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DEVELOPMENTAL DYSLEXIA AND FOREIGN LANGUAGE LEARNING
A Working Memory approach
(Fourth Section in Chapter 3)

1. *Biliteracy*

1.1. A brief introduction to Bilingualism

According to Grosjean (1998) an answer to the question “Who is bilingual?” should be “Half of the world population”. Nonetheless, ideological and political prejudices led in the past to a misleading image of reality. Actually, nowadays in the USA it is difficult to find out a sufficient number of monolinguals in order to conduct psycholinguistic experimental studies (Fabbro, 1996: 115). Furthermore, in Italy, as in the rest of the world, a person generally speaks her language and the dialect of the geographical area where she lives. Bilingualism is therefore found in most countries, at all levels of society, and in all age groups. I won’t discuss here the copious definitions that the word “bilingualism” has received over the years by different researchers; let’s just take the one by Grosjean (1998) as a reference: *“bilinguals are people who use two (or more) languages (or dialects) in their everyday lives”*.

According to Sorace (2006), many prejudices regarding bilingualism influence our culture. First of all, a very common belief is the one according to which bilinguals are less intelligent (or, on the contrary, more intelligent) than monolinguals. None of these claims is true, because there is no link between bilingualism and general ‘intelligence’ (Sorace, 2006); furthermore both conclusions have been found to be failing to take important sociological and cultural effects into account (Grosjean, 1982). Nevertheless, the experience of dealing with two languages seems to give bilingual children some cognitive advantages in several domains. As we will see in the following section, such advantages are particularly evident in tasks that involve cognitive flexibility and control of attention (Bialystok 1991; 2001). The relation between bilingualism and enhanced cognitive control stems on the fact that bilinguals must develop a powerful mechanism for keeping two languages separate. Indeed, there is a consensus in cognitive psychology literature on bilingualism that both languages are always simultaneously active (Green, 1998). Thus, bilinguals constantly have to inhibit one language when speaking the other; this seems to improve their ability to multitask in other domains.

Moreover, because bilinguals are able to perceive the linguistic competence of the person they are speaking to, they are said to have a high “awareness of the other”. It has been found that bilinguals actually develop this ability one year earlier than monolinguals, when tested on a classical Theory of Mind test. However, as Theory of Mind has also been found to correlate with central executive functions¹, like

¹ The term “executive functions” in cognitive psychology refers to a set of cognitive processes employed to perform activities such as planning, organizing, and managing time and space.

planning, problem-solving, and inhibition of habitual responses, bilinguals' superior performance may be due to their greater ability to suspend their own irrelevant beliefs, rather than to an understanding of other people's mental state (Sorace, 2006).

Another common misconception on bilingualism is that contemporarily learning two languages represents a burden for the child brain. Researches in psychology and neuroscience, instead, confirm that monolingual and bilingual children go through the same major milestones in language development and that bilingualism in itself is not a cause of language delay. This is also true for bimodal bilinguals, bilinguals who learn an oral language and a sign language at the same time (Petitto et al., 2001).

Another false belief on this topic is that bilinguals speak a 'mixed' language in their first years and end up not speaking either language properly, following the idea of a unitary lexicon, which cannot contain two words for the same referent. Recent research with modern techniques has completely discredited this idea, and, moreover, it has been shown that bilingual code switching is used by bilinguals in order to achieve particular communicative effects, when they are in the so called 'bilingual mode' (Grosjean, 1998), i.e. talking to other bilinguals. The most interesting counter-evidence to the confusion hypothesis comes from research that compares the order of acquisition of grammatical structures in monolingual and bilingual children: there is little evidence that the bilinguals' languages affect each other, neither they speed up nor delay normal acquisition processes. It is however possible that features of one language show up in the other, and a current hypothesis regarding mistakes between languages deals with the so called 'interface conditions'², at the boundary between grammar itself and the language use in the wider discourse context, as for example the question of dropping or not subjects pronouns.

The comparison between people who are bilingual from birth and people who are near-native speakers of a second language shows the fallacy of one approach that parents sometimes take to establishing bilingualism: introducing one language first, and waiting until it is established before exposing the child to the other. In all kinds of ways this appears to be the worst mistake one could make. There's no reason to think that children cannot handle acquiring two languages simultaneously, and some reason to think that early bilingualism confers different cognitive advantages (Sorace, 2006), as we will see in the next section.

