



THE UNIVERSITY *of* EDINBURGH

This thesis has been submitted in fulfilment of the requirements for a postgraduate degree (e.g. PhD, MPhil, DClinPsychol) at the University of Edinburgh. Please note the following terms and conditions of use:

This work is protected by copyright and other intellectual property rights, which are retained by the thesis author, unless otherwise stated.

A copy can be downloaded for personal non-commercial research or study, without prior permission or charge.

This thesis cannot be reproduced or quoted extensively from without first obtaining permission in writing from the author.

The content must not be changed in any way or sold commercially in any format or medium without the formal permission of the author.

When referring to this work, full bibliographic details including the author, title, awarding institution and date of the thesis must be given.

**Language change in bilingual returnee children:
Mutual effects of bilingual experience and cognition**

Maki Kubota



**Degree of Doctor of Philosophy
Linguistics and English Language
School of Philosophy, Psychology and Language Sciences
University of Edinburgh
2018**

Abstract

In this thesis, I focus on the linguistic changes that occur within bilingual returnee children; that is, children who were immersed in a second language (L2) dominant environment and returned to their first language (L1) environment. Tracking the development of such a specific population allows us to disentangle the effects of age from those of the bilingual experience. Longitudinally, these returnee children (ages 7-13) experience an increase in age but decrease in L2 exposure. In other situations that have been studied, age and bilingual experience are variables that are often difficult to tease apart because they are positively correlated. As this is not the case for the population I study, longitudinal data from bilingual returnee children offer opportunities to separate the relative influence of these factors on children's language and cognitive development.

Linguistic changes that occur due to detachment from the L2 environment are typically defined as 'L2 attrition'. However, these linguistic changes do not necessarily entail a loss of the second language and can be manifested through various linguistic phenomena. Thus, the first aim of the thesis is to examine *what aspects* of the language undergo changes over time. Various structures of the language, both in L1 and L2 are examined—from genitive structures (Chapter 6) to lexical access (Chapter 7) and language control (Chapter 8). The results of these studies demonstrate that not all changes in L2 are recessive (Chapter 7 and 8) and not all linguistic structures are vulnerable to change (Chapter 6). Specifically, the results of Chapter 6 show that cross-linguistic transfer alone cannot explain the change in preference for linguistic expressions, and instead suggest that processing difficulties (i.e., effects of bilingualism *per se*) are also at play in the selectivity of language change.

The second aim of the thesis is to examine *what factors* contribute to the process of language change in returnee children. Chapter 7 specifically examines the role of individual variables such as age of L2 onset, length of residence, language exposure, and proficiency on the changes in lexical access. The finding is that length of residence plays a crucial role in L2 maintenance, supporting the maturational account that children require some time to stabilize their language knowledge so that it becomes resistant to change.

In addition to individual variables, Chapter 8 explores the influence of cognitive factors on language control. Given the intricate relationship between bilingualism and cognition, I hypothesized that children who are better 'developers' in general cognition may also be better 'retainers' of the language. The findings offer support for this hypothesis—children who improved their cognitive performance (measured by the Simon task) also better developed their language control (measured by the language-switching paradigm), especially in their L2. Chapter 9 then focuses on the change in general cognition rather than in language, by demonstrating that proficiency is a significant determinant for development in executive control—children who had higher L2 proficiency showed a more significant enhancement in their cognitive performance over time.

Through these studies, this thesis contributes to an understanding of attrition and cognition in the development of children. Although much more work is required to fully explore the interplay of factors, this thesis provides evidence that executive control, in addition to bilingual experience, may affect (and even offset) the effects of language attrition in bilingual children.

Declaration

I hereby declare that this thesis is my own composition, that the work reported here has been carried out by myself, except where due acknowledgement is made in the text, that this work has not been submitted for any other degree or professional qualification except as specified in the text, and that the included publications are my own composition.

The following chapters of this thesis are formatted manuscripts that have been submitted to peer-reviewed journals:

- Chapter 6: Kubota, Heycock, & Sorace, *Individual differences in second language attrition in bilingual returnee children*.
Submitted to *Journal of Child Language* in October 2018, currently under review. Authorship details: Kubota designed the study, ran the participants, analysed the data and wrote the original manuscript. Heycock and Sorace acted as supervisors, gave feedback on each of these steps and contributed to the revision of the manuscript.
- Chapter 8: Kubota, Chevalier, & Sorace, *How bilingual experience and executive control modulate development in language control among bilingual children*.
Submitted to *Developmental Science* in October 2018, currently under review. Authorship details: Kubota designed the study, ran the participants, analysed the data and wrote the original manuscript. Chevalier and Sorace acted as supervisors, gave feedback on each of these steps and contributed to the revision of the manuscript.
- Chapter 9: Kubota, Chevalier, & Sorace, *Clarifying the influence of bilingualism on executive control development*.
Submitted to *Journal of Experimental Child Psychology* in November 2018, currently under review. Authorship details: Kubota designed the study, ran the participants, analysed the data and wrote the original manuscript. Chevalier and Sorace acted as supervisors, gave feedback on each of these steps and contributed to the revision of the manuscript.

Maki Kubota
Date: 28/11/2018

Acknowledgements

First and foremost, I would like to thank my supervisors, Antonella, Caroline, and Nic for their continuous support and encouragement throughout my studies. Antonella, thank you for always helping me stay positive and seeing the bright side in research; Caroline, thank you for all your detailed and valuable feedback; and Nic, thank you for teaching me everything from step one—I would have been completely lost without your support and guidance.

Second, I would also like to thank the parents and the children who participated in the research. Special thanks go to Japan Overseas Education Services (JOES), Setagaya Children's Center, and Telford Japanese Saturday School for assisting me with participant recruitment and test administration. I would also like to express my appreciation to the following foundations for providing financial support for my experiments and fieldwork: Great Britain Sasakawa Foundation [grant number 5038], Japan Foundation Endowment Committee [grant number 5780416], the British Association for Japanese Studies [award number JC2018-6-1], and School of Philosophy, Psychology, and Language Sciences [research support grants]. Also, I am grateful for Japan Student Services Organization for funding my Masters and PhD studies.

Third, I would like to thank everyone who assisted me throughout my studies: Vicky, thank you for allowing me to co-supervise students with you and also agreeing to be the internal examiner for my viva. Jamie and Stephen, thank you for putting up with all the computer problems I have had over the years; Jade, Ruth, Candice, and Adam, thank you for helping me record audio for the experiment in Chapter 6. Michela, thank you for helping me out with statistics—I've learned so much from you. Shona and Donald, thank you for reading through my thesis and correcting all my grammar mistakes.

Fourth, I would like to give a huge thanks to all my friends that kept me sane throughout all these years. Jade, I have never met anyone who is kind and caring as you. We will definitely co-publish something in the future (but you will do all the writing part). My minions—Wenjia, Eva, Candice, Franzi, Roberta, Simona—I loved every minute of our girl talk and will miss it dearly. Ernisa & Izwan and Cathleen, I still cherish the day we first met at the PhD induction and the countless get-togethers. Vanika, I miss your cooking so much and I'm glad that you were the first person I met in Edinburgh.

Fifth, I cannot thank Euan enough for being so supportive and caring through thick and thin. Thank you for always being there for me and making me laugh all the time (and sometimes forcing me to go to the office to work). Last but not least, I want to say a big thank you to my family—お母さん、お父さん、ちびなお—for always believing in me and letting me pursue my career as a researcher. We live miles apart and we don't really express our emotions, but from the bottom of my heart I want to say ありがとう.

Table of Contents

1	Introduction.....	1
2	Two sides of the same coin: acquisition and attrition.....	6
2.1	The effect of age.....	6
2.2	The effect of language exposure.....	10
2.3	Linguistic properties.....	13
2.4	Interim conclusion.....	15
3	Word Production.....	17
3.1	Language co-activation and production.....	17
3.2	Theoretical accounts of word production in bilinguals.....	22
3.3	Interim conclusion.....	25
4	Executive control and bilingualism.....	27
4.1	Models of executive control.....	27
4.2	Language control and executive control.....	31
4.3	Bilingualism and executive control.....	35
4.4	Interim conclusion.....	38
5	Summary of the literature review and research questions.....	40
6	A longitudinal study of genitive preferences in Japanese-English bilingual returnee children.....	45
6.1	Introduction.....	45
6.1.1	Explaining cross-linguistic transfer.....	47
6.1.2	Genitive variation in English.....	50
6.1.3	Genitive structure in Japanese.....	53
6.1.4	The present study.....	54
6.2	Methodology.....	56
6.2.1	Participants.....	56
6.2.2	Instruments and Procedure.....	58
6.2.3	Analysis.....	63
6.3	Results.....	63
6.3.1	Monolinguals vs. Bilinguals.....	63
6.3.2	Within Bilinguals.....	65
6.4	Discussion.....	67
6.5	Conclusion.....	72
7	Individual differences in second language attrition in bilingual returnee children.....	73
7.1	Introduction.....	73
7.1.1	Age and length of residence.....	74
7.1.2	Proficiency and length of residence.....	76
7.1.3	Current exposure and length of residence.....	77
7.1.4	Second language lexical attrition.....	78
7.1.5	The present study.....	79

7.2	Methodology.....	80
7.2.1	Participants.....	80
7.2.2	Instruments and Procedures	83
7.3	Results	86
7.3.1	Correlation of independent variables	86
7.3.2	The influence of independent variables on the change in verbal fluency performance	87
7.4	Discussion.....	90
7.5	Conclusion.....	94
8	How bilingual experience and executive control modulate development in language control among bilingual children.....	96
8.1	Introduction	96
8.2	Methodology.....	100
8.2.1	Participants.....	100
8.2.2	Instruments.....	102
8.2.3	Procedure.....	105
8.2.4	Data Analysis	105
8.3	Results	106
8.3.1	Simon task.....	106
8.3.2	Language-switching task.....	107
8.3.3	Effect of bilingual experience and executive control on development of language control.....	111
8.4	Discussion.....	116
8.5	Conclusion.....	121
9	Clarifying the influence of bilingualism on executive control development..	122
9.1	Introduction	122
9.1.1	Effects of bilingualism on executive control.....	123
9.1.2	Dimensions of bilingual experience.....	125
9.1.3	The present study	127
9.2	Methodology.....	128
9.2.1	Participants.....	128
9.2.2	Instruments.....	129
9.2.3	Procedure.....	132
9.2.4	Data analysis	132
9.3	Results	133
9.3.1	Exposure measures.....	133
9.3.2	The effect of bilingual experience on EC development.....	134
9.3.3	DCCS	137
9.3.4	Simon	138
9.3.5	N-back.....	139
9.4	Discussion.....	139
9.5	Conclusion.....	143

