The construct of language dominance, its operationalization and measurement

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Jeanine Treffers-Daller[1]

1.Introduction

Most researchers in the wide field of bilingualism agree that a bilingual is not two monolinguals in one person (Grosjean, 1998), that completely balanced bilinguals are very rare and that it is much more common for bilinguals to be dominant in one or the other language (Baker and Jones (1998); Hamers & Blanc, 2000). However, whether balanced or dominant bilingualism is the default can only be established if there is a generally accepted view of what these constructs mean as well as an agreed method for operationalising and measuring "balance" and "dominance" in bilinguals. Unfortunately, this is not the case. Rather, there is considerable amount of terminological confusion around these terms (Meisel, 2007)). To some the dominant language is the one in which the bilingual is more proficient (Deuchar & Muntz, 2003; Petersen, 1988), whilst others point to a range of other factors: the input to bilinguals (Yip & Matthews, 2006), frequency of use, overall fluency and domains of use, age of acquisition, ability to read or write in different languages (Grosjean, 2008), levels of language activation (Pavlenko, 2014) or speed, fluency, automaticity, or efficiency (accuracy) in processing (Birdsong, 2006; Favreau & Segalowitz, 1982). Lanza (2004, p. 237) brings these different dimensions together in referring to language dominance as "essentially a psycholinguistic phenomenon closely intermeshed with sociolinguistic parameters."

If we want to come to a unified understanding of the construct of language dominance, it is important to clearly separate the construct itself from factors which contribute to its development. A possible way forward in this is to link the definition of the

[1] I am very grateful to Carmen Silva-Corvalán and François Grosjean for detailed comments on an earlier version of this chapter. All remaining errors are mine.

construct of language dominance more closely to the construct of the bilingual experience (Luk & Bialystok, 2013), which is done in section 2.

Because there are so many different views of what language dominance means, it is not surprising that there is no generally accepted method to operationalize and measure it (Flege, MacKay, & Piske, 2002). In fact, not all researchers consider it useful to measure language dominance (or degree of bilingualism) because measurement can do more harm than good if students are only measured in one of their two languages and compared to monolingual norms which are not appropriate for bilinguals (Gathercole, 2013). However, the conflicting results from studies in the field (Grosjean, 1998, 2008) make it necessary for researchers to consider the issue more seriously. In the early seventies measuring language dominance was also seen as useful in the context of bilingual education (Gerken, 1978; Zirkel, 1974), but our main concern here is to clarify how language dominance could be measured for research purposes.

As can be seen in the contributions to the current volume and in other recent work in the field (Bedore et al., 2012; Gollan, Weissberger, Runnqvist, Montoya, & Cera, 2012; Silva-Corvalán, 2014; Treffers-Daller, 2011; Yip & Matthews, 2006), a great variety of approaches are being used to classify informants into "balanced" or "dominant" bilinguals, although many researchers do not make it clear how these two types were distinguished in their study ((Treffers-Daller, 2011). In fact, in his review of the measurement of language proficiency and language dominance in a decade of publications in *Bilingualism, Language and Cognition*, (Hulstijn, 2012) notes that "the notion of language proficiency, be it in a first language (L1) or second language (L2), is often taken for granted, and so are the notion of language dominance and the notion of native speaker." In quite a few cases, the classifications appear to have been made by the researchers who "know" their informants well enough to be able to make a classification. If we are to compare results from studies in

bilinguals, and to explain conflicting results from studies in the field we will need to move away from an approach whereby language dominance is identified on the basis of the elephant test (Jarrett-Kerr, n.d.), that is identifying a creature or phenomenon using a you-know-it-when-you-see-it approach.

The term *language dominance* can be used in a variety of ways. First of all, the term *societal language dominance* is used to refer to societies (or smaller geographical or social units), where different languages are used but only one or a few of these (the predominant ones) are used for the purposes of government or education or are more likely to be learned as a second language by speakers of other languages (Ferguson, 1993). Second, researchers use the term *hemispheric language dominance* to refer to the fact that the left and the right hemisphere of the brain have different specializations and that the left hemisphere is generally more involved in language processing, which is referred to as left hemisphere language dominance ((Springer et al., 1999). Third, the term *language dominance in the individual* is used to refer to the differences in proficiency and use of different languages by individual bilinguals, which is also sometimes referred to as *bilinguality* ((Hamers & Blanc, 2000; Lambert, 1956). In the current volume we do not deal with the first two types of language dominance, although societal language dominance is mentioned in the chapters by Kupisch and van de Weijer and Schmeißer et al. and many other authors e.g. Hohenstein, Eisenberg, and Naigles (2006), as a key factor which explains language dominance in individual bilinguals. From now on we will use the term *(language) dominance* only in the third meaning distinguished above. Because the term *dominance* has so many different meanings, some authors, in particular in the field of child bilingualism, prefer the terms *stronger and weaker languages* instead (Bernardini & Schlyter, 2004; Meisel, 2007). However, these terms are hardly ever used by authors outside the field of 2L1 acquisition (see also Gathercole and Thomas (2009) for a critique). Researchers from a range of fields use the

term *language dominance* in the third sense distinguished here, and for this reason we have chosen to do the same (but see De Houwer (1998), for objections against the use of the term).

Language dominance can be approached from two different perspectives. On the one hand it is often treated as an *explanans*, that is, the independent variable which explains another phenomenon, in other words, the *explanandum* or dependent variable (Hempel & Oppenheim, 1948). In the academic literature, language dominance is often invoked as the explanation for other findings. Gollan, Forster, and Frost (1997, p. 1127), for example, refer to language dominance in English as one of the two possible reasons for the fact that repetition priming is weaker in Hebrew than in English among their informants. In a similar vein, Wang (2013) shows that degree of language dominance affects translation priming in Chinese-English bilinguals.

However, if we want to use language dominance as an explanatory variable, we need to make it clear what it is, how it relates to similar constructs such as language proficiency, and how it can be operationalized and measured. In other words, there is an urgent need to further develop research where the construct of language dominance itself is the *explanandum* and where different ways to operationalise and measure this construct are presented and discussed. It is the need to further develop this second approach to language dominance which motivated the current volume.

In this chapter we endeavour to first of all systematically clarify and map out the construct of language dominance (section 2) and evaluate different ways to operationalise and measure it (section 3), building on the insights that have been provided by the contributors to the current volume. We evaluate a typology of language dominance which is based on the core dimension of language proficiency (section 4) and finish with a few suggestions for future research (section 5).

2. The construct of language dominance

This section starts with a discussion of the different dimensions which different researchers see as being subsumed under the construct of language dominance, how it can be differentiated from other constructs, such as language proficiency, and how it affects different language components of the languages (grammar, vocabulary, phonology etc.), and different skills (for example, oral versus written skills). Then we will try to get a better understanding of the meaning of the term *balanced bilingualism* and present different views of whether language dominance is stable or dynamic over time, and finally we turn to explanations for the development of language dominance.

Language dominance and language proficiency

Discussing the construct of language dominance is complex because it requires a common understanding of what it means to be bilingual. As pointed out by Fishman and Cooper (1969), descriptions of bilingualism somewhat resemble descriptions of an elephant as made by different people in a dark room. Some authors consider *competence* or *proficiency* in the two languages to be key (Bloomfield, 1962; Macnamara, 1967) and others refer to *communication* or *use* as the most important variable(s) (Grosjean, 1997; Haugen, 1953; Mackey, 1976; Mohanty, 1994; Weinreich, 1953). As in the story about the elephant in the dark room, the different points of view reflect different aspects of the issue. A complex phenomenon such as bilingualism is necessarily multidimensional: any description of bilinguals should therefore minimally involve a description of proficiency *and* usage ((Fishman, Cooper, & Ma, 1968; Grosjean, 2010). In their study of degree of bilingualism among Spanish-English bilinguals in the US, Fishman et al. (1968, p. 484) propose a range of methods to measure degree of bilingualism of informants, and these measures can be

classified as describing either proficiency or use. The authors give a very succinct description of the meaning of these two terms: they see language proficiency as "what a person *can* do" and language use as "what a person *typically* does." The importance of proficiency as well as use was again confirmed in Luk and Bialystok (2013) study among 160 bilinguals in Canada in which they investigated the relationships between variables measuring different aspects of the bilingual experience. Using a factor analysis Luk and Bialystok confirmed previous research (Fishman et al., 1968; Grosjean, 2010) that the bilingual experience involves two key dimensions: bilingual usage on a daily basis, and language proficiency.[2] Incidentally, according to Annett (1970), these two dimensions are also crucial to description of handedness: humans and other animate beings who have hands can be classified according to manual preference, that is how frequently they use each hand in different domains (e.g. dealing cards or using scissors), or according to the manual skill with which they perform tasks with each hand (see Birdsong, this volume, for a fuller discussion). This does not mean other factors do not play a role in the bilingual experience but these two factors are essential ingredients of this experience.