1.1.1. Being Bilingual: Advantages and Disadvantages for language and reading

Psycholinguistic evidence has demonstrated that the two representational systems for bilinguals are both active even when only one of these systems is being used (Green, 1998; Colomé, 2001; Costa, 2005). The implication of having access to two competing linguistic systems is that bilinguals need a mechanism to control attention to the required system and ignore the system not currently in use. Thus, rapid monitoring of the context and efficient switching between representations is also required for fluent performance in

² For more details see Sorace & Serratrice (2009).

both languages. In this sense, the integration of linguistic and cognitive systems is crucial, because with a fully integrated system, the problem of managing the competing linguistic representations can be handled by general cognitive processes. The processes necessary to control the two language systems, which are components of the so called 'executive function', are: attention; inhibition; monitoring and switching.

Recent research has developed and confirmed three hypotheses, starting from the proposal that bilinguals have greatly developed executive functions compared to monolinguals (Bialystok, 2007, 2009). The first hypothesis claims that development of executive processing occurs earlier in bilinguals than monolinguals. By studying the metalinguistic ability, i.e. the ability to manipulate and reflect on structural aspects of language as a system, it was possible to confirm this idea. Tasks of different experiments were: grammaticality judgment task, concept of quantity task and card sort task. Results show that bilinguals are superior to monolinguals in executive control of attention, although there are no differences in their knowledge of the language system. The consistent pattern is that bilingual children develop the ability to control attention and ignore misleading information, earlier than monolinguals. This dissociation is the basis for the claim that bilingualism has a specific impact in the development of executive processing but no effect on basic cognitive performance. The source of the advantage is the experience of controlling attention to the relevant language system in the face of competition from the other language, which is simultaneously active but irrelevant to the current language task.

The second hypothesis claims that the boost provided to these functions in development is sustained through adulthood, making adults bilinguals more competent or efficient in executing executive processing. Different experiments (Bialystok et al., 2007) show that there are few processing differences between monolingual and bilingual young adults on tasks usually used to measure executive control. However, there are reliable bilingual advantages on the most difficult conditions, suggesting that the extra control effort required when processing demands increase, are more easily met by bilinguals.

The third hypothesis concerns the delay of age decline of executive functions. Since the executive processes are the first abilities to decline with normal cognitive ageing, the lifelong experience in bilinguals will delay their decline. Several experiments (Bialystok, 2004, 2006) show that from the age of 60, reaction time in different tasks begins to slow down, but that this process is more rapid for monolinguals than it is for bilinguals.

Thus in general, the lifelong experience of bilingualism creates a context in which the executive processes for attention control are employed routinely, and this use for language management has the benefit of boosting their function across other cognitive domains, even those that have little connection to linguistic performance.

Nonetheless, in some linguistic areas bilinguals are handicapped, possibly because of the cost of maintaining two representational systems concurrently on line. In terms of vocabulary, for example, a bilingual disadvantage has been found both in reception, as bilingual children score lower than

monolinguals when tested in each of the languages; and in production, as bilinguals are worst on tasks requiring rapid generation of words, such as semantic fluency and picture naming tasks. While in children the main difference is in vocabulary size, in adults the problem seems to lie in lexical retrieval, or access to vocabulary. The reason why bilinguals experience deficits in lexical access is not clear, the idea has been proposed that the limited use of each language would create 'weaker links' among the relevant connections required for rapid and fluent speech production (Bialystok, 2009).

The study by Bialystok et al. (2008) aims at finding more evidence of the vocabulary deficits found in bilinguals. She examines lexical access through a series of different tasks both in bilinguals and monolinguals of different age. The results are quite clear: monolinguals show an advantage in all verbal tasks; furthermore, older bilinguals generate fewer items than younger participants, as predicted by the effect of aging. The researchers propose two explanations for the bilinguals' disadvantage on lexical tasks, the first follows from the salient difference in that monolinguals have had approximately twice as much experience in retrieving words in the studied language as the bilingual group. This explanation seems to be consistent with the role of frequency effects on performance of second language acquisition. The second possibility, according to Bialystok et al. (2008), is that the cost in lexical access is due to the need to resolve conflicts between competing responses, i.e. response production may suffer from the need to suppress interference from the unwanted language. This account can actually explain both the cognitive advantage and the lexical disadvantage of bilinguals, however, the researchers ask for caution because the two aspects may be attributable also to different causes.