10	General conclusion	144
10.1	Summary	144
10.2	Discussion and implications	147
10.3	Limitations	153
10.4	Conclusion	154
	Appendix A	155
	Appendix B	163
	Appendix C	165
	References	171

List of Figures

Figure 3.1 Word production model from Levelt and colleagues (Levelt, 1989; Levelt, Roelofs, & Meyer, 1999).....	19
Figure 3.2 The bilingual word production model from Poulisse and Bongaerts (1994)	20
Figure 3.3 Inhibitory control model (Green, 1998).....	24
Figure 4.1 Demand on control processes relative to interactional contexts in the Adaptive Control Hypothesis (Green & Abutalebi, 2013, p.519).....	29
Figure 4.2 Illustrations of the associations among the three executive control components (Friedman et al., 2008).....	30
Figure 6.1 PowerPoint presentation of the grammaticality judgement task	62
Figure 6.2 Performance on the grammaticality judgment task split by group	64
Figure 6.3 Performance on the grammaticality judgment task split by time (bilinguals from first and second round of testing) and condition	66
Figure 6.4 Semantic factors involved in the genitive conditions	71
Figure 7.1 Interaction between length of L2 residence and time of testing on English and Japanese verbal fluency performance.....	90
Figure 8.1 Interaction between Trial type and Time on the performance in the Simon task	107
Figure 8.2 Interaction between Language and Trial type on performance in the language-switching task	110
Figure 8.3 Interaction among Language, Time, and Trial type on performance in the language-switching task	111
Figure 8.4 Interaction between English exposure and Time on English single trial performance.....	115
Figure 8.5 Interaction between Simon global RT difference and Time on English single trial performance.....	115
Figure 8.6 Interaction between Simon global RT difference and Time on English repetition trial performance	116
Figure 9.1 Interaction between Time and Proficiency on RT for DCCS	137
Figure 9.2 Interaction between Time and Proficiency on RT for Simon	138
Figure 9.3 Interaction between Time and Proficiency on RT for N-back.....	139
Figure 10.1 The process of attrition using the water analogy	149

List of Tables

Table 6.1 Genitive framework from Rosenbach (2001)	52
Table 6.2 Summary of BiLEC variables split by Language	58
Table 6.3 Examples of experimental genitive items	59
Table 6.4 Examples of filler items	60
Table 6.5 Estimated coefficients of between-subject analysis on performance of grammaticality judgement task	65
Table 6.6 Estimated coefficients of within-subject analysis on performance of grammaticality judgement task	67
Table 7.1 Summary of participant information.....	81
Table 7.2 Summary of BiLEC variables split by Language	82
Table 7.3 Summary of the proficiency test results.....	86
Table 7.4 Correlation matrix of independent variables.....	87
Table 7.5 Estimated coefficients of the individual variables on verbal fluency scores	89
Table 8.1 Summary of participant information.....	101
Table 8.2 Summary of BiLEC variables split by Language	102
Table 8.3 Descriptive statistics of the Simon task split by Time	106
Table 8.4 Descriptive statistics of each trial in the language-switching task split by Time and Language.....	108
Table 8.5 Estimated coefficients of the mixed effect model for language-switching task	109
Table 8.6 Estimated coefficients of the mixed effect model for English single and repetition trials	114
Table 9.1 Summary of participant information.....	128
Table 9.2 Summary of BiLEC variables split by Language	134
Table 9.3 Descriptive statistics of executive control tasks split by Group and Trial type.....	135
Table 9.4 Estimated coefficients of each EC model with age, proficiency, and exposure as predictors	136

1 Introduction

“Bilingualism” has often been perceived as a dichotomous construct, where a speaker is categorised as either a bilingual who speaks two languages fluently, or as a monolingual who has no knowledge of a second language. It is not surprising that such a definition is still prevalent in society, given that most dictionary entries define a bilingual as “a person who is able to use two languages equally well” (Cambridge University Press, 2018). Studies in the past twenty years have been challenging this static view of bilingualism, by adopting the notion that bilinguals are not the two sum of monolinguals (Grosjean, 1989). In fact, current trends in bilingual research suggest that the two languages of bilinguals constantly interact with each other. Thus, bilingualism is conceptualised in both quantitative (i.e., how well one speaks the L2) and qualitative ways (i.e., how they acquire and process the L2). For instance, there are now considered to be several types of bilinguals. They can be characterised according to the age of L2 onset (simultaneous or sequential bilinguals), their generational status and dominance of the language (heritage speakers), or their relative proficiency in each language (balanced and non-balanced bilinguals).

This thesis targets a specific type of bilinguals referred to as ‘returnees’. These are bilingual children who first move from an L1 (Japanese)- to an L2 (English)-dominant environment, and then *return* to their L1-dominant environment. In other words, their language experience changes throughout the course of their development. Although an increasing number of studies—mostly in the field of language attrition—examine the linguistic consequences of change in language environment, there are still many gaps to fill, and this population can help fill some of them.

First, most research on attrition to date has targeted L1 attrition in adult bilinguals who have moved away from their native language environment post-puberty, thus having a fully developed knowledge of their L1. Language attrition research has rarely considered bilingual children whose L1 and L2 are both under development and

may therefore be especially vulnerable to linguistic shifts in the environment. Second, it is uncertain what aspects of linguistic knowledge—both at the levels of structure and processing—are sensitive to the effects of attrition. Not all linguistic components are susceptible to change, and some structures may remain stable despite interrupted contact with the language (Sorace, 2004). Arguably, therefore, the researcher should focus on pinpointing the conditions which generate such vulnerability. Third, the interplay between the factors that affect language change is still unexplored. How can we explain the difference between children who are able to develop or maintain the L2 (despite reduced exposure) and others who are not able to do so? So far, relevant work has focused on the modulating effect of individual factors, such as age of L2 onset, length of residence, amount of exposure, and proficiency. This thesis aims to contribute to the field, not only by examining the influence of individual variables, but also by further investigating the role of general cognition in attrition. Taking into account recent findings on the mutual effects of bilingualism and cognition (Bialystok, 2009), cognitive development may be partially responsible for the degree of attrition observed in children.

To address these questions, Chapter 1 explores the literature from both fields of study: acquisition and attrition. Although the term ‘attrition’ was initially used to refer to the *loss* or *dismantling* of a language (Schmid, 2002), this thesis adopts a more recent definition that regards attrition as the change in pre-existing knowledge due to change(s) in language environment (Schmid & Köpke, 2017). In particular, the effect of age on the process of acquisition and attrition is discussed. Here, ‘age’ refers to: the age of L2 onset (relevant to L2 acquisition, L1 attrition, and L2 attrition); the age of removal from the L1 environment (relevant to both L1 and L2 attrition); and age of removal from the L2 environment (relevant to L2 attrition). The subsequent section focuses on how language exposure influences the process of acquisition and attrition. I describe various ways to operationalise and define language exposure, as well as examining how and in what ways it may influence attrition. Finally, the discussion moves onto how the internal structure of the language contributes to variability in acquisition and attrition. I discuss linguistic hypotheses that were established to capture the disparity of acquisition and attrition patterns in bilinguals. Consistent with the idea that not all structures are equally susceptible to attrition (Sorace, 2011), it

follows that some structures are found to be especially difficult to acquire, and also vulnerable to the effects of attrition.

Chapter 2 reviews research on how bilinguals plan speech, focusing on word production. The review includes models of language production in monolinguals and bilinguals, primarily discussing studies focusing on the issue of cross-linguistic activation in bilinguals. The main point of this chapter is to outline why bilinguals lag behind monolinguals in word production (in terms of both size and access), examining both the within-language frequency account (bilinguals use each language less) and the domain-general interference account (bilinguals need to inhibit the non-target language). In the summary section, I argue that L2 attrition can be explained by a combination of both accounts: L2 becomes less available due to (a) reduced L2 exposure (thus frequency), and (b) the need to more strongly inhibit the L1 due to its heightened activity from increased exposure.

Chapter 3 expands on the discussion in Chapter 2 by reviewing the role of the domain-general system in the ability to control the production of two simultaneously activated languages. The chapter begins by introducing various theoretical models postulated to explain the executive control processes involved in language control. It then reviews a range of empirical research studies both supporting and denying the relationship between executive control and language control. The final section brings the discussions of the previous sections together by delving into what is often conceptualised as the ‘bilingual advantage’—namely, the often-reported superior cognitive performance in bilinguals (Bialystok, Craik, & Luk, 2012). If speaking two languages confers cognitive enhancements, what aspects of bilingualism may contribute to such development? I discuss this question in detail by focusing on the role of proficiency, the age of L2 onset, and the amount of language exposure. Critically, the chapter builds a theoretical basis for a question posited in the thesis: if there is a positive relationship between enhancement in executive control and the acquisition of another language, can such relationship also be observed in the context of attrition? That is, does improvement in executive control predict the degree of maintenance/attrition of linguistic knowledge in children?

To sum up, Chapters 2 to 4 aim to bring together studies of acquisition, attrition, and cognition, to provide a comprehensive picture of the empirical research described in Chapters 4 to 7. As context, four research questions are formulated, and each is addressed separately in four studies (the predictions are described in Chapter 5):

1. What aspects of the linguistic structure are sensitive to changes in the language environment of bilingual returnee children? (Chapter 6)
2. How do various dimensions of bilingual experience (age of L2 onset; L2 exposure; L2 proficiency; length of L2 residence) influence changes in lexical access in bilingual returnee children? (Chapter 7)
3. How do L2 exposure and development of executive control influence the development of language control in bilingual returnee children? (Chapter 8)
4. How do various dimensions of bilingual experience (L2 proficiency; L2 exposure; age of L2 onset) influence the development of executive control in bilingual returnee children? (Chapter 9)

The first study (Chapter 6) examines how the choice of genitive forms (*the table's leg* versus *the leg of the table*) may differ between bilingual returnee children and English monolinguals, and how the bilingual children's choice of genitive forms may change over time as a consequence of returning to their native language environment. The findings show that bilinguals behave differently from monolinguals in the evaluation of certain genitive conditions that require the processing of conflicting information. The choice of genitive forms made by bilingual children also changed over time, but only in one specific genitive condition—a condition that is hypothesised to be sensitive to cross-linguistic transfer effects, and may also involve processing costs.

The second study (Chapter 7) investigates the individual factors (age of L2 onset; age of return to the L1 environment; proficiency; length of residence; language exposure) that may modulate the change in lexical access (both L1 and L2) in bilingual returnee children. The results demonstrate that length of residence in the L2 environment predicts the maintenance of L2 lexical access. In other words, children who had lived longer in an English-dominant environment were better able to improve

their English lexical access even after returning to Japan. This finding is in line with the maturational account, postulating that it takes some time for children's linguistic knowledge to stabilise for it to become resistant to effects of attrition.