Definitions of language dominance in the literature make reference to either or both of the two key dimensions of the bilingual experience. Most frequently language dominance is defined in relation to *language proficiency* or *language competence* ((Cummins, 1976; Peal & Lambert, 1962). This link between dominance and language proficiency is also echoed in Genesee, Nicoladis, and Paradis (1995), Deuchar and Muntz (2003) and Unsworth (this volume) who see language dominance as relative proficiency in each language. However, not all researchers agree that using the term *proficiency* is appropriate for describing bilinguals.

[2] Luk and Bialystok (2013) only included a measure of proficiency in English because the informants came from a wide variety of language backgrounds.

Yip and Matthews (2006, p. 101) prefer the notion *competence* and note that "dominance must be related to underlying competence and not merely a measure of performance or language use" (see also Meisel, 2007), but not all researchers make a distinction between competence and performance as defined by (Chomsky, 1965). It is also interesting to note that the dominant language is *not* always the one in which a bilingual is most proficient: According to Harris, Gleason, and Ayçiçeği (2006, p. 264) it is possible for immigrants to become dominant in the language of their host country despite having a relatively low proficiency in that language, as measured with tests of grammar and vocabulary.

Many researchers see language dominance as a construct which involves different dimensions. Wang (2013, p. 739), for example, defines language dominance as "a global measure of relative frequency of use and proficiency in each language", which is particularly interesting because it is so closely aligned with the two dimensions of the bilingual experience distinguished by Fishman, Cooper and Ma (1968), Grosjean (2010) and Luk and Bialystok (2013). Montrul, this volume, also advocates a wider conceptualization of language dominance, and includes in her definition a linguistic proficiency component, an external component (input), and a functional component (context and use).

Researchers who see language dominance as relative proficiency focus on one or several of the many different components that are generally seen to be part of the construct of language proficiency (grammar, vocabulary etc.). Language dominance is clearly visible at the level of the lexicon in that bilinguals have words in one of their languages for concepts about which they talk in that language, whilst they may not have translation equivalents for those words in the other language. Because most studies focus on one language level only (but see LaMorgia, this volume and Kupisch, this volume), we do not know whether a bilingual who has a larger vocabulary in one of their languages also necessarily has a better command of the syntax or the phonology of that language. (Romaine, 1989, p. 13) notes there

is no "necessary connection between ability in one level and another", but also notes that in practice there are some interdependencies between these. Kupisch and van de Weijer (this volume) found, for example, that the French-German bilinguals with different migration histories showed clear differences in dominance on a cloze test and an accent test in both languages but with respect to gender assignment there were only differences in German between the two groups of French-German bilinguals. In their study of language dominance among Mexican and Cuban immigrants to the US, Bahrick, Hall, Goggin, Bahrick, and Berger (1994, p. 275) found moderate correlations between dominance scores obtained from lexical decision, category generation, and vocabulary recognition tasks but none of these were correlated to an oral comprehension test. Thus, the authors conclude that dominance is "quite task-specific" (see below for further discussion of this study). This clearly illustrates the importance of the choice of instruments to measure dominance. To what extent language dominance in one component of language is reflected in another component has not been investigated in great depth so far. For this reason, Paradis, Genesee, and Crago (2011) suggest that studies of dominance should consider a variety of linguistic and non-linguistic aspects and should include the analysis of a variety of linguistic levels (see also LaMorgia, this volume).

Researchers who adhere to the view that language dominance cannot be understood without involving the concept of language *use* generally make use of the notions of *domains* or *functions* of language (Birdsong, this volume; Grosjean, this volume; Mackey, 1976; Skutnabb-Kangas (1981). Grosjean notes that bilinguals should be studied in terms of their total language repertoire, and the domains of use and the functions of their various languages should be taken into account (see the discussion of the Complementarity Principle in Grosjean's chapter). Grosjean also reviews the sociolinguistic literature which provides detailed information about the fact that bilinguals use their languages for different domains.

While this has been known for many years (Grosjean, 1985), researchers have only recently become aware of the importance of the Complementarity Principle for experimental research into bilingualism.

Mackey (1976) highlights the importance of measuring degree of bilingualism by focusing on *compétence linguistique* "linguistic competence," which corresponds to what is generally referred to as proficiency in the English speaking world, and *aptitudes de base* "basic aptitudes", which refers to the four skills of reading, writing, listening and speaking (see also Carroll (1961), for a similar distinction between proficiency and skills in the field of Second Language Acquisition SLA). In the context of studies of language dominance it is important to consider skills separately from proficiency because bilinguals do not necessarily have oral as well as written skills in their two languages: Turkish-German bilinguals in Germany, for example, often have a higher ability in spoken than in written Turkish (H. Daller, Van Hout, & Treffers-Daller, 2003; Dirim & Auer, 2004). Bilinguals can also differ in their receptive and productive command of each language (Romaine, 1989). In some cases the differences are so large that the bilinguals can only understand one of their languages but not speak it (Sherkina-Lieber, Perez-Leroux, & Johns, 2011; Wald, 1974). For the purposes of the present chapter we employ the term *use* as a generic umbrella term to cover listening and speaking, as well as reading and writing. Our interpretation of the term *language use* also includes the different stages a pre-verbal message needs to go through in language processing, as described in (Levelt, 1993) blueprint of the speaker (the conceptualizer, the formulator and the articulator, as well as the speech comprehension system), because the four skills are built on these internal processes.

Studies of language dominance rarely make reference to models of L2 acquisition or models of language testing, probably because theories and findings from different fields are not often perceived outside their disciplinary boundaries. However, a brief look at one of

these models is helpful because it provides a comprehensive perspective on what it means to know and use language and can thus help us to get more insight into what it means to be dominant in one or the other language too. In addition, it can help uncover areas of language ability that have hardly been investigated in relation to language dominance so far.Bachman and Palmer (2010) model of language ability, which is widely used in the field of language testing in a second language but not well known outside this field provides a very helpful description of this construct. Bachman and Savignon (1990, p. 81) describe the notion *language ability* as "the ability to use language communicatively" and suggests it is "quite different" (Bachman & Palmer, 2010, p. 57) from language proficiency: language ability is a broad construct which covers a wide range of different kinds of knowledge, and builds on the key notion of communicative competence (Hymes, 1972). The model distinguishes two main components of language ability: language knowledge and strategic competence. Language knowledge is divided into organizational knowledge (grammatical and textual knowledge) and pragmatic knowledge (functional knowledge and sociolinguistic knowledge). Interestingly, research on language dominance has so far mainly concentrated on areas that are covered by grammatical knowledge in Bachman and Palmer's model, namely syntax, morphology, phonology, phonetics and vocabulary, but we know much less about language dominance in relation to other components of the model. Bilinguals' sociolinguistic knowledge (such as their understanding and use of dialects and language varieties), or their functional knowledge (such as knowledge of manipulative functions or imaginative functions) have hardly been investigated. While there is some evidence that L2 users can develop sensitivity to dialect differences in their second language (Eisenstein, 1982), we do not know to what extent it is possible for bilinguals to develop the same degree of sensitivity in dialect recognition in two languages and thus become "balanced" with respect to this aspect of language knowledge. Similarly, it has not been investigated to what extent

bilinguals are balanced with respect to their knowledge of genres, idioms or figures of speech. In other words, there is still a wide field of language ability that remains unexplored in relation to language dominance.

Balanced versus dominant bilinguals

In this chapter we have so far used the term "balanced" without scrutinizing it in any detail, although the term is used in different ways by different researchers in the field. Before delving into the meaning of the construct, it is important to note that the notion of balance is particularly relevant for those authors who assume that the cognitive advantages of bilingualism are only found among balanced bilinguals with a high proficiency in both languages (Cummins, 1976; Peal & Lambert, 1962). More recently, Bialystok (2009: 9), in a review of the advantages and disadvantages of the bilingual experience, formulated this very clearly. She notes that the research which shows an advantage for bilinguals

> "was based on individuals who were fully bilingual and used both languages regularly (often daily) to a high level of proficiency. Clearly, deviations from this ideal would modify the effect of the experience. How much bilingualism is necessary, what type of bilingualism is required, and what particular language pairs maximize these influences are all questions that are still waiting to be answered."