Another field of interest for a bilingual disadvantage is well represented by the so called 'Interface Hypothesis', which shows how bilinguals have some difficulties when dealing with linguistic aspects at the interfaces. The term 'Interface Hypothesis' was first proposed by Sorace & Filiaci (2006), who studied near-native Italian L2 speakers, testing them on the interpretation of pronominal subjects. They found that L2 speakers gave significantly different responses from monolingual native Italian speakers only with respect to overt subject pronouns, but, in contrast, their interpretation of null subject pronouns was native-like. The pattern emerging from this study showed an over-extension of the scope of overt subject pronouns, which led to the production and acceptance of these pronouns in the presence of a topical antecedent, as in (3b):

- (3)
- a. Perché Giovanna non è venuta?
Why didn't Giovanna come?
 - b. Perché lei non ha trovato un taxi.
 - c. Perché __ non ha trovato un taxi.

A similar pattern was attested in bilingual L1 acquisition. Furthermore, research in this area has already independently shown that syntax-pragmatics interface is a prime locus of protracted delays in young bilingual children who have not fully acquired the C-domain. However, it was the study by Serratrice et al. (2004) that brought anaphoric dependences involving pronominal subjects to the focus of interest of the

research in bilinguals. She examined the proficiency of an Italian-English bilingual child and found that he over-produced overt subjects from the beginning to the end of the data collection period, in spite of the prediction of a protracted early stage of null subjects in English, due to the influence of Italian. He actually never used more null subjects than monolinguals.

A large-scale study (Sorace et al. 2009) confirmed the developmental difficulty associated with the use of pronominal subjects. Moreover, elicited acceptability judgement experiments showed that different child bilingual groups accepted significantly more overt subjects referring to topic antecedents than monolingual children, although younger monolinguals also did this significantly more often than the adults control. In sum, the common finding of these and more studies on the topic is that bilinguals tend to produce and accept overt subject pronouns referring to a pragmatically inappropriate topic subject antecedent significantly more often than monolinguals. The strong version of the Interface Hypothesis predicts that *“structures involving an interface between syntax and other cognitive domains present residual optionality (in L2 acquisition), emerging optionality (in L1 attrition), and protracted indeterminacy (in bilingual L1 acquisition), but structures that require only syntactic computations are completely acquired in L2, remain stable in L1, and are acquired early in bilingual L1 acquisition”* (Sorace, 2011). This version of the theory is considered by Sorace (2011: 5) too broad, it is nevertheless a fruitful starting point for research.

Summarizing, in bilinguals both languages are always simultaneously active, and they need to exercise executive control to avoid language interference. This constant experience of inhibiting the unwanted language is the root of the bilinguals' cognitive advantage in non-linguistic tasks, however, it may take attention resources away from other tasks, including linguistic ones. It has been hypothesized that the computation of anaphoric dependencies partly draws on the same pool of attentional resources used to inhibit the language not in use. The topic needs to be explored more deeply, as Sorace (2011) recently suggested, no single factor can explain all the data. In the next section we will see how being bilingual can be an advantage when children enter the world of literacy.

1.2. Bilingual Literacy

Although research on bilingualism and literacy is a very recent field of investigation, a lot of studies show evidence that being bilingual can give some advantages in the development of reading abilities. The study by Bialystok et al. (2005) examines different literacy tasks of bilingual first grade children and shows that bilingual children have better reading abilities than monolingual children, especially if the languages they are learning are both alphabetical. They show, indeed, that the extent of the bilingual facilitation for early reading depends on the relation between the two languages and writing systems.

