen av 2017, i forbindelse med oppfølgende språkstudier. Anonymisering innebærer at direkte personidentifiserende opplysninger som navn/koblingsnøkkel slettes, og at indirekte personidentifiserende opplysninger (sammenstilling av bakgrunnsopplysninger som f.eks. fødselsdato, bakgrunn, alder, kjønn) fjernes eller grovkategoriseres slik at ingen enkeltpersoner kan gjenkjennes i materialet.

Appendix C: CLT target words

Table C.1 gives the target words in the three CLT versions used in this dissertation (Polish and Norwegian in paper III, and Polish, Norwegian and UK English in paper IV). The words are listed by order of appearance within each subtask (noun comprehension, verb comprehension, noun production and verb production), with English translations for the Polish and Norwegian target words.

Table C.1: Polish, Norwegian and UK English CLT targets

Noun comprehension				
but	'shoe'	*øre*	'ear'	*gate*
kot	'cat'	*fugl*	'bird'	*house*
listonosz	'postman'	*fløyte*	'whistle'	*ant*
ślimak	'snail'	*kjole*	'dress'	*tail*
gwizdek	'whistle'	*jordbær*	'strawberry'	*shirt*
tablica	'blackboard'	*genser*	'sweater'	*pen*
zapałka	'match'	*bukse*	'trousers'	*apple*
widelec	'fork'	*ball*	'ball'	*cat*
świeczka	'candle'	*hale*	'tail'	*ladder*
koperta	'envelope'	*gitar*	'guitar'	*drum*
szminka	'lipstick'	*ekorn*	'squirrel'	*lamp*
pomarańcza	'orange'	*kost*	'broom'	*cap*
pieczarka	'mushroom'	*øks*	'axe'	*match*
żyrafa	'giraffe'	*banan*	'banana'	*desk*
dzwonek	'bell'	*tre*	'tree'	*broom*
długopis	'pen'	*bjelle*	'bell'	*onion*
serce	'heart'	*flaske*	'bottle'	*airplane*
fala	'wave'	*løk*	'onion'	*banana*
helikopter	'helicopter'	*konvolutt*	'envelope'	*balloon*
zjeżdżalnia	'slide'	*pingvin*	'penguin'	*monkey*
cytryna	'lemon'	*sjiraff*	'giraffe'	*television*
krawat	'tie'	*skrivebord*	'desk'	*snake*
cebula	'onion'	*fisk*	'fish'	*sandwich*
sowa	'owl'	*snegle*	'snail'	*vest*
kanapa	'sofa'	*tannbørste*	'toothbrush'	*kangaroo*
pingwin	'penguin'	*tennisball*	'tennis ball'	*computer*
flaga	'flag'	*tak*	'roof'	*sweater*

beczka	'barrel'	*ananas*	'pineapple'	*umbrella*
szklanka	'glass'	*klesskap*	'wardrobe'	*lipstick*
kwiatek	'flower'	*batteri*	'battery'	*strawberry*
siekiera	'axe'	*seng*	'bed'	*lighter*
stołek	'stool'	*støvel*	'boot'	*scale*

Verb comprehension

siedzieć	'sit'	*våkne*	'wake up'	*kiss*
padać	'rain'	*tegne*	'draw'	*talk*
przytulać	'hug'	*spise*	'eat'	*bath*
doić	'milk'	*skjære ut*	'carve'	*push*
prać	'wash (clothes)'	*barbere seg*	'shave'	*extinguish*
pływać	'swim'	*banke på*	'knock'	*spin*
drzeć	'tear'	*feie*	'sweep'	*kick*
wysyłać	'post'	*grille*	'grill'	*run*
bić się	'box'	*stupe*	'dive'	*burn*
całować	'kiss'	*vispe*	'mix'	*knit*
wiosłować	'row'	*sprekke*	'burst'	*mop*
malować	'paint'	*bore*	'drill'	*shear*
dmuchać	'mushroom'	*danse*	'dance'	*tear*
dzwonić	'ring'	*kjøre*	'drive'	*beg*
palić się	'burn'	*falle*	'fall'	*dive*
prasować	'iron'	*slukke*	'extinguish'	*watch (TV)*
kopać	'dig'	*mate*	'feed'	*dance*
szeptać	'whisper'	*grave*	'dig'	*sleep*
pchać	'push'	*klippe*	'shear'	*clean*
ciąć	'cut'	*slikke*	'lick'	*climb*
spadać	'fall'	*tigge*	'beg'	*stroke*
rzeźbić	'carve'	*mure*	'build'	*drown*
budzić się	'wake up'	*se på TV*	'watch (TV)'	*listen*
gotować się	'boil'	*blåse*	'blow'	*crawl*
mrugać	'wink'	*lime*	'glue'	*melt*
piec	'roast'	*bære*	'carry'	*drag*
grać	'play (the piano)'	*kysse*	'kiss'	*sharpen*
tańczyć	'dance'	*klekkes*	'hatch'	*stir*
pukać	'knock'	*bokse*	'box'	*sting*
gasić	'extinguish'	*klatre*	'climb'	*squeeze*
kierować	'drive'	*tørke*	'dry'	*whistle*