Bialystok, Craik, and Luk (2008) also show that levels of language ability in both languages may affect executive control in bilinguals. While many authors have shown that bilinguals are slower at tasks which involve lexical retrieval, Bialystok et al

demonstrate that such a disadvantage disappears if bilinguals are carefully matched to monolinguals with respect to lexical knowledge. However, informants' language proficiency in both languages and language dominance have not been described in sufficient detail in many studies to be able to draw firm conclusions on the conditions under which the bilingual advantage manifests itself. The impact of language dominance (and other variables) on executive functioning continues to be the subject of important debates in the field (Costa, Hernández, Costa-Faidella, & Sebastián-Gallés, 2009).

Let us now turn to the construct of "balance" itself and focus on how balance can be defined along the two dimensions distinguished above, namely the language proficiency dimension and the language use dimension. If we define dominance in terms of the *proficiency* dimension, a balanced bilingual would be one who displays equal proficiency in both languages across a range of different variables (grammar, vocabulary, etc.) or across the four skills (reading, writing, listening and speaking). However, as De Houwer and Bornstein (this volume) point out, it is difficult to conceptualize dominance as a global phenomenon which affects all aspects of knowledge, skill, preference, and/or use. Although bilinguals often have intuitions as to which language is their *overall* stronger one (Harris et al., 2006), upon closer scrutiny it is often the case that dominance varies according to the domains and the functions for which the languages are used or to the instruments used to measure it (Bahrick et al., 1994). It becomes if even more difficult to conceptualize what it means to be a balanced bilingual if the construct is interpreted as referring to "perfect balance" between two languages. For this reason, Favreau and Segalowitz (1982) prefer the term *fluent bilinguals* over balanced bilinguals. Before explaining why conceptualizing balance is problematic, we will look at a few of the early sources on bilinguals which have used the term *balance* (see also Romaine, 1989, for further discussion).

Lambert (1956) uses the term “balanced bilingual” in relation to an advanced L2 learner who produces the same number of word associations as a native speaker in response to a target word in his/her L2, but indicates at the same time that there will be qualitative differences between this learner’s word associations and those of native speakers, for example in that the L2 learner will give more stereotypical answers. The author also suggests reaction time measures would be an efficient way to measure degree of dominance or balance, but thinks a comprehensive test of bilinguality would need to be based on results from a group of different tests. Lambert, Havelka, and Gardner (1959, p. 78) also use the term “balance” in relation to bilinguals. They made use of several measures of automaticity to distinguish between dominant bilinguals (those showing statistically significant differences in speed of response between their two languages) and balanced bilinguals (those showing similar speed of response in both languages). Lambert et al. also computed difference scores by subtracting reaction times in one language from the other, which they assume indicated “degree of bilingualism”, and allowed for the possibility that some informants are “perfectly bilingual”, that is obtain a difference score of zero, although it remains unclear whether there were any such bilinguals in their sample. The authors appear to have interpreted the notion of balance in a generous way in that 30 out of 43 French-English bilinguals in their sample were considered to be balanced, although they do not specify what exactly the cut-off point for “balance” was in their study.

Other authors use the term *relative similarity* to define balanced bilingualism. Peal and Lambert (1962) in their widely cited study on the cognitive effects of bilingualism, controlled for degree of bilingualism by using only bilinguals who had attained a relatively similar degree of competence in both languages, i.e. "balanced" bilinguals. In a similar vein, Cummins (1976: 22) defines balanced bilinguals as those who have achieved “relatively

equal competence in both languages" or who have attained "a similar level of skills in both languages" (p. 37). Cummins also recognises that it is possible to be balanced at different levels in that respondents might, for example, produce either a large number of or a small number of words in a word association task in each language. Hamers and Blanc (2000) concur that the notions of balance and competence need to be kept separate, and note that being balanced does not necessarily imply a high level of competence in both languages (see also Birdsong, this volume). Bialystok et al. (2008) agree and split their informants into a high and a low proficiency group, after which they established for each individual within both groups whether they were dominant or balanced bilinguals. Hamers and Blanc assume balance refers to a state of equilibrium between the two languages, but it is not clear when such a state of equilibrium would be achieved, as the authors claim this does not necessarily imply being able to use both languages for all functions and all domains (see also Treffers-Daller, 2011). The latter point is particularly important, as it seems difficult for bilinguals to be balanced if they are using their languages for different purposes.

Birdsong (this volume) distinguishes beween an *across domain* approach and a *within domain* approach to dominance in language use. If the first approach is taken, a balanced bilingual could be defined as someone who uses language A for half of the domains investigated and language B for the other half of the domains. If the second approach is adopted, a balanced bilingual would be someone who uses both languages with equal frequency within a specific domain. However, as the examples in Grosjean (this volume) illustrate, the distribution of languages in the everyday life of bilinguals is often more complex than this. Grosjean illustrates the complexity of language use by bilinguals making reference to Bilingual 8 in Jaccard and Cividin (2001), who uses French and Italian in different proportions to talk about different topics. Thus, s/he uses Italian and French 50% of the time to talk about leisure, but French 40% and Italian 60% of the time to talk about

administration. For education the percentages are again different: s/he uses French 85% of the time and Italian 15% of the time in this domain. In multilinguals, the distribution of labour between the languages is even more complex. It is hardly possible to conceptualize the notion of balance if one takes a serious look at the complexities of language use both within and across domains in bilinguals and multilinguals. In fact, as the examples discussed here illustrate, being balanced is at odds with the Complementarity Principle (Grosjean, 1997).

As Grosjean (this volume) points out, bilinguals have translation equivalents for only 30-37 percent of their words, which means that the lexicon is to a large extent language-specific. Bilinguals are unlikely to know exactly the same number of words in each language in all domains. Instead, the words they know in each language will be related to the domains for which they use each language (see Grosjean, this volume, for further discussion). Of course, asFishman (1971, p. 560) puts it, "any society producing functionally balanced bilinguals who used both languages equally well in all contexts would soon cease to be bilingual because no society needs two languages for the same set of functions." In addition, if we consider in more detail what it means to know a word (Nation, 2001), it quickly becomes clear that being "perfectly balanced" at the level of vocabulary knowledge is not a realistic option. In Nation's overview, vocabulary knowledge is seen as comprising knowledge about form, meaning and use. Knowledge of a word entails, for example, knowing how it is being used in collocations, which affixes can be used in combination with a particular root, which associations it has with other words, what register it belongs to etc. Monolingual children and adults differ widely from each other with respect to the number of words they know (Bates, Dale, & Thal, 1995; Nation & Waring, 1997) and also in the type of knowledge they have about each word, although vocabulary depth has been studied much less than vocabulary size (Read, 2007). Because mastering the vocabulary of a language is a truly mammoth task, it is very difficult to imagine that a bilingual would possess an equal amount

of knowledge of all these subsystems of vocabulary knowledge in both languages. Instead, it is much more likely that *all* language users (monolinguals and bilinguals) have *partial* knowledge of words, and that the specific knowledge a speaker has of the vocabulary of his/her languages is linked to the specific experience they have with each language: a particular user might, for example, know that the word *table* is a noun and refers to a "piece of furniture with a flat top and one or more legs, providing a level surface for eating, writing, or working and can be used to hang up clothes" (Oxford online dictionary. http://www.oxforddictionaries.com/), but may not know that it is also possible to use this word as a verb in the construction *to table a motion* where it means "present formally for discussion or consideration at a meeting" (Oxford online dictionary). Even if researchers wanted to investigate all these different aspects of vocabulary knowledge as distinguished by Nation (2001), it is not clear how one would measure these, as there are only a few reliable and valid tools of vocabulary available for a limited number of languages (see Read, 2007, for an overview). To ensure measurements are comparable across typologically different languages would be another gigantic task which has only been accomplished for a few tests, such as the Peabody Picture vocabulary task (D. M. Dunn & Dunn, 2007) and the MacArthur Communicative Development Inventories (Fenson et al., 1993), for which comparable tests exist in a few languages.

The notion of balance is also problematic at other levels of analysis, for example in phonology. The literature on the production and perception of sounds and prosodic features, and their acquisition by monolinguals, bilinguals and L2 learners shows that it is possible for some bilinguals to separate two phonological systems from the beginning (Johnson & Wilson, 2002; Kehoe, 2002), but other bilinguals use systems which differ from monolinguals of either language (Bosch, Costa, & Sebastián-Gallés, 2000; Mack, 1989). It is possible that the outcome depends in part on age of acquisition of each language, with early

bilinguals being better at separating two phonological systems than late bilinguals ((Flege, MacKay, & Meador, 1999), but (Flege et al., 2002) also report that even early bilinguals in their study were considered to have an accent in English. With respect to perception of speech sounds, there is evidence early French-English bilinguals' perception of English vowels ''approximated but did not match'' that of monolinguals (Mack, 1989:187).