After exploring the effects of individual factors on language change (measured by lexical access), I addressed the question of whether cognitive factors play any role in the development of language control, measured by a language-switching task (Chapter 8). The findings show that development in executive control as well as L2 exposure predict the change in language control. Specifically, executive control modulated the change in performance when bilinguals had to switch between L1 and L2. In contrast, L2 exposure predicted the performance in trials where the bilinguals had to name pictures only in L2. Taken together, these findings suggest that development of language control in bilingual returnee children is modulated by the dual effects of language exposure and executive control.

Finally, Chapter 9 complements the study in Chapter 8 by investigating the effect of bilingual experience (i.e., proficiency, language exposure, and age of L2 onset) on the development of executive control. Rather than focusing on the change in linguistic knowledge (as in the other three studies), this chapter examines how executive control changes over time and how this process may be influenced by the individual profiles of bilingual children. The results demonstrate that L2 proficiency, rather than L2 exposure or age of L2 onset, influences the development in executive control. I discuss these findings in reference to previous studies that have found L2 proficiency to be a determining factor in observing a cognitive advantage in bilinguals.

In sum, this thesis explores how multiple facets of linguistic knowledge, mainly at the level of processing, change over time as an effect of change in the language environment. The main aim of this thesis is to look at what factors—both language-related and domain-general—influence the change in linguistic performance of bilingual returnee children. Its central purpose, therefore, is to integrate the study of language and cognition in the context of attrition.

2 Two sides of the same coin: acquisition and attrition

This chapter focuses on three important factors that influence acquisition and attrition. These include age (Section 2.1), exposure (Section 2.2), and linguistic structure (Section 2.3). Age is a variable that follows a protracted course of development; everyone ages as time proceeds. Exposure (both in L1 or L2), on the other hand, follows a fluid developmental trajectory, where its quality and quantity may increase or decrease with time, depending on external circumstances. The type of linguistic property is a within-language variable that is independent of the effects of time. Different theoretical approaches are discussed that offer explanations to how these key factors play a key role in the process of acquisition and attrition. By exploring research in acquisition and attrition, I challenge that notion that these are two distinct and independent processes, and alternatively show that the principles and theories formed in the study of acquisition offer insights into the process of attrition. After all, both processes involve change in processing or representation of the language system, whether this is in the L1 or L2.

2.1 The effect of age

A major debate in the field of second language acquisition has been concerned with the age of onset of acquisition (AoA). Ever since the formulation of the critical period hypothesis (CPH) by Lenneberg (1967), researchers have extensively examined how the AoA contributes to ultimate attainment in L2. The CPH proposes that there is a time period where sensitivity to language learning is heightened due to high plasticity of the neural circuits in the human brain. Although no consensus has been reached as to when this ‘age limit’ is reached, studies in second language acquisition have observed a clear difference in ultimate L2 attainment between child and adult learners (Abrahamsson & Hyltenstam, 2009; DeKeyser, 2000; Hyltenstam, 1992; Johnson &

Newport, 1989; Lenneberg, 1967; Oyama, 1976). Child learners (who acquired their L2 in a naturalistic setting) have been found to outperform adult learners in attainment in various linguistic domains, especially in phonology, but also in morphology and syntax (Bylund, Abrahamsson, & Hyltenstam, 2012).

Parallel to the effects of age on the acquisition of a L2, studies in language attrition have also presented converging evidence outlining the significant effect of AoA on the degree of L1 attrition. Following the idea of maturational constraints in language learning, it has been suggested that the later the interrupted contact to the L1 takes place, the better speakers can retain their L1. Again, the exact age at which the effects of attrition are more likely to set in is unclear (although it is suggested it occurs around the age of 12), but it is well-established in the literature that the degree of L1 attrition differs considerably between child and adult attriters (Bylund, 2009b; Hakuta & d'Andrea, 1992; Hyltenstam, Bylund, Abrahamsson, & Park, 2009; Schmitt, 2010; Silva-Corvalán, 1994). Initial work on language attrition has mainly focused on adult attriters, or speakers who experienced change in L1 use post-puberty. These speakers have been found to demonstrate limited and selective effects of L1 attrition, even after living in a L2-dominant environment for several years (Chamorro, Sturt, & Sorace, 2016; Gürel, 2004; Kaltsa, Tsimpli, & Rothman, 2015; Schmid & Keijzer, 2009; Tsimpli, Sorace, Heycock, & Filiaci, 2004). Child attriters, on the other hand, are speakers whose patterns of L1 use undergo change during childhood. One example of such population is heritage speakers. There is a large amount of cumulative evidence to demonstrate that, despite receiving the majority of their L1 input in their earlier years at home, the L1 knowledge of heritage speakers diverges from that of monolinguals (Cuza & Pérez-Tattam, 2016; Montrul, Davidson, De La Fuente, & Foote, 2014; Polinsky, 2008). Another example comes from studies on international adoptees (Pallier et al., 2003; Ventureyra, Pallier, & Yoo, 2004), where some research shows that L1 knowledge is completely replaced by L2 knowledge, as these adoptees experience virtually no contact with their L1 after adoption. Other studies, however, suggest that the attrited language can be reactivated through intense re-exposure (Hyltenstam et al., 2009; Park, 2015), implying that the representation of the language is not completely lost.

It should be emphasised here that, in the field of L1 attrition, AoA in L2 is commonly used as an analogous term for the age of reduced contact to the L1 (e.g., age of L2 onset = 12 years old; age of reduced contact to L1 = 12 years old). A recent proposal made in the L1 attrition field is to consider every bilingual as an attriter (Schmid & Köpke, 2017), suggesting that as soon as we begin learning another language, our L1 also changes. Thus, the definition of ‘attrition’ has extended from conceptualising it as the *loss* of L1 due to a protracted period of reduced contact to treating it as a predictable change and subsuming various types of linguistic phenomena that occur under the effects of L2 on the L1.

The issue with this over-encompassing term, however, is that it does not take into account the process of L2 attrition. Under the definition proposed by Schmid and Köpke (2017), L2 attrition is perceived as the effect of L1 cross-linguistic transfer (discussed in detail in Section 2.3). As Flores (2018) points out, L2 attrition should refer specifically to cases where L2 performance changes as an outcome of interrupted contact, and “does not occur in cases of continued use of the two languages” (p.695).

Adding to claims made by Flores (2018), I propose that L2 attrition can be defined as follows: pre-existing L2 knowledge that becomes less accessible as a result of the acquisition of a third language, or because of reduced L2 exposure. Research pertaining to the first definition (a change in L2 knowledge due to the acquisition of a third language) is rarely investigated and requires more scholarly attention. The majority of research on L2 attrition falls under the scope of the second definition, concerning L2 change in a specific population (returnees) whose dominant environment shifts from being L2-dominant to being L1-dominant (Flores, 2010, 2012, 2015; L. Hansen, 1999; Hansen-Strain, 1990; Reetz-Kurashige, 1999; Tomiyama, 1999, 2000, 2008; Yoshitomi, 1999).

In the case of L2 attrition in returnees, it has been suggested that the age when they left the L2-dominant environment is a significant predictor for the success of L2 maintenance. Empirical evidence comes from works of Hansen-Strain (1990) and Tomiyama (2008), who demonstrate that younger siblings who left the L2-dominant environment at a younger age are more vulnerable to the effects of L2 attrition than older siblings. Recent work by Flores (2010) has also found a significant difference in

L2 syntactic knowledge between speakers who left the L2-dominant environment before and after puberty. Flores suggests that the lack of a ‘stabilisation period’ for L2 knowledge to consolidate in the speaker’s mind contributes to a higher susceptibility of input loss. However, it should be noted that in Flores’s studies, the returnees were simultaneous bilinguals, who were born in the L2-dominant environment and raised there before returning to their L1-dominant environment (i.e., their parents’ home country). The situation is therefore similar to L1 attrition, where the age of reduced contact to L2 is equal to the length of residence in the L2 environment (e.g., someone who left the L2 environment at age of 12 has also lived in the L2 environment for 12 years). It is questionable, however, whether the age of reduced contact in L2 affects attrition in the same way for sequential bilingual children, who start learning their L2 at different ages in childhood. If the ‘stabilisation period’ is a crucial factor for L2 maintenance, then the length of residence in the L2 environment—rather than the age at which they left the L2 environment—should determine the degree of L2 attrition in sequential bilingual children. Chapter 7 examines this question in detail, and the evidence demonstrates that length of residence in the L2 environment indeed determines the degree of L2 lexical attrition.

To summarise, AoA appears to be an external, individual factor that has consistently been shown to have an impact on the ultimate attainment of L2 and the degree of L1 attrition. As an individual grows older, the brain adapts to the native language, making it less flexible to L2 learning but also more resistant to modifications in L1. In a similar vein, the age at which an individual experiences reduced contact with L2 is a crucial factor behind the degree of L2 attrition in simultaneous bilinguals, whose L1 and L2 onset begin from birth. However, it is uncertain whether the same principle applies for sequential bilingual children, whose L2 onset begins at various time points throughout childhood. Perhaps what modulates the effect of L2 attrition in sequential bilingual children is not age, but length of residence—that is, *how much time* they have had to consolidate their L2 knowledge.

2.2 The effect of language exposure

Language exposure involves multiple dimensions of language input and use, in both quantitative and qualitative terms (Unsworth, 2016b). Quantitative measures may include current language input (e.g., how much input the parents give to the child) and cumulative language input (e.g., how much input children have had in their lifetime). Qualitative measures are composed of (but not limited to) richness of language input (i.e., receiving input from various sources and multiple speakers), proficiency of the speaker (e.g., non-native or native), and type of literacy-related activities. Language exposure is indisputably necessary for L2 acquisition, but the central question in the acquisition of an L2, investigated to this date, is how language exposure modulates the rate of L2 acquisition.

Language exposure has been found to explain the variability in the development of children's vocabulary (Cattani et al., 2014; Chondrogianni & Marinis, 2011; David & Wei, 2008; Hoff et al., 2012), as well as morphology and syntax (Blom, Paradis, & Duncan, 2012; Chondrogianni & Marinis, 2011; Gathercole & Thomas, 2009; Nicoladis, Palmer, & Marentette, 2007; Paradis, Nicoladis, Crago, & Genesee, 2011). For instance, Thordardottir (2011) examined the relationship between language exposure and vocabulary knowledge among French–English bilingual preschoolers in Montreal, Canada. The findings showed that while 40% to 60% exposure was sufficient to enable children to perform comparably to their monolingual counterparts in both French and English for receptive vocabulary, more than 60% exposure was required to reach monolingual-like performance in expressive vocabulary. Another example is a study by Chondrogianni and Marinis (2011), which investigated the effects of external (English language exposure, proficiency and education level of the parents) and internal (age/time) factors on Turkish–English bilingual children's acquisition of syntax, tense morphology, and vocabulary. They found that external factors, specifically the mother's English proficiency, predicted the children's complex syntactic knowledge and general grammatical abilities. However, no influence of external factors was found on their performance in tense morphology.