We have already seen that the prerequisite skills crucial for literacy are *oral proficiency*, *metalinguistic awareness*, and *general cognitive development*. It has been demonstrated that oral vocabulary can influence children's acquisition of literacy (Stanovich, 1987). Furthermore, bilingual preschool children

show to command a smaller vocabulary comparing to monolingual speakers of each language (Bialystok, 1988). These differences in vocabulary level may disadvantage bilingual children in early literacy acquisition comparing to their monolingual peers, but evidence shows this is not the case.

Furthermore, a considerable amount of evidence illustrates that phonological awareness, a crucial basis for reading, transfers across languages depending on the relation between the languages and the relation between the writing systems. Different researches on phonological awareness have demonstrated its importance for alphabetic reading; furthermore, it seems to be also related to learning to read non alphabetic languages such as Chinese (Ho & Bryant, 1997), although research comparing learning to read in different writing systems is still open to discussion. A study by Huang and Hanley (1994) shows significant correlations between phonological awareness skills in the two languages of Chinese-English bilinguals living in Taiwan and Hong Kong, but at the same time it doesn't report any evidence that phonological awareness in one language influenced reading in the other. In contrast, Gottardo et al. (2001) found a significant correlation between Chinese rhyme detection and English phonological and reading measures, furthermore regression analysis indicates that Chinese rhyme detection predicted English reading. They conclude, thus, that phonological processing skills in L1 can influence reading performance in an alphabetic orthography, no matter the orthography of L1; but their results are actually difficult to interpret because rhyme detection was the only measure of phonological awareness, which is, as we have seen, a complex skill; and working memory was not assessed.

The scarce literature on the relation between phonological awareness and bilingualism cannot confirm the idea put forward by some researchers that bilingual children have an advantage at 5 years old that disappears a year later (Bruck & Genesee, 1995), however the relation between the two languages is considered to be probably relevant in influencing the children's access to phonological awareness.

The study by Loizou and Stuart (2003) examined and compared phonological awareness skills in monolingual English and bilingual English-Greek 5-year-olds. By assessing a set of six phonological tasks, they found that bilingual children significantly outperformed monolingual English children. Furthermore, they predict that there would be effects of learning to read in an alphabetic language, such that the bilingual children tested in Britain would show higher levels of phonological awareness at the level of the phoneme than their peers in Greece attending an English-Greek bilingual school. They also found that the significantly better performance of bilingual children on tasks requiring phoneme awareness actually shows that learning to read in an alphabetic language promotes a higher level of phonological awareness.

Finally, the third crucial skill analysed in literature, cognitive development, is also related to the achievement of literacy. Geva & Siegel (2000) reported an interaction of different factors in the ability of learning to read, first of all working memory, and then language specific factors, such as orthography, also within languages whose orthographic demands change. They concluded that if there are advantages for

bilinguals in acquiring literacy skills, they should be limited by the peculiarity of the languages and their writing systems.

The article by Ibrahim (2007) aims at finding a causal role for bilingualism in reading acquisition. He tested monolingual Hebrew, bilingual Russian-Hebrew and monolingual Arab children in the first grade and showed that second language experience in early childhood positively affects reading skills at the first grade level.

The general pattern of the effects of bilingualism is that bilinguals achieve higher scores than monolingual peers on phonological awareness, and lower scores than monolinguals on tests of vocabulary size (Doyle et al. 1978), this is probably due to the fact that they use their languages in different contexts and therefore develop only the necessary vocabulary in these contexts. This is in line with Grosjean's claim that "*bilingual is not two monolinguals in one person*" and the two language systems cannot be identical in all respects (Grosjean, 1998). Ibrahim (2007) also measured tasks on text reading, single word and non-word reading. Results show that there is a positive relationship between language experience and reading performance. Bilinguals had higher scores on the syllable deletion tests than monolinguals, while their reading scores were equivalent. He calculated that vocabulary size accounts for almost 30% of the variance in text reading for monolingual but not for bilinguals, showing that other variables may compensate their smaller vocabulary.

To conclude, the study by Ibrahim (2007) supported the idea that exposure to a second language in early childhood affects reading skills in children in the first grade, as found by Da Fontura & Siegel (1995), and that bilingualism is a powerful predictor of the speed and efficiency of reading acquisition. However, more investigations in the future will surely provide a clearer picture.