One variable that has been studied in detail in second language learners and bilinguals is Voice Onset Time (VOT). VOT refers to the time between the release of the air and the moment the vocal cords start to vibrate when a speaker produces a consonant ((De Groot, 2011, p. 459). It is well known that languages make stop voicing distinctions at different points along the VOT dimension. The results from research show that it is possible for some bilinguals to maintain phonological voicing contrasts in each language while code-switching between the two (Grosjean & Miller, 1994), but Goldrick, Runnqvist, and Costa (2014) found convergence in VOT values for Spanish-English bilinguals under experimental conditions which required bilinguals to unexpectedly switch languages between trials. This is relevant for our discussion about balance, because the available evidence shows that being "perfectly balanced" at the level of phonology (that is, for example, maintaining different VOT values or subtle distinctions in vowel qualities for each language at all times) is a virtually impossible task for many bilinguals. Although a balanced bilingual is sometimes defined as a person who shows little interlingual interference (Lambert, 1990), it is well known that bilinguals often have an accent, which is an indication of convergence between the phonetic/phonological systems of two languages. This shows that keeping the two systems completely separate is too tall an order for many, as can be seen in the work of Kehoe, Lleó, and Rakow (2004) who discuss the difficulties experienced by some bilingual children in acquiring different VOT values for their two languages).

Similar problems in conceptualising a perfect balance at other levels of language proficiency (e.g. morphology or syntax) could also be discussed here, but space does not allow us to elaborate on this further. However, the wide-spread occurrence of transfer (sometimes called interference in the psychological literature) in child and adult bilinguals (Treffers-Daller & Sakel, 2012) shows that language competence, use and processing are different in monolinguals and bilinguals. It is therefore completely unrealistic to expect bilinguals to be "balanced" at all these levels and with respect to all variables that could be investigated. Instead, we concur with Romaine (1989: 18) who states that

> "The search for the true balanced bilingual depicted in some of the literature on bilingualism is elusive. The notion of balanced bilingualism is an ideal one, which is largely an artifact of a theoretical perspective which takes the monolingual as its point of reference."

In the current volume we have avoided using terms such as *unbalanced* or *non-balanced* (except in quotes from the other authors), although these terms are frequently found in the literature on bilinguals. These terms might be interpreted to imply that being balanced is the normal or even the most desirable state for a bilingual to achieve, which we argue is unrealistic. Other researchers use the term "full competence" when talking about highly proficient bilinguals, which is equally unfitting because it entails conceptualizing linguistic competence in terms of an implicit container metaphor, that is a container which can either be "full" or "partially full" (Romaine, 1989: 236). As explained above in relation to vocabulary knowledge, it is unlikely that full competence is achievable at the level of vocabulary, nor does anyone claim that it is impossible to add new words to a person's vocabulary storage because it is full. We also need to be aware of the fact that the majority of the studies into 2L1 bilinguals have been done in Western Europe and North America, where raising children with the one parent-one language strategy is relatively common, although not the most

frequently used strategy - see De Houwer (2007) for a detailed analysis of different input patterns to bilingual children in Flanders - and language separation in the family is valued. Input patterns to bilingual children in other cultures may differ from these. To avoid a Western bias in studies on language dominance, we urgently need more information about bilingual practices in Subsaharan Africa or the Indian continent, where growing up with more than two languages is the norm and several languages are used in the home of bilingual families, before we can begin to evaluate whether being balanced is the norm across the world and how relative language dominance impacts on cognition.

The fact that "balanced bilingualism" is seen as a positive value in the wider public and sometimes seen as an aim for children who are raised with two languages may in part stem from the fact that symmetry is preferred over asymmetry in a wide variety of fields, ranging from the physical sciences to fields such as architecture, music, maths or biology (see the journal *Symmetry*, which is entirely devoted to the analysis of symmetry across fields (http://www.mdpi.com/journal/symmetry). It has often been shown, for example, that symmetrical faces are preferred over asymmetrical ones (Perrett et al., 1999) and symmetry is interpreted as a sign of good health in humans (Penton-Voak et al., 2001). However, it is questionable whether perfect symmetry exists, and as we have shown in this chapter perfect bilingualism is equally elusive. A comparison with the field of handedness may be helpful here. In its rarity, perfect balance is comparable to ambidexterity. As pointed out by Birdsong (this volume) only one percent of the population is truly ambidextrous in that they are able to do any task to the same level of skill with either hand. Importantly, no one sees ambidexterity as a goal that needs to be achieved in raising children. This goal is not only unrealistic but also unnecessary because a distribution of labour between both hands works very well for most people. In addition, consistent right-handers or left-handers are not described as "unbalanced" just because they use one hand more for a range of tasks. Similarly, setting

balance as the goal for 2L1 acquisition is unrealistic. Describing dominant bilinguals as "unbalanced" is equally inappropriate (though sadly very common in the academic literature) as it appears to imply that "balance" is the default or the preferred outcome of bilingual development. Cook (1995) makes it very clear that the balanced bilingual is a fiction that obscures the normal situation, and notes that the same objections apply to the idealized construct of the balanced bilingual and to the definition of competence as the ideal speaker-hearer's knowledge of a language. The same point is made by Baetens Beardsmore (1986) and Skutnab Kangas (1981). Although we have seen that *overall* balance with respect to use or proficiency in two languages is difficult to conceptualize, it is possible for bilinguals to be more or less balanced with respect to a *specific criterion* (e.g. scores on the PPVT in two languages or percentage of use of each language across different domains of usage). Pursuing research into the construct of balance and its operationalization also remains important in light of the discussion around the link between language dominance and executive functioning with which we started this section. We will look in more detail at different variables which have been used to operationalize dominance in section 3.

Is language dominance static or dynamic?

There is general agreement in the literature that language dominance may vary with time over the developmental trajectory of the two languages (Döpke, 2000; Lanza, 2004; Ronjat, 1913). In particular in children, there is much evidence that dominance patterns can change in the course of development (see also De Houwer & Bornstein, this volume; Schmeißer et al. this volume, for further references and a fuller discussion). De Houwer and Bornstein show, for example, that for two thirds of the French-Dutch bilingual children in their longitudinal study, different dominance patterns in children's vocabulary knowledge were found at 13

months and at 20 months, whilst for only one third of the children the same language was dominant at both measurement points. Of course, to what extent bilinguals are seen to change dominance patterns over time depends crucially on the cut-off point that is chosen to separate dominant bilinguals from relatively balanced bilinguals (see section 3).

Studies of changes in language dominance patterns among adults provide different results. In their study of highly proficient German-French adult bilinguals, Kupisch and Van de Weijer (this volume) found that the childhood environment of their informants was the main predictor of language proficiency in each language. The current environment of their informants was not so important, although the study of the informants' accents revealed that participants who spoke more German per day were more likely to be classified as foreign sounding in French than participants who spoke less German per day. The authors conclude that language dominance is unlikely to shift during adulthood, even upon changing the place of residence. Treffers-Daller and Korybski (this volume) also found that few of their Polish-English informants had become English-dominant in the course of their stay (three or six out of 22, depending on the choice of the cut-off criterion). Two of the three who had become English-dominant had lived in the UK for over 50 years (one was born in the UK and the other had arrived at the age of 5).[3] Thus, these two informants had lived in their host country for a considerably longer period of time than the informants in Kupisch and van de Weijer, which may explain the differences between both studies.

One of the most impressive longitudinal studies of language dominance to date is the one by (Bahrick et al., 1994). For a period of three years, they studied changes in language dominance among 800 Cuban and Mexican immigrants who had been living in the United

[3] Only one (a 28 year-old male) in this data set had become English dominant in a shorter period of time, namely after three years of residence.

States for up to fifty years and were between the ages of 10 and 26 years when they came to the US. The authors used a lexical decision task, a category generation task which requires participants to decide which category an object belongs to (focused on the semantic categories of clothing and body parts), and a vocabulary recognition task where participants had to identify synonyms for a target word from among five alternatives with the same part of speech. They found that performance was consistently better on the Spanish subtests than on the English ones, except for the category generation task. For this task, participants who had been in the US for at least eleven years performed better in English. Whilst the Spanish scores were higher on average than the English scores, the authors point out that it cannot be concluded that all participants were Spanish-dominant, in the first place because it is difficult to ascertain the tests were equally difficult in each language, and in the second place because one would need to compare individual language dominance scores and not just group averages. They therefore calculated difference scores for each individual participant, by subtracting the scores in one language from scores in the other language, but decided to disregard the size of the difference. Thus, a participant who obtained a score of 18 out of 20 in both languages on the vocabulary recognition task, for example, was considered to be a balanced bilingual, but a participant who scored 19 on this task in English and 18 in Spanish was considered to be English dominant. In other words, any difference between scores (however small) led to this participant being classified as dominant in either Spanish or English. This choice of cut-off point means that only very few participants were classified as "balanced bilingual" in this study. Interestingly, the authors also show that there is an effect of length of residence and age of acquisition on language dominance: the proportion of English-dominant subjects increased with length of residence in the United States on the four tasks they used. Eventually, in the course of their stay in the US, 60 percent of the

participants became English-dominant on the category generation task, versus 35 percent and 29 percent of participants on the lexical decision and the vocabulary recognition tasks.