wąchać	'smell'	*skli*	'slide'	*burst*
		Noun production		
dom	'house'	*katt*	'cat'	*doll*
pies	'dog'	*hund*	'dog'	*bed*
żółw	'turtle'	*trapp*	'stairs'	*bird*
rakieta	'racket'	*tiger*	'tiger'	*snowman*
traktor	'tractor'	*ballong*	'balloon'	*pencil*
gitara	'guitar'	*traktor*	'tractor'	*chain*
spodnie	'trousers'	*skjorte*	'shirt'	*watermelon*
termometr	'thermometer'	*vannmelon*	'watermelon'	*barrel*
skarpetka	'sock'	*belte*	'belt'	*scarf*
słońce	'sun'	*strykejern*	'iron'	*feather*
zapalniczka	'lighter'	*racket*	'racket'	*paintbrush*
wiewiórka	'squirrel'	*høne*	'Hen'	*helicopter*
linijka	'ruler'	*solbriller*	'sunglasses'	*penguin*
zegar	'clock'	*lue*	'cap'	*orange*
komputer	'computer'	*hus*	'house'	*rainbow*
gruszka	'pear'	*paraply*	'umbrella'	*frog*
kangur	'kangaroo'	*hest*	'horse'	*needle*
koszula	'shirt'	*leppestift*	'lipstick'	*dog*
żelazko	'iron'	*nål*	'needle'	*bear*
kość	'bone'	*blyant*	'pencil'	*swing*
tygrys	'tiger'	*briller*	'glasses'	*basket*
krokodyl	'crocodile'	*sebra*	'zebra'	*roof*
truskawka	'strawberry'	*blomst*	'flower'	*button*
ciężarówka	'truck'	*blad*	'leaf'	*belt*
kanapka	'sandwich'	*slange*	'snake'	*boot*
huśtawka	'swing'	*pensel*	'paintbrush'	*toothbrush*
gniazdo	'nest'	*fyrstikker*	'matches'	*tie*
królik	'rabbit'	*sol*	'sun'	*heart*
banan	'banana'	*kurv*	'basket'	*telephone*
bęben	'drum'	*snømann*	'snowman'	*guitar*
nożyczki	'scissors'	*reir*	'nest'	*flag*
kapelusz	'hat'	*ugle*	'owl'	*elephant*
		Verb production		
spać	'sleep'	*male*	'paint'	*laugh*

kapać	'drip'	*hviske*	'whisper'	*read*
szyć	'sew'	*hamre*	'hammer'	*plant*
obierać	'peel'	*haike*	'hitchhike'	*fight*
latać	'fly'	*fiske*	'fish'	*dripp*
smażyć	'fry'	*fly*	'fly'	*hammer*
łowić	'fish'	*melke*	'milk'	*ski*
skakać	'jump'	*file*	'file'	*roast*
wybuchać	'erupt'	*helle*	'pour'	*throw*
czytać	'read'	*drikke*	'drink'	*sweat*
słuchać	'listen'	*seile*	'sail'	*water*
mierzyć	'measure'	*svette*	'sweat'	*brush (teeth)*
suszyć	'dry'	*steke*	'fry'	*peel*
ciągnąć	'pull'	*spille golf*	'play golf'	*hatch*
gwizdać	'whistle'	*svømme*	'swim'	*vacuum*
karmić	'feed'	*spille*	'play (the piano)'	*conduct*
huśtać się	'swing'	*skrive*	'write'	*swim*
machać	'wave'	*veie*	'weigh'	*build*
tonąć	'sink'	*sparke*	'kick'	*get married*
śpiewać	'sing'	*dryppe*	'drip'	*row*
głaskać	'stroke'	*vinke*	'wave'	*cook*
zapalać	'light'	*klippe*	'cut'	*mix*
lizać	'lick'	*hoppe*	'jump'	*boil*
topić się lód	'melt'	*stryke*	'iron'	*hug*
ważyć	'weigh'	*ro*	'row'	*sit*
gotować	'cook'	*drukne*	'drown'	*light*
miksować	'mix'	*tisse*	'pee'	*shave*
wiązać	'tie'	*smelte*	'melt'	*drink*
trzeć	'grate'	*ri*	'ride (a horse)'	*clap*
wyrzucać	'throw'	*vaske*	'wash (clothes)'	*sail*
kleić	'glue'	*dusje*	'shower'	*paint*
pękać	'burst'	*krabbe*	'crawl'	*iron*