Taken together, it has been suggested that the relationship between the relative amount of exposure and linguistic performance is non-linear; that is, exposure beyond a certain threshold does not expedite the acquisition process. Different measures of language exposure—not only quantitative, but also qualitative—influence the rate of acquisition in L2. Moreover, not all aspects of the language are sensitive to the effects of exposure (Chondrogianni & Marinis, 2011; Hoff et al., 2012; Oller, Pearson, & Cobo-Lewis, 2007; Paradis et al., 2011; Unsworth, 2014, 2016a), nor does exposure affect language acquisition in the same manner for all ages (Unsworth, 2016b).

Compared to the prominent role of exposure on second language *acquisition*, its effect on the process of language *attrition* is much less pronounced and more complex. Earlier works in attrition typically and intuitively assumed that the current and cumulative exposure to L1 was one of the strongest predictors determining the degree of attrition (Schmid & Yilmaz, 2018). In other words, it was expected that the less exposure the speaker has to L1, the greater the effects of attrition that are observed—often referred to as the ‘use it or lose it’ explanation. However, this hypothesis so far lacks empirical evidence, with many studies failing to observe a link between exposure and attrition (Schmid, Forthcoming). For instance, Schmid and Dusseldorp (2010) examined the predictive power of language use and exposure, as well as attitude and motivation, on L1 attrition in German. Their results showed that none of the measures of language use and exposure accounted for the variability in L1 proficiency. Similarly, findings by Schmid and Jarvis (2014) on L1 lexical attrition among German–Dutch and German–English bilinguals showed that the use of L1 in various settings, as well as length of residence in the L2 environment, did not have any impact on L1 lexical access and diversity.

However, using an alternative method of statistical analysis rather than the ‘traditional’ way of building models based on linear relationship, Schmid and Yilmaz (2018) identify four levels of bilingual proficiency: (1) poor L1 maintainer and poor L2 learner; (2) poor L1 maintainer and good L2 learner; (3) good L1 maintainer and poor L2 learner; and (4) good L1 maintainer and good L2 learner. By running a Discriminant Analysis, they found that daily informal use of the language in both L1 and L2 was a significant factor discriminating the participants into these four levels of proficiency. The authors contended that the non-linear nature of the interaction

between predictors and outcome may have blurred the effect of exposure in previous studies (Chamorro et al., 2016; Hopp & Schmid, 2013; Schmid & Dusseldorp, 2010; Schmid & Jarvis, 2014), which applied statistical analysis that predetermined a linear relationship.

The impact of language exposure on L2 attrition further complicates the picture, given that many studies on L2 attrition are qualitative, involving a small number of participants, mostly returnee children (Flores, 2015; Hansen-Strain, 1990; Reetz-Kurashige, 1999; Tomiyama, 1999, 2000, 2008; Yoshitomi, 1999). These studies, however, all point towards the notion that most L2 knowledge is retained, regardless of the very limited exposure they receive of L2. In fact, the conceptualisation of ‘L2 attrition’ itself already presupposes that L2 undergoes modification *as a result of* reduction of L2 exposure. Language exposure in L2 attrition is typically conceived as a single, dichotomous, and homogenous variable that acts as the main distinction between attriters and monolingual controls (Schmid, Forthcoming). Empirical studies often overlook the effect of L2 exposure, and thus the quantity and quality of L2 exposure are rarely measured or reported. A study by Flores (2010) on 16 Portuguese–German returnees is one of the few studies finding that the length of time away from the L2 German environment has no effect on the degree of L2 syntactic deviation. Rather, the age at which the bilinguals left the German environment was a significant predictor for L2 maintenance.

To summarise, there is a considerable gap between theories of attrition and empirical evidence, which suggests that perhaps factors other than exposure—but more likely the interplay among all individual factors—drive the variability in attrition. This is not to say that exposure plays no role in attrition, but much more work needs to be done to disentangle the complex web of factors, especially in the field of L2 attrition, which lacks quantitative, large-scale investigations.

2.3 Linguistic properties

So far, I have discussed speaker-related, individual factors that affect the process of acquisition and attrition. The determining factors are nevertheless not confined to external variables: the internal structure of the language may also play a role, given that not all linguistic properties are acquired or undergo attrition at the same rate or to the same degree. Generally, bilinguals follow similar linguistic milestones to their monolingual counterparts in the acquisition of their L2 (De Houwer, 2009). Linguists have therefore focused on specifying the linguistic conditions under which monolingual and bilingual acquisition diverges. This phenomenon is often referred to as a ‘cross-linguistic transfer’, or a structural influence from one language to another (Nicoladis, 2015). The influence of L1 on L2 has been extensively explored, and this effect has been observed at all levels of linguistic description, from phonological (Brulard & Carr, 2003; Paradis, 2001) and morphological (Nicoladis, 1999, 2002, 2003) to syntactic levels (Sorace, 2011).

A major focus in this line of research over the past twenty years has been identifying the cause of cross-linguistic transfer (Hervé & Serratrice, 2018). An influential account by Müller and Hulk (2001) first predicted that cross-linguistic transfer occurs under two conditions: (a) when there is structural overlap between the two languages, i.e. one language has two alternatives for the same structure while the other language has one; and (b) when the structure involves an interface between syntax and pragmatics. For example, pronominal forms are expressed using overt and null pronouns in Italian, and the choice of these two forms is determined by discourse-related factors—a null pronoun is used when referring to the topic of the sentence, whereas an overt pronoun is used when there is a non-topical antecedent and marks a topic shift. The same function is expressed in English using only overt pronouns (e.g. he, she). Thus, cross-linguistic transfer is expected to occur from English (one form; overt pronoun) to Italian (two forms: overt and null pronoun), and this effect may be manifested in the overuse of overt pronouns in Italian in bilingual children. Many empirical investigations have demonstrated supporting evidence for this prediction (Döpke, 1998; Müller & Hulk, 2001; Paradis & Navarro, 2003; Serratrice, 2007; Sorace, Serratrice, Filiaci, & Baldo, 2009), while others have found effects outside the

syntax-pragmatics interface (Fernández Fuertes & Liceras, 2010; Serratrice, Sorace, Filiaci, & Baldo, 2009; Sorace & Serratrice, 2009). A few even found cross-linguistic transfer in the absence of structural overlap (Nicoladis, 2002; Yip & Matthews, 2000).

Complementary to this hypothesis, Sorace and Filiaci (2006) propose that language structures involving the syntax-pragmatics interface are especially difficult to acquire by adult L2 learners, and are also vulnerable to attrition when compared to structures that require only syntactic computations. Along these lines, studies have shown that the computation of anaphora resolution—a phenomenon dependent on the integration of pragmatic and contextual variables—is one prominent case that distinguishes monolinguals from near-native speakers (Sorace, 2011). Although Sorace (2011) discusses this hypothesis with respect to near-native speakers, it has been tested against various types of bilinguals, including intermediate-level learners (Ivanov, 2012; Montrul & Louro, 2006; Rothman, 2009), adult heritage language speakers (Cuza, 2013; Jia & Paradis, 2015; Kaltsa et al., 2015; Montrul, 2004), and bilingual children (Serratrice, Sorace, Filiaci, & Baldo, 2012; Serratrice, Sorace, & Paoli, 2004; Sorace & Serratrice, 2009; Sorace et al., 2009).

Convergent patterns have been observed in the context of L1 attrition (Chamorro et al., 2016; Tsimpli et al., 2004; Wilson, Sorace, & Keller, 2009). For instance, Tsimpli et al. (2004) found that Italian and Greek near-native speakers of English differed from their respective monolingual control groups in their interpretation of overt pronominal subjects (Italian–English bilinguals only) and in the production of preverbal subjects (Italian–Greek bilinguals only). However, both bilingual groups performed similarly to their monolingual counterparts in their evaluation of subject positions parameterised by purely formal features (i.e., a forward anaphora with a null subject). Moreover, a study by Chamorro et al. (2016) tested three groups of bilinguals: L1 Spanish attriters, L1 Spanish re-exposed speakers (who spoke exclusively in L1 for a week before testing), and Spanish monolinguals. The results showed a significant difference in the evaluation of Spanish pronominal subjects between L1 attriters and monolinguals, but no differences were found between the L1 re-exposed group and monolinguals. Taken together, the findings imply that attrition is flexible to input changes and affects the *processing* of interface structures rather than the *representations*. In relation to this, Sorace (2011) suggests that the integration

of two levels of representation (i.e., syntax and pragmatics) is more costly in terms of processing than accessing only the syntactic level. Therefore, bilinguals are required to use more mental resources to process interface structures than their monolingual peers, resulting in a divergent performance between monolinguals and bilinguals. Attrition also affects these structures because of the reduction of the opportunities to apply cognitive resources in processing such multi-faceted information.

In the context of L2 attrition, studies by Flores (2010, 2012, 2015) showed that simultaneous Portuguese–German returnees differed from German monolinguals in their production of German subject and object expression (i.e., syntax–pragmatic interface structure), but not in verb placement (i.e., an internal structure involving mainly syntactic computations). Adding to this, Tomiyama's (2000) longitudinal study on a sequential Japanese–English returnee child revealed that the child began producing erroneous noun modifications (e.g., genitives) 20 months after returning to Japan. However, it should be noted here that noun modification involves integrating syntactic rules with *semantic* conditions. The vulnerability of the syntax–semantics interface to attrition is still an underexplored area of research that requires further examination (Sorace, 2011). Chapter 6 attempts to pursue this question by looking at whether the evaluation of genitive forms (governed by semantic constraints) changes relative to reduced exposure to L2.

In sum, not all linguistic structures are acquired or undergo attrition in the same manner, and the combination of the two languages, the amount (and probably the quality) of language exposure, and the processing strategies all seem to play a role in how linguistic structures are acquired and change as a result of attrition in bilinguals.

2.4 Interim conclusion

This chapter has discussed how age, language exposure, and linguistic structure influence the process of acquisition and attrition. Throughout these discussions, I have highlighted the fact that the principles governing the process of acquisition and attrition are not necessarily distinct. Converging evidence from acquisition and attrition underline the selectivity of both—some structures are especially difficult to

acquire and more susceptible to reduced exposure than others. However, the linguistic constraints that regulate this selective nature are the subject of debate, especially within the developmental trajectories of children.