1.2.1. Transfer of phonological awareness

As we have seen, there is a growing amount of evidence showing that phonological awareness skills transfer from a language to the other(s) in bilinguals, especially when the two languages share a common writing system. Since bilinguals show advantages in general cognitive abilities, especially in the so called cognitive control function, now the question is, whether a transfer in itself occurs between the abilities of the two (or more) languages, or whether this simply reflects a more general cognitive ability in dealing with the phonological representations of the languages.

Bialystok (2005: 46) confirmed the idea of 'transfer' claiming that phonological awareness skills developed in one language actually transfer to reading ability in any other language. Furthermore, the transfer of phonological awareness has been detected in the studies by Chiang & Rvachew (2007), Jared et al (2011) and Geva & Siegel (2000). In addition, Durgunoglu (1998) found similar results for English-Spanish transfer; and Comeau et al. (1999) found the same for French. The topic became even more controversial, when it was found that bilingual children do not differentiate in their phoneme awareness abilities from

monolingual children (Bialystok, 2004). Moreover, studies have revealed that experiences with two different phonological systems enhance phoneme awareness as literacy skills develop, and that bilinguals are likely to be good decoders (Bialystok, 1988; Cambell and Sais, 1995; Gregory, 1996 in Deponio et al. 2000).

The study by Xuereb (2009), examining English-Maltese bilingual children, shows that English word reading correlates highly with Maltese segmenting non-words task, with Maltese elision task and non-word repetition task. Furthermore, receptive vocabulary and Maltese speed of processing predicted English word reading. In sum, Xuereb (2009) found that English phonological skills have a great degree of association with, and are valid predictors of Maltese reading proficiency. In addition, letter naming explained unique variance in reading achievement: letter reading in Maltese was found to be the only variable consistently and reliably predictive of Maltese and English reading and spelling. In this study, phonological awareness was highly correlated with, but did not significantly predict reading ability; therefore the researcher claims that it is possible that at least some tasks of phonological awareness may be language-specific, as not all phonological awareness tasks predict Maltese reading proficiency. They conclude that, possibly, if psychologists and professionals would supervise tutorials directed to phonological awareness in English, and the alphabetic principle for English and Maltese, this could enhance Maltese student learning outcomes. They believe that *“intervention that provides phonological awareness training in both the L1 and the L2 or in the regular language may improve disabled students’ ability to read”* (Xuereb, 2009: 342).

A study by Geva and Siegel (2000) tested reading abilities of English children attending Hebrew schools. They found that age could predict performance for words and pseudo-words reading. The difference between reading progress in the two languages was attributed to the different levels of orthographic transparency. Although the transfer of phonological awareness remained positive, they concluded that phonological awareness is a general processing ability and that reading develops individually for the specific demands of the writing systems being used.

According to Bialystok (2005), transferability of phonological skills and transferability of reading skills are not the same. Furthermore, the transfer of these skills depends on the similarity of the systems, phonological structure from the one hand, and writing system from the other hand. With her colleagues, she investigated the decoding ability of four groups of children: a group of Spanish-English bilinguals, a group of Hebrew-English bilinguals (who were learning to read the vowelized form of Hebrew), a group of Chinese-English bilinguals and a group of English monolinguals. The purpose of the study was to isolate the role of bilingualism on children’s early progress in reading and to identify the role of language and writing system similarity on that effect. She proposed two hypotheses, the first one claims that, since the prerequisites to literacy develop differently in bilinguals and monolinguals, this will lead to an advantage for bilingual children on reading measures, but that advantage will be greater if the two languages use the same writing system. The second hypothesis is that the writing system will determine the extent to which

the skills developed in one language will transfer to the bilinguals' other language. Results showed that the Hebrew and the Spanish group performed very similar, and both were more advanced than the Chinese group, confirming the idea that reading experience with similar writing systems can enhance reading ability.

Bialystok (2005) concluded that bilingualism makes two contributions to children's early acquisition of literacy. The first one is a general understanding of reading and its basis in symbolic systems of print; all bilingual groups showed an advantage over the monolinguals, although the advantage given to the Chinese-English group was modest. The second contribution of bilingualism is a potential transfer of reading principles across languages. This transfer is facilitated if the two languages are written with the same system. Thus, the two groups, whose two languages were both based on an alphabetic principle, take advantage from applying the concepts of reading that they learn to their two languages.