A detailed example of a person for whom language dominance changed four times over a period of 50 years can be found in Grosjean (2010).Thus, there is a considerable amount of evidence that it is possible for language dominance to shift during adulthood, but whether or not this happens depends on a range of factors, in particular of course how frequently and for which purposes a person uses each of his/her languages. This brings us to the reasons for language dominance, which will be discussed in the next paragraph.

Explaining language dominance: the role of input and language use

Among the key factors which explain the emergence of language dominance in children and changes to language dominance later in life researchers often mention the quantity and the quality of the input bilinguals receive in each language (Döpke, 1992; Silva-Corvalán, 2014; Yip & Matthews, 2006). The importance of input is particularly clear in the literature on language abilities of heritage language speakers. Heritage speakers are a specific category of bilinguals in the sense that they learned language X – the 'heritage language' – as an L1 in childhood, but became more proficient or dominant in another language later in childhood (Benmamoun, Montrul, & Polinsky, 2013). The fact that many heritage speakers become dominant in the language of the wider society is sometimes attributed to the fact that they do not receive as much input in the home language, for example because they may not receive schooling in it (Cabo & Rothman, 2012). On the basis of analyses of Italian-English bilingual children living in the UK or Ireland, LaMorgia (this volume) concludes that "a weekly average of 20 percent of input may not be sufficient to develop a heritage language as a strong language." What the input to heritage speakers consists of exactly, and

how this impacts on their language development is the subject of intensive debates which cannot be summarized here in any detail, although most researchers agree that the quality and the quantity of input are key factors in the development of language dominance in this group.

We should, however, not consider only the input to learners or bilinguals in explaining dominance but also what they *do* with this input. Human beings are not passive recipients of input but active participants in social situations in which they use language for communicative purposes. Grosjean (2008: 24; this volume) makes this very clear in saying that language dominance is a reflection of the Complementarity Principle. Of course how bilinguals distribute their languages over different domains and functions depends on micro as well as macro sociolinguistic factors: the languages spoken by bilinguals often have a different status and are used for different functions in the society in which they live, which brings us to the issue of *societal language dominance* or *predominance* (see section 1). Many authors point out that it is often the language to which the bilingual had more exposure outside the home (the predominant language,) which develops into a bilingual's dominant language (Kupisch & van de Weijer, this volume; LaMorgia, this volume; Meisel, 2007; Schmeißer et al., this volume; Silva-Corvalán, 2014).

In the field of 2L1 acquisition, many researchers have tried to explain why some children develop speaking skills in both languages while others develop productive skills in one but only receptive skills in the other, and thus do not develop "balanced bilingualism". In this context, parental strategies, such as the one parent one language strategy (Ronjat, 1913) are often evoked as being key to ensuring the child learns to speak both languages. However, there is little evidence to support this view. In a detailed analysis of questionnaires focused on parental input and strategies used to raise children bilingual among 1899 families in Flanders, De Houwer (2007: 420) concludes that the one person–one language strategy "appears to be neither a necessary nor a sufficient condition" for children to learn to speak two languages,

and the same conclusion is reached by Schmeißer et al., (this volume). Instead, more detailed analyses of what happens at the discourse level in bilingual families are needed to explain the different outcomes of 2L1 acquisition (see also Gathercole & Thomas, 2009, for a critique of the one person-one language strategy in the Welsh context).

It is also important to realize that in some cultures, language use may not be so neatly separated by interlocutor or by domains. The mixed use of both languages in conversations, even when talking about one topic to the same interlocutors, can become the norm in some bilingual situations, as is the case for example for urban Wolof speakers in Dakar (Senegal), who mix Wolof and French on a daily basis (Swigart, 1992) or Lingala-French bilinguals in Belgium (Meeuwis & Blommaert, 1998) where new mixed varieties have emerged. Similar observations were made in other countries on the African continent, such as Ghana (Nartey, 1982), South-Africa (Finlayson & Slabbert, 1997) and Tanzania (Blommaert, 1992), to name but a few. Put differently, code-switching is an unmarked choice (Myers Scotton, 1983) in many social situations, and the need to separate languages strictly by domains may not be felt as strongly in each culture. According to Romaine (1989), the mixed languages strategy may be the most common one in multilingual societies, but it is also the least studied one. We still know too little about language use in cultures outside Europe and North America to be able to say how code-switching practices by young children and their carers impact on bilingual or multilingual development in children in general and the development of language dominance in particular. From the few accounts that we have (Paugh, 2005) it is clear that mixing languages is very common in particular in unsupervised play. Further studies of the ways in which children grow up with more than two languages in multilingual situations in Africa and Asia are urgently needed as these can throw a new, non-Western perspective on language dominance.

3. The operationalization and measurement of language dominance

In this section we look at a number of different ways in which researchers have operationalized language dominance. The first important point to be made with respect to the operationalization of the construct of language dominance is that it is problematic to try to obtain a measure of "global language dominance" (e.g. by subtracting scores on purportedly generic measures for each language), because there is no such thing as global dominance. As argued above, there are two key dimensions to language dominance: language proficiency/ability and language use. Because language ability is multidimensional (Bachman & Palmer, 2010), it is not possible to measure this construct or any constructs that are derived from it, such as language dominance, with a single index that covers all its different dimensions. Second, as Grosjean (this volume) points out, the problem with global dominance is that it does not take into account how the languages are distributed over the domains.

The second point we would like to make is that any measure of language dominance should preferably be gradient, because bilingualism is not a categorical variable (Luk & Bialystok, 2013) and simple classifications which divide informants into dominant and balanced bilinguals are not sufficient to capture the bilingual experience. Degree of bilingualism or language dominance is therefore best measured on a gradient (interval) scale (A. L. Dunn & Fox Tree, 2009). If language dominance is measured in this way, it is possible to use this variable subsequently as a predictor variable in a regression analysis to establish to what extent it can explain variance in the researcher's chosen dependent variable (Birdsong, this volume; Treffers-Daller & Korybski, this volume). The latter point is crucially important to demonstrate the validity of any indices of language dominance, because a valid index would be expected to predict performance on other measures (Flege et al., 2002). Of course it

would only be useful to compute an index of language dominance if this index explained more variance in the researcher's chosen dependent variable than other predictor variables, such as Age of Acquisition (AoA) or Length of Residence (LOR), which do not involve the computation of complex measurements. Once a continuous measure of dominance has been obtained it is possible to subsequently choose cut-off points on the interval scale that are appropriate for classifying the bilinguals into "dominant" and "balanced" groups, should this be necessary for the specific aims of a study.

Because *generic* and *subjective* evaluations of language dominance (self-ratings and questionnaires) are problematic for a variety of reasons, researchers often prefer to use *specific* and *objective* forms of assessment (tests of different types). While some researchers argue that there is a generic component to language ability (Eckes & Grotjahn, 2006), in most cases tests are developed to measure specific components of language ability or specific skills (see also Montrul, this volume). Bachman and Palmer (2010) recommend researchers use the different components of language ability (preferably as distinguished in their model) as the basis for their assessments, and specify the skills that are to be measured as part of the task set to test takers. An example of this can be found in the documentation about the Vocabulary Size Test (VST) developed by Nation and Beglar (2007), which is widely used to measure bilinguals' vocabulary knowledge in English. In the information and test specification for the VST, Nation (2012) explains that the test "is designed to measure both first language and second language learners' written receptive vocabulary size in English", and notes that it is not intended to measure listening vocabulary or the vocabulary that is needed for reading or writing. In addition, Bachman and Palmer note that language use is different across domains, and this should be taken into account in the construction of a language test (see the discussion about Target Language Use domains in their book), which strikes a chord with Grosjean's Complementarity Principle.

Next, we will look at subjective evaluations first and then at objective measures of language ability.