The effect of age has yielded the most concrete evidence of decreasing learning ability, with many researchers claiming that L2 acquisition becomes more difficult after the brain adapts to the native language, but is also less vulnerable to attrition once language knowledge is consolidated in the brain. Language exposure has also been found to be a determining factor in second language acquisition, but its role in attrition—specifically L2 attrition—is still unclear.

Since studies in Chapter 7 and Chapter 8 involve the production of words in L1 and L2 by bilingual returnee children (Chapter 7: verbal fluency task; Chapter 8: language-switching task), the focus of the following chapter will be on reviewing the literature on the co-activation of languages (Section 3.1) and the specific processes (at both a linguistic and a non-linguistic level) involved in speech planning (Section 3.2).

3 Word Production

The previous chapter has discussed the *independent* individual factors (Section 2.1: age; Section 2.2: language exposure) influencing the degree of attrition in various linguistic domains. It also focused on the morphosyntactic domain, and reviewed how this *dependent* factor is selectively influenced by attrition (Section 2.3: linguistic properties). This chapter will shift focus onto another linguistic domain, described as “the most vulnerable part of the linguistic repertoire” (Schmid & Jarvis, 2014 p.729)—namely, the lexicon. There are two possible explanations for why lexical retrieval may change as a result of reduced language exposure. The first explanation involves within-language process, where frequency and recency of use determine how easily the items stored in memory can be retrieved *within* a language. The second explanation involves domain-general processes, where stronger inhibition must be applied to avoid interference from the dominant, non-attributed language. The next sections discuss theoretical models to account for these processes, and explore how language-specific and domain-general processes may interact in attrition.

3.1 Language co-activation and production

One of the most compelling findings concerning research on the bilingual lexicon is that both languages are activated in parallel when a bilingual hears, reads, or produces words in the target language (for discussions see Kroll, Gullifer, & Rossi, 2013). Much of this evidence stems from research on comprehension, and several models have been proposed to capture the consequences of various types of cross-linguistic activation (e.g. the Revised Hierarchical Model: Kroll & Stewart, 1994; the Bilingual Interactive Activation Model: Van Heuven, Dijkstra, & Grainger, 1998). The Revised Hierarchical Model (Kroll & Stewart, 1994) assumes that access to L2 is mediated by the translation of L1, since the link between L1 and the conceptual system is stronger

than the link between L2 and the conceptual system. The model also postulates that L2 can be accessed directly from the conceptual system, if the speaker is highly proficient in the L2. The Bilingual Interactive Activation Model (Van Heuven et al., 1998) proposes four levels of processing at the feature, letter, word, and language node level. A visual input first activates the *features* and then moves on to processing each *letter*, which in turn spreads its activation to both languages that contain those letters at the *word* level, and finally proceeds to the *language node* level, where the non-target word is inhibited. This model therefore also assumes a non-selective nature of language processing, where two languages are simultaneously activated at the word and lexical node levels.

Subsequent empirical research has offered converging support for the non-selectivity of lexical access by experimentally manipulating words that overlap, such as cognates (i.e., words that share the same orthography, phonology, and meaning) or homographs (i.e., words that share orthography and phonology but not meaning). The idea here is that if lexical access is a selective process, then no consequences should emerge in the presence of linguistic overlap. In fact, studies have shown facilitation effects for cognates (Brenders, van Hell, & Dijkstra, 2011; Duyck, Van Assche, Drieghe, & Hartsuiker, 2007; Schwartz, Kroll, & Diaz, 2007) and interference effects for homographs (Dijkstra, Timmermans, & Schriefers, 2000; Dijkstra, Van Jaarsveld, & Ten Brinke, 1998; Lagrou, Hartsuiker, & Duyck, 2011). In other words, since cognates fully overlap in their linguistic features, bilinguals are faster at recognising cognates than non-cognates, whereas competition arises in homographs due to conflicted meaning, resulting in slower recognition.

In language comprehension, the speaker is not able to choose the language they encounter, but this is not the case with production; speakers, in theory, should have full control of speech planning and the selection process of the intended language. In this sense, non-selectivity in language production appears to be counterintuitive, as production is inherently a top-down process. Thus, the important question to ask here is as follows: is the non-intended language also activated in language production? Before moving on to this discussion, there is a need to consider the models of speech production in monolinguals.

The most influential model of word production was proposed by Levelt and his colleagues (Levelt, 1989; Levelt, Roelofs, & Meyer, 1999). As shown in Figure 3.1, at least three stages of processes are engaged in the articulation of the intended word. The first level involves the conceptual or semantic system in which lexical representations are first activated. This activation spreads to its corresponding lexical nodes at the lemma level. In this case, the semantic system spreads its activation not only to the intended lemma, but also to the semantically related lexical nodes. For instance, when the concept of a *dog*—a four-legged domesticated animal—is activated, the activation simultaneously spreads to other lexical nodes such as *bark* or *cat*. The lexical selection mechanism then prioritises based on its level of activation, which will undergo further processing at the level of form. At this stage, morphological, phonological, and phonetic encoding take place on the selected lemma, finally leading to the articulation of the word.

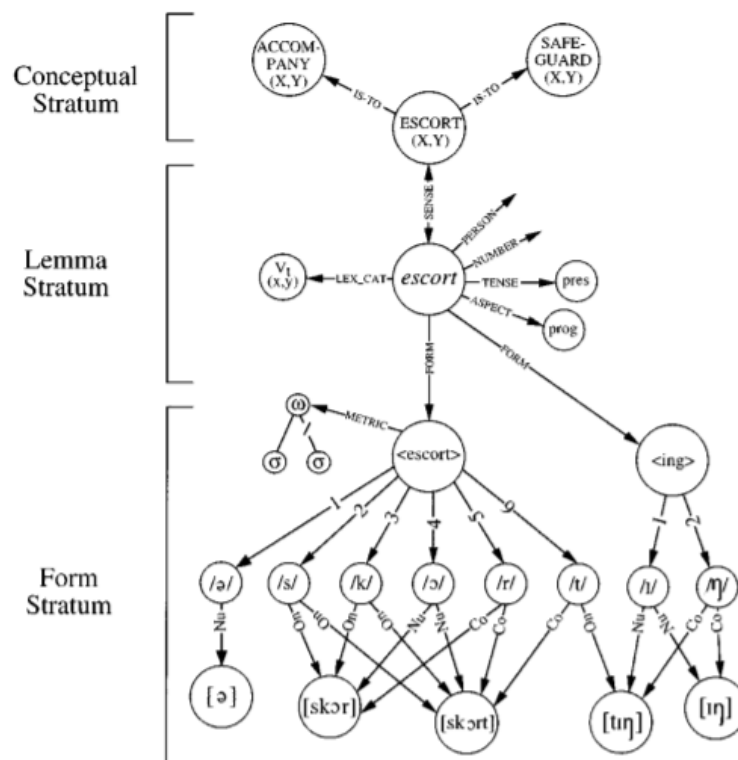


Figure 3.1 Word production model from Levelt and colleagues (Levelt, 1989; Levelt, Roelofs, & Meyer, 1999)

Adapting this framework in bilingualism, Poulisse and Bongaerts (1994) postulated that, in addition to the activation of lexical representation at the semantic level, bilinguals receive language cues or information about the intended language (Figure 3.2). This activation next spreads to the semantically related lexical nodes in both languages, such as ‘chair’ in English and ‘silla’ in Spanish. As in Levelt’s model, the lexical node with the highest activation is selected to proceed to the phonological level, where the form of the word is specified. Therefore, this model assumes that word production is a non-selective process where both languages are activated at the lemma level.

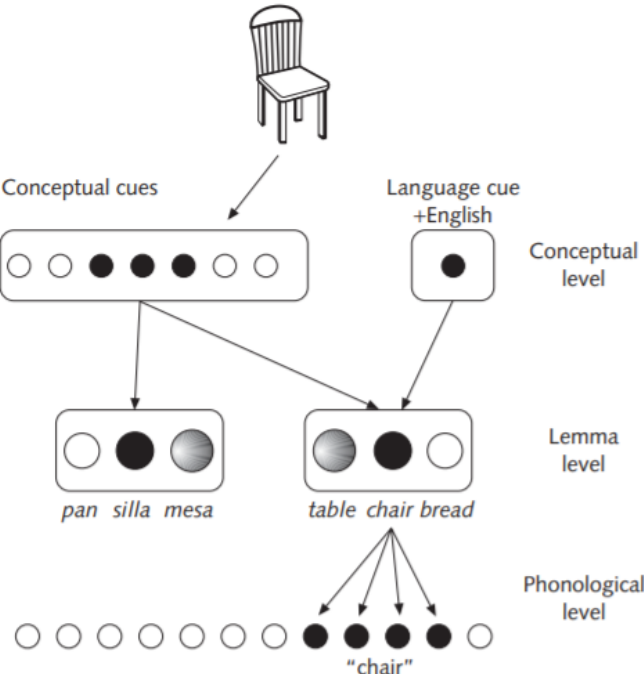


Figure 3.2 The bilingual word production model from Poulisse and Bongaerts (1994)

As with studies on bilingual word recognition, the aim of research in lexical production has been to employ cross-linguistic ambiguities such as cognates, homophones, and equivalent translations to evaluate the presence of parallel activation of the two languages. One way to test this is to present a distractor word in the non-target language during speech planning, in which translations or words that are orthographically and/or phonologically related are found to facilitate picture naming

(Costa, Miozzo, & Caramazza, 1999; Hermans, 2004), whereas semantically related words cause interference (Hermans, Bongaerts, De Bot, & Schreuder, 1998).

The facilitation effect of cognates has also been extensively identified in the literature on word production (Costa, Caramazza, & Sebastian-Galles, 2000; Dijkstra et al., 2000; Hoshino & Kroll, 2008; Kroll, Dijkstra, Janssen, & Schriefers, 2000). For instance, Kroll et al. (2000) found a cognate facilitation effect among unbalanced Dutch–English bilinguals, but only in L2. In a similar vein, Costa et al. (2000) demonstrated that the magnitude of the cognate facilitation effect was larger for L2 than for L1. This is explained regarding the magnitude of activation: since bilinguals are generally able to activate their dominant L1 to a greater extent than their L2, greater influence is observed from L1 to L2 than from L2 to L1. This asymmetrical cognate facilitation effect has also been replicated in a study of sequential bilingual children, simultaneous bilingual children, and trilingual children (Poarch & Van Hell, 2012). All these children benefited from cognates to a greater extent when naming pictures in their L2 than in their L1. Critically, the cognate facilitation effect in L1 was not observed for sequential bilingual children. Taken together, these results suggest that cross-language activation is evident in children, but the external factors that differentiate sequential bilinguals from simultaneous bilinguals and trilinguals (such as age of acquisition, length of residence, and proficiency) may determine the magnitude of the facilitation effect in L1. Since the sequential bilinguals in the study had a lower proficiency, shorter length of residence, and older age of acquisition than the other children, they may have had difficulties in activating their L2 at a sufficient level for cross-linguistic activation to occur from L2 to L1.