Still, it is not clear if one can really talk about 'transfer' or if bilingual children can get some benefit from their general cognitive advantage. The field of research is quite complex and needs to be examined more deeply.

On the whole, it appears that children are well aware of the difference between their two languages from very early on, and that each language develops in more or less the normal way, independently of the other. Curiously, however, what is known about bilingualism and the brain looks at first sight inconsistent with this idea. The latest generation of neuroscience studies has taken a serious interest in bilinguals, and particularly in the way the representation of the two languages in the brain is affected by the age at which they're acquired. Several modern neuroimaging studies (such as fMRI and PET) indicate that early or simultaneous exposure to two languages from birth results in both languages being represented in the same areas within the left hemisphere, which is normally associated with the native language of monolingual speakers (Wartenburger et al. 2003; Abutalebi et al., 2001). By comparison, exposure to one language and then subsequent exposure to a second language results in a more bilateral representation, and in the involvement of more distributed frontal lobe areas typically recruited in working memory and inhibitory tasks. According to some models (for example Ullman 2001)³, early bilingualism is neurally distinguished from late bilingualism by its reliance on procedural memory mechanisms, which are implicated in long-established skills, or habits, and are not accessible to consciousness; late(r) bilingualism, on the other hand, would mainly be served by declarative memory mechanisms, which are typically used in learning facts and events, and may be explicitly recalled. The brain signatures of these different neural mechanisms are visible in the greater involvement of left frontal ganglia brain areas in early bilinguals, as opposed to the recruitment of temporal lobe areas in later bilinguals.

However, these features are not permanently fixed: proficiency in a second language can also involve brain reorganization (Perani et al., 1998). The flexibility of the brain has also emerged from a study by Mechelli

³ See Ullman (2001) for a discussion on the procedural/declarative model of language.

(2004), who analysed structural differences between the brains of bilinguals and monolinguals. The participants in his study had started learning English at various ages and had reached varying levels of proficiency. He found that bilinguals have more grey matter than monolinguals – in other words, that they develop a bigger brain in response to exposure to two languages – and that the growth involves a portion of the cortex (the left inferior parietal cortex) that is involved in some verbal fluency tasks and in verbal short-term memory. This happens not only to people who are bilingual from birth, but also, to a lesser extent, to late bilinguals. So while it may not be justified to say that bilinguals are more intelligent, it does seem that they may literally have bigger brains. We won't deepen the discussion on neural aspects of bilingualism because it is not the purpose of this work. We will rather proceed our examination on the effects of bilingualism in reading, analysing morphological awareness in the next section.

1.2.2. Transfer of morphological awareness

As we have seen, morphological awareness refers to the ability to understand how words are made of, and represents one of the key components to be able to read, but also to understand words (McBride-Chang, 2008). Furthermore, while increasing their vocabulary, children gain more insights into the morphological structures of the language they speak and read. MA has been found to be related to vocabulary learning, both in children and adults (Anglin, 1993). Classic developmental studies of morphological development from preschool to adulthood using both real and nonsense word stems, found that the development of inflectional rules occurs earlier than derivational rules, with the derivational rules showing a particularly protracted course of development even into adulthood (Casalis & Louis-Alexandre, 2000).

However, studies on this topic are sparse, since most researches investigating vocabulary acquisition rather focus on the importance of phonological awareness and phonological processes (Gathercole et al., 1999). Studies on the development of morphological skills in bilingual children are thus more limited. However, a cross-language effect on word reading has been found both for awareness of derivational and inflectional morphology in children exposed to two alphabetic languages (Ramirez et al., 2010). For example, transfer effects have been found from Hebrew to English (Schiff & Califf, 2007), and from Spanish to English (Ramirez et al., 2010). More evidence shows a cross-language transfer of morphological awareness both in languages with similar morphological structures like English, Spanish and French (Deacon et al., 2007), and between languages with different morphological structures like English and Hebrew (Schiff & Califf, 2007) or English and Arabic (Saiegh-Haddad & Geva, 2008).