Subjective evaluations of language dominance: self-ratings and questionnaires

Self-ratings are a very popular instrument to obtain information about language dominance, probably because they are easy to administer. However, the validity of such self-ratings is questionable (Ross, 2006), certainly if they do no differentiate between different skills and/or different components of language ability (Hulstijn, 2012). As Zell and Krizan (2014) have shown, correlations between self-ratings and objective performance measures are stronger when self-ratings are *specific to a given domain* rather than broad, and when performance tasks are objective, familiar, or low in complexity. It is very common in the field of bilingualism research which focuses on adults to make self-ratings more specific by asking informants to rate their own competence in reading, writing, listening and speaking, but it is doubtful whether these are sufficiently detailed to capture the complexity of language use and proficiency across a range of tasks.

A brief excursion to the field of language testing is helpful here to clarify the validity issues involved in using self-ratings based on the four skills. Bachman and Palmer (2010) note that a division into four skills ignores the fact that there are large differences between written tasks. Thus, an email and an academic essay are very different from each other in obvious ways. In addition, many tasks people carry out involve more than one "skill": speaking in a communicative situation always involves listening too and writers tend to read over what they have written. Therefore Bachman and Palmer conclude that construct definitions in terms of the four skills are not useful, and the construct validity of self-ratings or tests which measure competence at such a generic level in the four skills is therefore

doubtful. An alternative would be to use self-ratings of the different components of language ability, but as Hulstijn (2012) points out, it is very difficult for non-experts to assess their own language ability in, for example, pronunciation, vocabulary, grammar etc. Therefore this is probably not a fruitful avenue.

Self-ratings are sometimes used as part of a more detailed questionnaire which provides background information about the informants ((A. L. Dunn & Fox Tree, 2009; Gertken, Amengual, & Birdsong, 2014; Li, Zhang, Tsai, & Puls, 2014; Marian, Blumenfeld, & Kaushanskaya, 2007). Not all of the questions included in these questionnaires tap the two dimensions of the construct of language dominance as discussed in this chapter. In particular, we think it is important to separate questions which tap into the construct itself from questions which tap into the causes of language dominance (e.g. questions about an informant's language history or his/her attitudes to different languages). Similarly, the question "If you had to choose which language to use for the rest of your life, which language would it be?", which is included in Dunn & Fox Tree's (2009) Quick, Gradient Bilingual Dominance Scale (an adaptation of a question formulated by Cutler, Mehler, Norris, and Segui (1989) do probably not tap language dominance but rather language loyalty or language identity (see also Grosjean, this volume, for further comments on this question). While it is no doubt useful to develop standardized questionnaires to obtain personal background information about informants, we need to be careful not to confuse the different constructs that are measured by the range of questions. It is also problematic to compute a generic dominance score on the basis of answers to questionnaire items if the questions do not measure the same construct.

The questionnaires mentioned above do not only contain questions aimed at operationalizing the language proficiency dimension of language dominance but also some questions about the frequency with which informants use their languages with different

people and in different social situations. However, it often remains unclear how this information can be used to demonstrate how language-specific the different domains or functions are. There is no general language use index that can clarify this issue. Grosjean (this volume) filled this lacuna by developing a Complementarity Index (CI) which indicates to what extent the topics or activities are language-specific. The index ranges from 0% to 100%, where a score close to zero would mean that all topics or activities are covered equally by the two languages and a score close to 100% that all topics or activities are language specific. Anyone scoring 50% percent on this index would use one language for half of the topics or activities and two languages for the other half (see Grosjean's chapter for the exact computation). This index is very easy to compute (and therefore usable in non-academic settings too), and can also be very easily adjusted to bilingual as well as multilingual settings. In addition, it describes language use at a much higher level of granularity than any of the questionnaires which have been proposed in the literature, and therefore provides much more precise information about the distribution of labor between bilinguals' language use patterns and overlap between use of languages within domains.

Objective tests of language dominance

In this section, we present a selection of studies in which language dominance is operationalized in a variety of ways along the proficiency dimension or the language use dimension. In the latter we include measures of fluency and automaticity. The aim of this section is not to be comprehensive, but to point to a number of different approaches to the issues of dominance and balance, and in particular to how researchers have dealt with the choice of a cut-off point which separates "balanced bilinguals" from "dominant ones" (see Table 1 for a selection of studies).

== table 1 approximately here ===

Before doing this we need to briefly point to the difficult issue of norms. In many studies, bilinguals are compared against monolinguals, although setting monolingual norms is inappropriate for reasons outlined in the introduction to this volume. In an ideal world researchers would need to refer to bilingual norms for their tests that are appropriate for the type of bilingual that is being studied. As Gathercole (2013) points out, bilinguals need multiple norms, because there are so many different types of bilinguals, but developing such bilingual norms is very difficult. Mahon and Crutchley (2006), for example, provide information about test scores for typically developing children with English as an Additional Language (EAL) on the British Picture Vocabulary Scales (L. M. Dunn, Dunn, Whetton, & Burley, 1997) but do not claim their results are normative for this group or for any other group. The challenges involved in developing norms for the wide range of bilinguals are truly enormous, and cannot be discussed in any detail here. However, there is a growing awareness of the importance of developing tests for bilinguals that are appropriately normed for particular groups of bilinguals. For further discussion the reader is referred to Gathercole (2013).

If researchers want to compare proficiency in two languages on the basis of tests, it is important to realize that creating parallel versions of the same test in two languages is extremely difficult: vocabulary items cannot simply be translated from one language into another because of cultural differences and the issue of linguistic relativity (the fact that the conceptual distinctions in one language do not always correspond to those in another language (Pavlenko, 2014). According to Bedore et al. (2012) using parallel versions of tests, such as the Spanish version of the Peabody Picture Vocabulary Task (L. M. Dunn, Lugo, Padilla, & Dunn, 1986) to measure language dominance is not as straightforward as it seems, as the two versions were not created for the purpose of comparing scores across languages.

Ascertaining they are indeed equivalent is very complex. Gollan et al. (2012) also mention the problem of establishing whether tests in both languages are equally difficult.

Some researchers appear to have chosen a zero difference as the cut-off point in operationalizing language dominance. Mägiste (1992) for example, studied reaction times in picture naming and naming of two-digit numbers in a cross-sectional study among German children who had moved to Sweden and were enrolled in a German school in Stockholm. The children's LOR in Sweden ranged from 1 to 9 years. She shows that reaction times on both tests increase for German and decrease for Swedish as length of residence increases. This way, Mägiste shows that the primary school children reach "a point of balance" in picture naming after 4 years of residence in Sweden, whilst the secondary school children reach this point two years later. For the naming of two-digit numbers both groups reached "balance" after 3-4 years of residence. Balance in this study is operationalized as the crossing of the curves for each language, that is at the point where – at group level – there are no differences in reaction times between the two languages. However, the author does not compute differences between scores at individual level, so we do not know how many children were "balanced" according to this criterion in each group.

In the field of 2L1 acquisition, language dominance measures are often based on transcripts of spontaneous speech of the children, because formally testing small children is very difficult. Deuchar and Muntz (2003) studied a Spanish-English bilingual child, whom they followed from age 1.7 to age 2.6, which is interesting from the perspective of the operationalization of the distinction between balanced and dominant bilinguals. The authors used a range of measures that are widely used in L1 acquisition: mean length of utterance (MLU), upper bound (number of morphemes in the longest utterance in the records of each child's language), percentage of multimorphemic utterances (MMUs) and word types for each language, and computed a composite dominance index on the basis of the MMUs and

the word types. While this overall dominance score fluctuates somewhat around 50%, the authors conclude that this does not warrant the conclusion that the child's dominance shifted from one recording to the next. Rather, they conclude that the child was a balanced bilingual for the duration of the study. This is important because it illustrates that being balanced does *not* mean obtaining exactly the same score in both languages, because this is virtually impossible, and does not take into account the possibility of measurement error (see also Birdsong, this volume). However, if the exact same score is not a suitable cut-off point to operationalise "balance", the question remains what a suitable alternative is.

(M. H. Daller, Yıldız, de Jong, Kan, & Başbağı, 2010) and Treffers-Daller and Korybski (this volume) use correlations and regression to study the validity of their measure of language dominance, as this avoids creating artificial and arbitrary cut-off points (see also Birdsong, this volume). Treffers-Daller and Korybski suggest using z-scores to facilitate a discussion about suitable cut-off points across different studies. They try out two possible cut-off points for their data and propose Z-scores between -1 and +1 or between -.5 and +.5 as possibilities. These choices led to a relatively large number of informants being included in the category of balanced bilinguals (72.7 percent versus 50 percent), comparable to the percentage of balanced bilinguals (69.8 percent) found by Lambert et al. (1959).