In sum, a range of empirical evidence points towards the notion that bilinguals do not plan their speech in the same way as monolinguals, and that both languages are simultaneously active. Following this, the consequences of bilingualism on language production are manifested in slower lexical access/retrieval and smaller vocabulary size (in one language) when compared to the monolingual norm (Bialystok, 2009; Kroll & Gollan, 2014). The factors that account for these differences, however, are still debated, with two major strands of theoretical accounts dominating the literature—the frequency-lag hypothesis and the interference model. The next sections will discuss these two accounts in further detail.

3.2 Theoretical accounts of word production in bilinguals

Why are bilinguals slower to speak in L2—and even their dominant L1—when compared to their respective monolingual counterparts? One explanation is proposed by Gollan and her colleagues (Gollan & Acenas, 2004; Gollan, Montoya, Fennema-Notestine, & Morris, 2005; Gollan, Montoya, & Werner, 2002; Gollan & Silverberg, 2001), who postulate the frequency-lag or weaker links hypothesis. This assumes that bilinguals simply have less exposure to each language and use them less frequently than monolinguals, resulting in a ‘weaker link’ between concept and form, and thus limiting its accessibility. This mechanism also accounts for slower access of low-frequency words in monolingual production, as well as slower access in the non-dominant language of the bilinguals. Critically, the frequency-lag hypothesis characterises the accessibility of words in *each* of the bilinguals’ two languages. Converging evidence for this hypothesis comes from studies that show bilinguals lag behind monolinguals in their production of low-frequency words, but not high-frequency words (Gollan, Montoya, Cera, & Sandoval, 2008; Gollan et al., 2011). For example, in a study by Gollan et al. (2008), bilingualism and language dominance determined the magnitude of frequency effect (i.e., the difference in reaction time between high and low frequency words). Moreover, as the bilinguals increased in age, the frequency effects in the non-dominant language became smaller, implying that increased use and exposure (with age) modulated the accessibility of low-frequency words.

Another type of evidence comes from a phenomenon referred to as the ‘tip of the tongue’ state (TOT), where speakers experience difficulty in retrieving a specific word but have access to partial phonological information (e.g., starts with /k/) or have an imminent feeling that the word can be retrieved. Bilinguals—including bimodal bilinguals and heritage speakers—have been found to experience more TOTs than monolinguals (Ecke, 2004; Gollan & Acenas, 2004; Gollan & Brown, 2006; Gollan, Montoya, & Bonanni, 2005; Gollan & Silverberg, 2001; Pyers, Gollan, & Emmorey, 2009). In line with the frequency-lag hypothesis, the weaker link between concept and form in bilinguals (due to less frequent use) contributes to the increased number of TOTs.

TOTs have also been documented as an indication of language attrition in cases where its occurrence increases due to a reduction in language exposure (Ecke, 2004). For instance, a longitudinal study of L2 attrition in a Japanese–English returnee child showed that the child expressed TOTs (for example, “umm...what is *gogatsu* in English?”) eight months after returning to the Japanese environment. Lexical retrieval difficulties in the context of attrition have been discussed under the Activation Threshold Hypothesis (ATH) (Paradis, 1993), which was originally postulated to account for the distinction between the loss of representation and the inaccessibility of language knowledge. Similar to the frequency-lag hypothesis, the ATH also assumes that the accessibility of items depends on the frequency and recency of its activation events. Items become more accessible if they are frequently recalled (because the activation threshold becomes lower), and even high frequency words may become more difficult to retrieve after a prolonged period of inactivity (since the activation threshold becomes higher).

The fundamental difference between the frequency-lag hypothesis and the ATH is that the latter not only subsumes processes of *activation*, but also processes of *inhibition*. The idea here is that the increased use of the target language heightens its activation, while simultaneously requiring speakers to inhibit the non-target language. Consequently, the inhibition of competitors raises the activation threshold, making it difficult for speakers to retrieve the suppressed, inactivated language.

The role of inhibition in the ATH speaks to the interference model of speech planning, which proposes that lexical items in both languages compete for selection and are eventually resolved through the inhibition of the non-target language. As discussed above, if both languages are activated in speech planning, speakers must rely on an external mechanism—inhibition—to solve the competition across and within languages.

Green (1998) postulated the inhibitory control model to explain the way in which language selection is achieved through domain-general control mechanism. In the model presented in Figure 3.3, prior to the output (i.e., ‘O’), a conceptual representation is established through the Conceptualiser. In sequence, the supervisory attention system (SAS) that regulates the Language Task Schemas are activated. In

response to the linguistic goal (G), SAS and Conceptualiser work in tandem to control the activation of language tasks to be further processed through the lexico-semantic system. Although further explanation of this model is beyond the scope of this section, what is important here is that the mechanism that controls the selection of language schema is *external* to the lexicon.

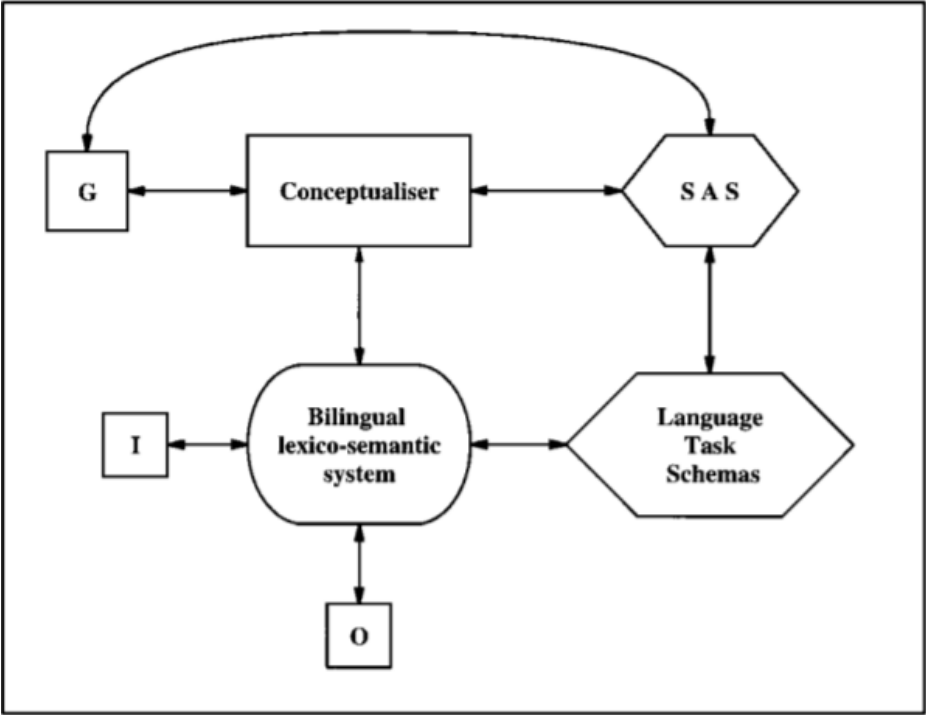


Figure 3.3 Inhibitory control model (Green, 1998)

An important source of evidence for inhibitory control comes from studies examining language-switching performances in bilinguals. Meuter and Allport (1999) conducted one of the first studies to discover an asymmetrical switch cost in the bilinguals’ two languages: switching into L1 (dominant language) was slower than switching into L2 (non-dominant language). This process can be understood as a consequence of inhibition: more attentional resources are required to suppress the dominant, highly activated language, and thus releasing that inhibition when switching back into this language takes more time. Subsequent studies have also reported the presence of asymmetrical switch costs (Costa & Santesteban, 2004; Philipp, Gade, & Koch, 2007; Schwieter & Sunderman, 2008; Verhoef, Roelofs, & Chwilla, 2009), but

debates persist regarding the role of inhibition in switch cost asymmetry and the modulating effect of individual variables such as proficiency, language use, and age of onset on the magnitude of switch costs (Bobb & Wodniecka, 2013). Additionally, more direct correlational analyses between inhibition (and other dimensions of executive control) and switching performance have yielded mixed results, with some studies revealing a significant relationship and others revealing a non-significant one (for further discussion, see Bobb & Wodniecka, 2013).

3.3 Interim conclusion

In sum, the profile of bilingual language production discussed above suggests that both L1 and L2 are influenced by the effect of bilingualism. The frequency-lag hypothesis posits that there are reduced frequency effects for bilinguals relative to monolinguals in *each* of their two languages. The interference model, on the other hand, proposes that the competition between candidates from *both* language pools is resolved through the inhibition of the non-target lexicon. Although these two accounts—*frequency* and *competition*—have been considered at odds with one another in terms of explaining why bilinguals lag behind monolinguals in word production, they are compatible and provide explanations for different types of bilingual effects on language processing (Kroll & Gollan, 2014). In fact, these two accounts combined can explain how attrition may take place: reduced exposure to the target/attrited language may weaken the link between concept and form and decrease its accessibility, while increasing exposure to the other/non-attrited language may heighten its activity, requiring bilinguals to use more cognitive resources to globally inhibit it. In other words, the dual effects of reduction in frequency and rise in competition may equally contribute to the process of attrition.

Although cross-language activation in bilingual speech planning appears to be a well-established notion, the specific components of the cognitive mechanism controlling language production and the host of factors that modulate these domain-general processes are not fully understood. The next chapter reviews models of executive control other than the Inhibitory Model (Green, 1998) to explore alternative

types of cognitive functions that may be involved in language production (Section 4.1). Thereafter, the relationship between language control and executive control is further elaborated (Section 4.2), followed by a discussion of what aspects of the bilingual experience may be responsible for the development of executive control (Section 4.3).

4 Executive control and bilingualism

The previous chapter discussed how bilingual speech is characterised in terms of functional frequency *within* each of the bilinguals' languages and/or in competition *between* the two languages. The latter account assumes that both languages are simultaneously active, and that inhibitory control is involved in selecting the appropriate item for production. This chapter expands on the discussion of the interference model (Section 3.2) and explores further types of cognitive mechanisms that operate at different levels of linguistic activities (Section 4.1). I then elaborate on the relationship between language control (i.e., the ability to attend selectively to one language) and executive control by focusing on the empirical evidence stemming from manipulations of the language-switching paradigm (Section 4.2). In the final section of this chapter, I discuss how the process of speech planning may be related to the cognitive consequences of bilingualism that have been reported for domain-general processes. Most importantly, consideration is given to the various dimensions of bilingualism (i.e., language exposure; proficiency; context of language use) that influence domain-general processes and how they may interact developmentally in attrition (Section 4.3).