Interestingly, research is spreading on the analysis of morphological awareness in languages with a different writing system, in particular in Chinese. For example, Pasquarella and colleagues (2011) investigated English and Chinese children, with the aim of examine whether English morphological awareness would predict children's Chinese reading abilities and vice versa, i.e. whether Chinese morphological awareness would also predict English reading skills. Children attending the first year of

primary school were tested on a series of tasks both in English and Chinese, like word reading, reading comprehension, morphological awareness and compound awareness. Results show that English compound awareness explained individual differences in Chinese reading comprehension, after controlling the effects of Chinese word reading, Chinese reading comprehension and Chinese compound awareness. The contrary however was not observed, since Chinese compound awareness had no effect on English reading comprehension. According to the authors, the specific direction of transfer of morphological awareness to reading comprehension is influenced by the morphological features of the language of the outcome variable. It seems thus that transfer of morphological awareness across languages is different from the transfer of phonological awareness, since the first can transfer regardless the nature of the writing system that represents the language, whereas the second is influenced by the morphological features of the languages involved.

The study by McBride-Chang (2008) analyzed the relation between morphological awareness of children and their vocabulary development in three languages, Cantonese, Mandarin, and Korean. They found that the morphological awareness task emerged as a stronger predictor of subsequent vocabulary knowledge compared to phonological processing skills over time across all three of the languages we tested.

As we have seen along the chapter, morphological awareness plays an important role on reading, specifically on reading comprehension and in advanced stages of literacy development. This ability has been found to transfer from a language to the other depending on the characteristics of the languages, although research is still sparse. If cognitive skills like phonological and morphological awareness can transfer through languages in bilingual children, it is reasonable to ask if another important cognitive capacity will also have a positive effect for bilingual children, specifically it is interesting to understand whether working memory capacity in bilinguals is strengthened or worsened by the ability of speaking and reading two languages.

1.3. Working Memory in Bilinguals

It is not clear a priori whether bilingualism affects the development and functioning of memory in general, and working memory in particular. WM is considered to be part of the cognitive executive functions (Bialystok, 2008); therefore enhancement in general executive control ability may have the consequences of also boosting the WM system. The topic is still controversial.

Different studies show that there is no difference in WM capacity of bilinguals and monolinguals; when comparing them on non-verbal WM tasks, they achieve the same scores in the simple conditions, but as the executive control demands increase, bilinguals do better (Bialystok et al. 2008). On the other hand, other studies measuring the capacity of working memory in bilinguals show evidence that bilinguals have an advantage. Papagno and Vallar (1995), for example, found that polyglots had a superior level of performance in verbal short-term memory tasks.

Moreover, the importance of WM in learning an L2⁴ was well stressed by Baddeley et al. (1998), who claimed that short-term phonological storage is important for learning unfamiliar verbal material. Service (1992) found similar results, in that the ability to repeat words (pseudo words) in an unknown language significantly correlates with the ability to succeed in learning that language. A study by Ardila (2003) examined the relation between working memory capacity and bilingualism, claiming that in bilinguals, brain activation patterns during WM tasks are more complex when using an L2, processing information in L2 is more demanding and WM may be less efficient.

It has been noticed (Nell, 2000) that Digit Span⁵, a measure of working memory, significantly differs among languages. For example, in bilingual Welsh-English children with Welsh as L1 and English as L2, digit span was greater in English than Welsh (Ellis, 1992). Apparently, the difference lies in the higher speed digits in English which can be repeated mentally. Ardila (2003) analysed digit span measures in Spanish-English bilinguals, with Spanish as L1 and English as L2, and found that when performing English, they do better than Spanish, but anyhow lower than the English average. However, bilinguals' performance in Spanish was higher than the one observed in Spanish monolinguals. This could show an advantage for bilinguals in the WM capacity, although more research is needed. Moreover when age of acquisition of L2 (English) was taken into account, it was found that for early bilinguals performance in English correspond to the English norm, and performance in Spanish was higher than expected in native Spanish-speakers. For late bilinguals, performance in Spanish corresponds to the norm in Spanish and performance in English was higher than in Spanish. Thus, also the specific level of bilingualism is important when dealing with working memory measures.

⁴ The topic will be further discussed in chapter 5.

⁵ For a detailed description of WM tests see chapter 6.