Yip and Matthews (2006) use MLUs to measure language dominance and suggest it is possible to compute MLU differentials by subtracting MLU values in one language from those in another language if some adjustments are made to account for typological differences between languages (from now on MLU differentials). They computed MLU in words (not in morphemes) as the MLUw is more comparable between Chinese and English, which are typologically very different. They conclude that the majority of the five children in their study are Cantonese dominant, with one of the five children being balanced, but do not explain how they arrived at this conclusion. Schmeißer et al. (this volume) also use MLUw to

group their informants. Interestingly, they distinguish a strongly balanced group from a balanced group: Children with MLU differentials between 0.02 and 0.35 were considered to be strongly balanced, and children with MLU differentials between 0.36 and 0.62 were considered balanced.

In their longitudinal study of vocabulary knowledge among French-Dutch bilingual children De Houwer and Bornstein (this volume) tried out different cut-off points (a six percent and a ten percent difference between scores in both languages) and found that at 13 months, only three out of the 31 children in the study understood the same number of words in both languages. As for productive language skills, less than half produced similar numbers of words in each language at 13 months, and only four did so at age 20 months. They also compared comprehension or production scores across languages, and concluded that only 20 percent showed no difference between languages. The authors also tried out a cut-off point of 1 z –score and 0.5 z-scores (as in Treffers-Daller & Korybski), but concluded that this did not work very well for their data.

Favreau and Segalowitz (1982) chose a ten percent difference from zero in either direction as the cut-off point for balanced bilingualism using reading rates as the target variable, while Gollan et al (2012) used picture naming and found a five percent difference was an acceptable margin to operationalize balance.

Finally, Lemmon and Goggin (1989) look at transfer to operationalize language dominance among Spanish-English bilinguals. They focus on their informants' ability to complete fixed expressions (seven for each language) of which slightly different versions exist in the bilinguals' two languages. Informants were, for example, offered the English expression *All day long he . . .* , followed by two alternatives (*comes and goes* or *goes and comes*) from which they had to pick one. The authors note that the "more natural" order in English is *comes and goes*, whereas in Spanish it is *va y viene* "goes and comes". The choice

of this test is not motivated, nor is it explained why this test would measure the construct of language dominance. The authors only say that bilinguals with a "substantial control" over these languages should make few errors in filling in the test. The reference to the notion of *control* is reminiscient of Bloomfield (1962, p. 56) definition of bilinguals as having native-like control of two languages, which few researchers nowadays adhere to. The problem with this test is that in bilingual communities norms may exist which diverge from the monolingual norms. As shown in Otheguy, García, and Fernández (1989) and Silva-Corvalán (1994) English has strongly influenced Spanish as spoken by different communities in the US, at all levels of linguistic analysis, which means that the norms for the use of both languages inside the communities differ from the monolingual norms for each. For this reason, Skutnab-Kangas (1981: 217) condemns the use of interference (transfer) as a test of degree of bilingualism in the strongest possible terms as "at worst actually objectionable and at best problematic in that it tends to penalize linguistic creativity and social sensitivity and to define this as "less bilingual".

Several authors grapple with the complex issues of comparing measurements across typologically different languages. Yip and Matthews (2006) and Schmeißer et al. (this volume) propose to adjust MLU calculations to compensate for differences between the languages under study, while M. H. Daller (2011)Daller et al. (2011) adjust the text length of stories told in one language to that of the other, to make measures more comparable. Finally, Treffers-Daller and Korybski (this volume) show how a careful lemmatization of texts can help making measures of lexical richness in two languages more comparable. However, completely solving the issue of the comparability of sores in two languages is not possible: because of typological differences and differences in the ways languages are used measurements will never be wholly comparable across different languages. According to (Jakobovits, 1969, as cited in Romaine, 1989) even comparing reaction times in two

languages may be problematic, because a range of non-linguistic factors might influence how fast a person responds. This issue cannot be pursued here any further, but it is important to raise awareness of the fact that comparing test results from two languages continues to be a difficult area.

In summary, the overview of a few selected studies discussed in this section reveals that it is possible for bilinguals to be *balanced with respect to a specific criterion*, but the percentages of balanced versus dominant bilinguals vary widely in each study (from around ten percent in De Houwer and Bornstein (this volume) and over 70 percent in Treffers-Daller and Korybski (this volume). If informants are found to be balanced (or dominant in one language) with respect to a specific criterion this does *not* mean we can conclude they are globally balanced in both languages, or globally dominant in these languages. Those researchers who use different criteria to operationalize language dominance (for example receptive versus productive vocabulary tasks) show that dominance is task-specific in that bilinguals who are dominant with respect to one criterion are not necessarily dominant if another criterion is used, which confirms the findings of Bahrick (1994). This makes it particularly important to motivate the choice of a measure of dominance, and to explain why a particular measure of dominance is preferred over another.

4. A typology of language dominance

As several authors in this volume consider language dominance as relative proficiency (e.g. Schmeißer et al; Kupisch & van de Weijer), we first look at a typology of language dominance based on the dimension of proficiency in two languages only.

===Figure 1 approximately here===

Figure 1 represents this view of language dominance, but it is important to note that it does *not* refer to global or generic dominance, as we have argued that there is no such thing. Instead, it depicts dominance in relation to a specific criterion, selected by the researcher. Proficiency in Language X is projected on the x-axis and proficiency in Language Y on the y-axis. For some groups of bilinguals it may be appropriate to identify LX as the L1 and LY as the L2, but this is not meaningful in all contexts (e.g. 2L1 acquisition).

This results in four different quadrants which represent different combinations of proficiency in two languages with respect to the researcher's chosen specific criterion. Adult bilinguals who have a high proficiency in this specific aspect in both languages (balanced bilinguals "high") are represented in the top right quadrant (B). Quadrant A represents adult bilinguals who have a low competence in both languages on a given measure (if such bilinguals exist). The other two quadrants represent dominant bilinguals: for these LX stands for the L1 and LY for the L2. Quadrant C represents those bilinguals who have a higher proficiency in L2 than in L1 with respect to the researcher's chosen measure (typically heritage speakers), while Quadrant D contains those for whom the L1 is more developed than the L2 with respect to the researcher's chosen variable (typically late bilinguals).

While Figure 1 offers the four logical possibilities with which proficiency in two languages can be combined, it does not have great explanatory value as it does not indicate how proficiency in these languages has developed. In addition, the category of "balanced" bilinguals is problematic, for reasons explained in this chapter, in particular if it refers to "overall balance" between two languages. In addition, many researchers have questioned the category of balanced bilinguals with a low ability in two languages, as can be seen in the discussion around the notion of semilingualism (Bloomfield, 1927; MacSwan, 2000; Paulston, 1983; Skutnabb-Kangas, 1978), even though in many studies balanced bilinguals are divided into different proficiency groups (e.g. Bialystok et al., 2008).

Future research will need to concentrate on the development of typologies of language dominance which include more than one dimension, and in particular language use, as proficiency and use are the two key dimensions of the bilingual experience (Fishman et al., 1968; Grosjean, 2010; Luk & Bialystok, 2013). Ability and use may go hand-in-hand as in Treffers-Daller and Korybski (this volume), but they do not always do so. Late bilinguals may use their L2 frequently, but do not always develop a particularly high ability in that language. Conversely, attriters may have a high ability in their L1 but do not use it very frequently. Further studies of the interaction between language use and language ability can help to develop more refined models of language dominance.

5. Conclusion

In this section we will summarise the main points raised in the chapter regarding the construct of language dominance, its operationalization and measurement, and point to avenues for future research in the field. In relation to the definition of the construct, we appreciate that it is possible to have different views of what a bilingual is but think it is reasonable to expect there to be a link between an author's definition of bilingualism and his/her definition of language dominance. Authors who define bilinguals in terms of language competence or proficiency will tend to define language dominance on this basis, whilst those who view bilinguals as those using two or more languages on a daily basis will tend to define language dominance on the basis of actual or reported use of both languages. However, most researchers agree that bilingualism is a multi-multidimensional construct, and that both *proficiency* and *use* are essential ingredients of the bilingual experience (Fisher, Cooper & Ma, 1969; Grosjean, 2010; Luk & Bialystok, 2013). Therefore, we have argued in

this chapter that both these dimensions should be part of the definition of language dominance too, as in Wang (2013: 739), for example, who defines language dominance as "a global measure of relative frequency of use and proficiency in each language". In the current chapter the term language ability is preferred over language proficiency. Language ability as defined by Bachman and Palmer (2010) represents a broad construct which covers a wide range of different kinds of knowledge, and builds on the key notion of communicative competence (Hymes, 1972). The discussions about language dominance often concentrate on grammatical knowledge only (grammar and vocabulary in particular), whilst the wider construct of language ability includes, for example, pragmatic and sociolinguistic knowledge. These aspects have hardly been considered in research on language dominance so far. Further research into language dominance could therefore concentrate on the wider range of knowledge and skills that fall under the construct of language ability, as it is likely that new insights into language dominance will emerge from such studies.