4.1 Models of executive control

While the Inhibitory Control model (Green, 1998) assumes the exclusive role of inhibition in language control, more recent research on bilingualism and cognition makes reference to a variety of emerging models from both fields of study. For instance, the Dual Mechanism framework (Braver, 2012; Braver, Gray, & Burgess, 2007; Braver, Paxton, Locke, & Barch, 2009) postulates a distinction between two types of control mechanism: proactive control, which consists of active preparation of the cognitive system to prevent interference from arising; and reactive control, which

involves the transient retrieval of goal information to resolve interference that has already arisen. Studies have shown that there is a shift from reactive control to proactive control during childhood (Chevalier & Blaye, 2008; Chevalier, James, Wiebe, Nelson, & Espy, 2014; Doebel et al., 2017; Lucenet & Blaye, 2014) For instance, Chevalier et al. (2014) found in a longitudinal study of 213 children aged 3 to 10 that preschool children approached working memory span tasks reactively, while school-age children (from around 7 years old) proactively planned response sequences with increasing efficiency. From this perspective, individual variability in executive control can translate into how the speakers combine these two control mechanisms. Speakers may be required to optimally balance proactive and reactive control based on their surroundings and circumstances.

Taking contextual factors into account, Green and Abutalebi (2013) developed the Adaptive Control hypothesis, tailoring its framework to describe mechanisms of executive control in bilinguals. Briefly, this framework postulates that bilinguals adapt cognitively to various interactional contexts, namely single language contexts (only one language is spoken exclusively in a given environment), dual language contexts (both languages are spoken in an environment but with different interlocutors), and dense code-switching (both languages are spoken to the same interlocutors). The demands imposed on bilingual control processes vary as a function of context, as shown in Figure 4.1. Here, eight control processes are introduced, as well as the magnitude of cognitive demands relative to interactional context. From this, the dual language context imposes the highest demand on control processes, in which all but opportunistic planning entail a moderate to high cognitive load (this refers to all the “+” signs under the dual language context in Figure 4.1). Although further description of these control processes goes beyond the scope of this section, it should be underlined that, unlike other models of executive control, this framework considers the impact of language experience on the patterns of engagement of control processes, specifically in the bilingual population.

<i>Control processes</i>	<i>Interactional contexts</i>		
	<i>Single language</i>	<i>Dual language</i>	<i>Dense code-switching</i>
Goal maintenance	+	+	=
Interference control: conflict monitoring and interference suppression	+	+	=
Salient cue detection	=	+	=
Selective response inhibition	=	+	=
Task disengagement	=	+	=
Task engagement	=	+	=
Opportunistic planning	=	=	+

Figure 4.1 Demand on control processes relative to interactional contexts in the Adaptive Control Hypothesis (Green & Abutalebi, 2013, p.519)

+ indicates the context increases the demand on the control process (more so if in bold); = indicates that the context is neutral in its effects

The final framework is referred to as the unity and diversity model (Miyake & Friedman, 2012; Miyake et al., 2000). This model has been widely adopted in research examining the cognitive effects of bilingualism, described as the “primary processes in the executive system” (Bialystok, 2009, p.5). In this model, three basic components of executive control are proposed: inhibition, updating, and shifting. ‘Inhibition’ is the ability to override unwanted, dominant, or prepotent responses; ‘updating’ is the ability to constantly monitor and rapidly add or delete information in Working Memory; and ‘shifting’ is the ability to alternate flexibly between tasks or mental sets. Essentially, Miyake and his colleagues propose that these components correlate with one another, yet each stands as an individual construct showing some degree of diversity (see Figure 4.2). The confirmatory factor analysis reported in Friedman et al. (2008) demonstrates that the three latent variables significantly correlate with one another (as indicated by the numbers on the curved double headed arrows in Panel a), but its coefficient values are far from a perfect correlation (i.e., a value of 1). Panel b illustrates the revised version of the model, in which there is a common executive control variable on which all nine cognitive tasks load, in addition to updating and shifting variables that account for the variance between the tasks. Interestingly, the common executive control variable correlates perfectly with the inhibition tasks, positing the central role of inhibition in executive control.

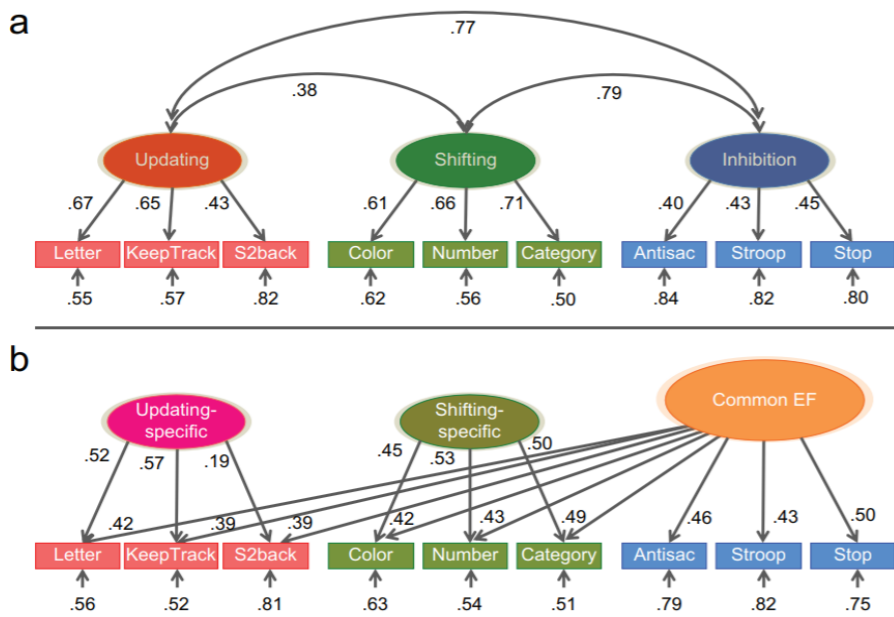


Figure 4.2 Illustrations of the associations among the three executive control components (Friedman et al., 2008). Letter = letter memory; Keep = keep track; S2back = Spatial 2-back; Colour = colour–shape; Number = number–letter; Category = category–switch; Antisac = antisaccade; and Stop = stop-signal

Adopting Miyake and Friedman’s original framework, several developmental studies have documented that executive control emerges in the first years of life and continues to develop throughout childhood and adolescence (Best & Miller, 2010). Critically, components of executive control do not all develop at similar rates, or follow similar trajectories (Diamond, 2002). For example, updating performance has been found to progress until young adulthood (Beveridge, Jarrold, & Pettit, 2002; Gathercole, Pickering, Ambridge, & Wearing, 2004; Luciana, Conklin, Hooper, & Yarger, 2005) while shifting and inhibition reach adult level performance around puberty (Cepeda, Kramer, & Gonzalez de Sather, 2001; Kray, Eber, & Lindenberger, 2004; Van den Wildenberg & Van Der Molen, 2004). It is nevertheless difficult to pinpoint the age of mastery for specific executive control construct, as the complexity of the tasks employed differs among studies and different tests are used to measure the same component. For example, Luciana et al. (2005) found that less cognitively demanding Working Memory tasks were mastered earlier in development than others involving a heavier cognitive load. Despite these methodological issues, findings

obtained in the literature appear to suggest that performance on complex updating and monitoring tasks (which involve sustaining and manipulating specific information) increases steadily in a linear manner until adolescence, whereas a rapid development during early childhood is observed for inhibition tasks (see review in Best & Miller, 2010). In light of this background, I investigate the development of executive control in bilingual returnee children aged 7 to 12 in Chapter 9, where the greatest improvement (i.e., in terms of both accuracy and reaction time) is shown in the complex Working Memory task (i.e., N-back), supporting the findings of previous research.

In sum, all accounts of executive control described above (the Inhibitory Control model, the Dual Mechanism framework, the Adaptive Control Hypothesis, and the unity and diversity approach), whether developed and applied within or outside the field of bilingualism, share the conception that inhibition plays a crucial role, along with further mechanisms that may govern bilingual language control. In the next section, I will elaborate on what was discussed in Section 3.2 and review various types of empirical research examining the relationship between language control and executive control.

4.2 Language control and executive control

In the previous section, I described various models of executive control that are relevant to linguistic activities of bilinguals. These models all assume that processes external to language at least partially overlap with bilingual language control. Empirical evidence, however, does not necessarily support the notion that bilingual language processing recruits domain-general control mechanisms, and further questions remain as to what extent and under what circumstances these two mechanisms overlap.

One well-established way to test the underlying mechanism of language control is to employ language-switching tasks. Language-switching performance has been investigated in bilingual comprehension (Bultena, Dijkstra, & Van Hell, 2015; Kohnert & Bates, 2002; Orfanidou & Sumner, 2005) and production (Festman,

Rodriguez-Fornells, & Münte, 2010; Linck, Schwieter, & Sunderman, 2012; Meuter & Allport, 1999), as well as in bilingual children (Ellefsen, Shapiro, & Chater, 2006; Jia, Kohnert, Collado, & Aquino-Garcia, 2006; Kohnert, Bates, & Hernandez, 1999) and adults (Calabria, Branzi, Marne, Hernández, & Costa, 2015; Prior & MacWhinney, 2010; Weissberger, Wierenga, Bondi, & Gollan, 2012). The language-switching paradigm requires bilinguals to switch between their two languages, either based on a language cue (e.g., visual or auditory), a specific rule (e.g., switch after every second trial), or on an entirely voluntary basis (Declerck & Philipp, 2015). The findings of these different paradigms converge on the conclusion that, regardless of the type of instructions on language-switching, switching from one language to another usually contains a performance cost, operationalised as switch costs or mixing costs. Switch costs refer to the difference between switch and repetition trials in which the bilinguals have to *switch* to the other language or *repeat* something in the same language within the same block. Mixing costs are the difference between repetition trials in the mixed language block and repetition trials in the single language block (i.e., a single language is relevant across all trials).

As previously discussed, asymmetrical switch costs have been regarded as one of the significant markers for inhibition. L2 learners experience greater switch costs in their L1 than in their L2, as a consequence of the magnitude of inhibition applied in the previous trial. Not all studies, however, have observed this phenomenon, especially in comprehension tasks (Macizo, Bajo, & Paolieri, 2012; Thomas & Allport, 2000) and tasks involving highly proficient bilinguals (Costa & Santesteban, 2004; Costa, Santesteban, & Ivanova, 2006; Meuter & Allport, 1999; Schwieter & Sunderman, 2008). For instance, Costa et al. (2006) reported symmetrical language-switch costs in highly proficient bilinguals of two dissimilar languages (Spanish–Basque) and bilinguals with a late age of L2 onset (age 10). This evidence speaks to the possibility that highly proficient speakers, regardless of their language combination or the age of L2 onset, do not rely on inhibition when switching between languages, but rather on enhanced activation of the target language (i.e., a language-specific selection mechanism). Hence, the magnitude of asymmetrical switch costs appear to be modulated by the type of tasks and language profile of the bilinguals.