Next, we discussed the conceptual distinction between "dominant bilinguals" and "balanced bilinguals". It is very common in the academic literature to assume there is a principled distinction between these two types of bilinguals and to divide informants in groups of dominant and balanced bilinguals, depending on different criteria. In this chapter we have argued that the notion of balance is problematic, both conceptually and operationally. At the level of the lexicon, for example, it is very difficult to imagine that bilinguals know the same words in each language (because of the Complementarity Principle, Grosjean, 1997 and this volume) or that they have exactly the same knowledge about individual words in either language. The attraction of the word "balance" probably needs to be sought in extralinguistic factors, such as the wide-spread preference for symmetry in natural as well as cultural phenomena. While it may be possible to find that informants are more or less "balanced" with respect to a particular variable chosen by the researcher, this does not mean they are globally

balanced, as such a state is unlikely to exist. A possible way forward in this would be to abandon the concept of balance altogether and to replace it with *fluency*, as proposed by Favreau and Segalowitz (1982: 330), who point out that the advantage of using the term fluency is that it refers to skilled second language performance "without seeming to imply, as does the word "balanced," that first and second language skills are equal in all aspects and under all conditions." The construct of fluency has received a great deal of attention in recent years in psycholinguistics (see Segalowitz, 2010, for a detailed overview) as well as applied linguistics ((Housen, Kuiken, & Vedder, 2012) and exploring this notion in relation to language dominance is probably a very fruitful avenue for further research.

Among the many factors which explain language dominance, input figures very prominently. The quantity and the quality of input to bilingual children has been studied extensively as well as the impact of input patterns or strategies and children's receptive and productive knowledge of the languages. Some doubts are raised in this volume as well as elsewhere (De Houwer, 2007) that the one-parent-one-language strategy is the one which is most successful. In this chapter the point is also made that we do not know very much yet about the input to bilingual children in countries outside Europe and North-America. In particular code-switching practices and perceptions of the need to separate languages in the input to children may well be very different across the world. Insights from studies about bilinguals and multilinguals in other parts of the world may well change our views regarding the link between input patterns and language dominance. A priority for research in future should therefore be to obtain evidence from bilinguals and multilinguals from a different continents who speak a wide variety of typologically diverse languages.

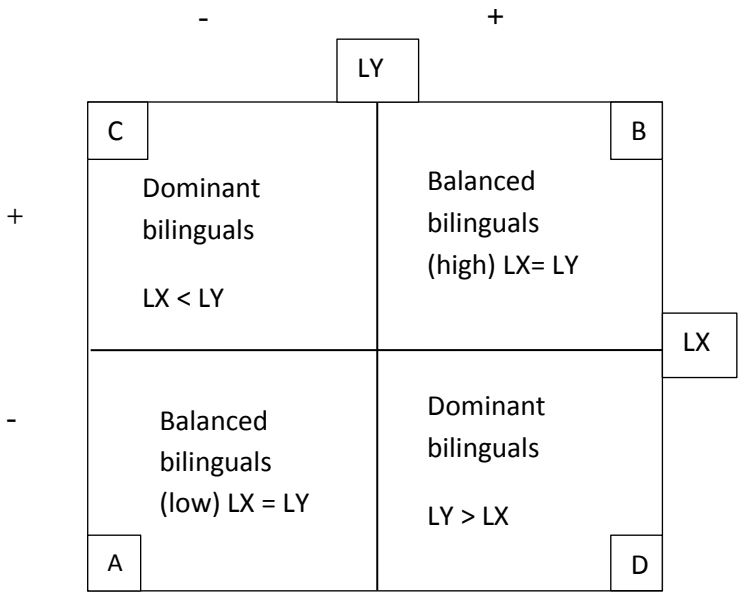
A summary of the literature on the operationalization and measurement of the constructs of language use and language ability (proficiency) revealed that a wide range of different instruments are being used to assess language dominance, including questionnaires,

self-ratings, transcripts of spontaneous speech, and tests. While questionnaires and self-ratings are very popular in the field, there are serious doubts about their validity as there is evidence that correlations between self-ratings and objective performance measures are stronger when self-ratings are *specific to a given domain* rather than broad, and when performance tasks are objective, familiar, or low in complexity (Zell & Krizan, 2014). Clearly, language use is a highly complex and subjective phenomenon and a self-rating may therefore not be the most appropriate instrument. The questionnaires which tap into bilinguals' everyday use of languages are also often rather coarse instruments which do not tap into the complexities of the distribution of labour between different languages and the degree of overlap between languages. Grosjean's (this volume) Complementarity Index (CI), which indicates to what extent the topics or activities are language-specific, offers a new way forward in looking at this complex issue. It is hoped many researchers will want to use this index in future studies of language dominance.

While tests appear to be more objective than self-ratings, it is extremely complex to construct different tests which can be considered to measure the same kind of ability and to be equally difficult in two (or more) languages. In addition, the issue of the appropriateness of norms for bilinguals taking such tests is highly complex (Gathercole, 2013). For these reasons, there are only very few such tests available, for only very few languages. For researchers using transcripts of oral language as the basis for the computation of indices of language dominance the comparability of structures across typologically different languages is also a problem, as is the comparability of indices computed. The development of a wider range of tests or elicitation tasks which facilitate comparisons across different languages would be a very important contribution to knowledge in this field of research.

In the current chapter we have argued that calculating *overall* language dominance is not very useful because dominance is task-specific and domain-specific. This makes it even

more important to explain why a particular variable or a particular domain is chosen to operationalise language dominance in a particular study. As far as measurement is concerned it is argued that language dominance should be measured on an interval scale rather than a nominal scale, because this avoids arbitrarily choosing a cut-off point which separates "dominant bilinguals" from "balanced bilinguals", which is undesirable because language dominance is not a categorical variable. Further research into how language dominance differs depending on specific domains and tasks is urgently needed to shed further light on intra-individual and inter-individual differences in language dominance.



(x-axis represents proficiency in language X; y-axis proficiency in language Y)

Figure 1: typology of language dominance based on language proficiency

Table 1. Examples of the operationalization of balance and dominance in bilinguals

Dominance measure(s)	Authors (year)	Dominance indices	Cut-off point between "balanced and dominants bilinguals"	Percentage "balanced bilinguals"
Reaction times to instructions in two languages	Lambert, Havelka & Gardner (1959)	Differences between reaction times in both languages	"relative similarity"	69.8%
MLU	Schmeißer et al. (this volume)	Mean MLUw difference (MMLUD)	Five categories of bilinguals; Strongly balanced: $0.02 \leq \lvert x \rvert \leq 0.35$ Balanced: $0.36 \leq \lvert x \rvert \leq 0.62$	Strongly balanced: 8 Balanced: 3 Total 11 out of 23 = 47.82%
Text length of stories in both languages	Daller, Yıldız, de Jong, Kan & Başbağı (2011)	Difference in text lengths and ratio of text lengths in both languages	Variables used as continuous variables in logistic regression only – no categorical distinctions made	n.a.
McArthur Bates CDI (receptive and productive)	De Houwer & Bornstein (this volume)	Differences between vocabulary scores in two languages	Balanced: less than 6% or less than 10% difference in scores.	13 months: receptive CDI: 3 out 31 (10%); productive CDI: less than 50%; 20 months: 4 out of 31 (12.9%)
Lexical diversity scores	Treffers-Daller & Korybski (this volume)	Differences in lexical diversity scores	Balanced: Z-scores between -1 and +1 or between -.5 and +.5	72.7% or 50% balanced
Semantic and morphosyntactic measures	Bedore et al. (2012)	Differences in percent correct on a semantic and a morphosyntactic test	Balanced: difference scores from -20 to +20	21.5% balanced
Reading rates	Favreau & Segalowitz (1982)	Differences in reading speed	Balanced ("fluent"): less than 10% difference Dominant: more	50% balanced

			than 10% difference	
Picture naming task	Gollan et al (2012)	Differences on Multilingual naming task	Balanced: difference scores from -5% to +5%	20% balanced
Average sentence duration	Flege, Piske & Mackay (2002)	Ratio of sentence duration in each language	Balanced: if ratio was not significantly different from 1	25% balanced

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