The switch costs we have discussed so far relate to local, trial-based inhibitory processes. A different form of inhibition at the global level has been observed in several studies, demonstrating faster performance in the dominant language in a single language block, but slower performance in a mixed language block (Costa & Santesteban, 2004; Costa et al., 2006; Gollan & Ferreira, 2009; Misra, Guo, Bobb, & Kroll, 2012). The faster reaction time for the dominant language (that is, faster than for the non-dominant language) in the single block can be explained by heightened activation or frequency effects (as discussed in Section 3.2). A slower reaction time for the dominant language in the mixed block, on the other hand, has generally been contextualised as a constant and global inhibition of the dominant language. To illustrate this, findings from an ERP (Event Related Potential) study employing two blocks of naming in one language followed by another two blocks of naming in the other language (rather than trial-to-trial switches) showed that the ERPs were more negative when the block of L1 naming followed a block of L2 naming. This suggests that L1 inhibition may not only be applied in the immediate switch to L2, but it may also persist throughout subsequent trials (Misra et al., 2012).

In an attempt to examine the relationship between language control and executive control directly, some studies ran regression analyses to estimate whether bilinguals who perform better in language-switching tasks also do better on executive control tasks. Many of these studies utilised a task-switching test, where the experimental set-up is similar to that of a language-switching task, requiring bilinguals to sort stimuli according to a certain cue/criterion such as shape or colour. Positive correlations have been reported between language-switching and task-switching (Declerck, Grainger, Koch, & Philipp, 2017; Liu, Fan, Rossi, Yao, & Chen, 2016; Liu, Rossi, Zhou, & Chen, 2014; Prior & Gollan, 2011), as well as between language-switching and inhibition (de Bruin, Roelofs, Dijkstra, & FitzPatrick, 2014; Linck et al., 2012). Nevertheless, several studies also report a non-significant relationship (Branzi, Calabria, Boscarino, & Costa, 2016; Calabria et al., 2015; Jylkkä et al., 2018; Weissberger et al., 2012), contributing to the persisting debate on the involvement of domain-general control processes in language control. A few results from developmental studies also suggest a different developmental trajectory across the lifespan between language control and executive control in a bilingual population

(Calabria et al., 2015; Weissberger et al., 2012), further questioning the existence of an overlap between language control and executive control.

Taken together, one can conclude that much more work is needed to reveal the extent of overlap and the circumstances involved in the relationship between language control and executive control. Language control in bilingual children is an understudied area of research, and questions remain as to how the two control mechanisms interact developmentally. If these two control types overlap, then children who experience greater development in executive control should also do so in language control. This hypothesis is investigated in Chapter 8, where a relationship is indeed found between language control development and executive control development.

What must not be forgotten, however, is that language control is largely modulated by bilingual experience (Bobb & Wodniecka, 2013). While executive control is generally found to increase with age (for a review see Best & Miller, 2010), the bilingual experience is a fluid process that does not increase in a linear manner with age. Some children may experience a reduction in language exposure (as in the case of returnee children); others may undergo an increase in language input due to environmental or circumstantial changes. Thus, when examining the development of language control in children, the characteristics of the bilingual experience (in addition to executive control) must be taken into consideration.

Nevertheless, there is no consensus in the literature as to what this ‘bilingual experience’ actually entails. One may refer to bilingual experience as the frequency of language-switching, the level of proficiency in each language, or the amount of use, input, and exposure in each language. Following this, Prior and Gollan (2011) tested Spanish–English bilinguals, Mandarin–English bilinguals, and English monolinguals using language-switching and task-switching paradigms. Their results revealed that the Spanish–English bilinguals who reported switching often between the two languages showed an advantage over the monolinguals for switching costs on both linguistic and non-linguistic switching tasks. In comparison, the Mandarin–English bilinguals who reported not switching as often as the Spanish–English bilinguals performed similarly to monolinguals in both of the tasks. Given these findings, the extent of language-switching may be a key factor in the enhancement of language

control and executive control. Furthermore, high-proficiency and low-proficiency bilinguals activate different parts of the brain (left caudate and the pre-SMA/ACC) when performing language-switching tasks (Garbin et al., 2011), suggesting that language proficiency may also modulate language control. In Chapter 8, I looked specifically at the influence of language exposure on language control development, and found a significant effect of L2 exposure on the development of L2 naming latencies.

4.3 Bilingualism and executive control

As discussed in the previous section, if managing two languages is at least partially governed by domain-general processes, this should theoretically give rise to enhancement in executive control in bilinguals when compared to their monolingual counterparts. This is due to the idea that bilinguals have more training in controlling competing sets of languages, which in turn may enhance the ability to regulate non-linguistic tasks. Much research has delved into the debate of this ‘bilingual advantage’ by comparing executive control performances between bilinguals and monolinguals. This section focuses on the three types of executive control mechanism—inhibition, shifting, and updating—outlined by the unity and diversity approach (Friedman et al., 2008; Miyake & Friedman, 2012; Miyake et al., 2000). It reviews the literature on this topic, focusing on what aspects of the bilingual experience may contribute to cognitive advantage in bilinguals. A further critical discussion of this literature can be found in Chapter 9, which examines the role of proficiency, language exposure, and age of L2 onset on the development of bilingual children’s inhibition, shifting, and updating abilities.

Earlier work on cognitive benefits in bilinguals arose from the Inhibitory Control model (Green, 1998), which compared performances of monolinguals and bilinguals using tests specifically designed to measure inhibitory control. Among these, the most commonly used tests include the Simon task, the Flanker task, and the Stroop task. In all tasks, participants are required to suppress the urge to respond to irrelevant information. For example, in the Simon task, the location of the button (e.g., right or left) and the location of the stimuli (e.g., right or left) may match (button: right,

stimulus: right) or mismatch (button: right, stimulus: left). In the mismatched trial, the participants must inhibit their prepotent response to push the button that lines up with the position of the stimulus. The measure of inhibition (i.e., the Simon effect) is the difference in reaction time between matched and mismatched trials.

Several studies have reported inhibitory control advantage of bilinguals using the aforementioned tasks in adults (*Simon*: Bialystok, 2006; Bialystok et al., 2005; Bialystok, Craik, Klein, & Viswanathan, 2004; *Flanker*: Costa, Hernández, Costa-Faidella, & Sebastián-Gallés, 2009; Costa, Hernández, & Sebastián-Gallés, 2008; Emmorey, Luk, Pyers, & Bialystok, 2008; *Stroop*: Bialystok et al., 2012). However, the link between bilingualism and inhibitory control is much more elusive in children, with many studies failing to observe a performance cost advantage (Bialystok, Martin, & Viswanathan, 2005; De Cat, Gusnanto, & Serratrice, 2018; Martin-Rhee & Bialystok, 2008). All these studies discovered a clear bilingual advantage in global reaction time; regardless of the trial type (e.g., mismatched/incongruent or matched/congruent), bilingual children were generally faster at responding than their monolingual peers. Debates persist in the literature as to what mechanisms are reflected in global reaction time. Researchers in bilingualism stress the role of conflict monitoring (Costa et al., 2009; Hilchey & Klein, 2011), while others interpret it as processing speed (Diamond, 2013). The findings from Chapter 9 also reveal that bilinguals' global reaction time decreases over time, despite there being no changes in the Simon effect. Further discussion regarding the cognitive mechanisms emulated in global reaction time can be found in Section 9.4 (Discussion) in Chapter 9.

Mixed results have also been obtained in studies on updating and the Working Memory advantage in bilingual children (Engel de Abreu, Cruz-Santos, Tourinho, Martin, & Bialystok, 2012; Morales, Calvo, & Bialystok, 2013), while measures of shifting have generally obtained a bilingual advantage (Bialystok & Martin, 2004; Carlson & Meltzoff, 2008; Iluz-Cohen & Armon-Lotem, 2013; Tran, Arrendono, & Yoshida, 2018). For instance, Tran et al. (2018) found the largest bilingual advantage in the Dimensional Change Card Sorting (DCCS) task, which requires participants to shift flexibly between sorting the stimulus based on colour or shape. They suggested that task-switching tests such as DCCS, which require multiple cognitive processes

(e.g., monitoring two sets of tasks, inhibiting the irrelevant task, and shifting between dimensions), exhibit the largest bilingualism effect.

In addition to the scattered picture of the existence of bilingual advantage in the literature, we are still far from identifying what aspects of the bilingual experience confer cognitive enhancement. Several factors have been proposed, from proficiency, age of L2 onset, and context of language use, to the amount of switching between languages. The modulating role of proficiency has attracted the most scholarly attention, and findings reveal advanced cognitive abilities in highly proficient and balanced bilinguals (Hommel, Colzato, Fischer, & Christoffels, 2011; Kushalnagar, Hannay, & Hernandez, 2010; Rosselli, Ardila, Lalwani, & Vélez-Urbe, 2016; Vega & Fernandez, 2010; Vega-Mendoza, West, Sorace, & Bak, 2015; Verreyt, Woumans, Vandelanotte, Szmalec, & Duyck, 2016). Among these studies, Vega & Fernandez (2010) is the only study to test the cognitive abilities of bilingual children (third and fourth graders) with balanced and unbalanced proficiency in Spanish (L1) and English (L2) respectively. They found that the balanced group outperformed that unbalanced group in their performance on shifting in the Wisconsin Card Sorting Test.

The modulating role of age of L2 onset has also been extensively studied. Some studies found that the earlier onset of bilingualism positively influences executive control performance (Carlson & Meltzoff, 2008; Kapa & Colombo, 2013; G. Luk, De Sa, & Bialystok, 2011; Tao, Marzecová, Taft, Asanowicz, & Wodniecka, 2011). Patterns of language-switching were also found to modulate executive control development (Prior & Gollan, 2011; Verreyt et al., 2016; Yim & Bialystok, 2012). It should be emphasised that not all studies dealing with the effect of bilingual experience on executive control were successful in obtaining a significant result; in fact, several studies report otherwise (age of L2 onset: Humphrey & Valian, 2012; Pelham & Abrams, 2014; proficiency: Vega-Mendoza et al., 2015).

To sum up, the existence of bilingual advantage and the modulatory effect of bilingual experience on executive control by no means present an unequivocal picture. Methodological challenges remain in terms of raising the convergent validity of the tasks, increasing statistical power, and controlling for group and individual differences.

4.4 Interim conclusion

The first section of this chapter (Section 4.1) discussed various models posited to explain how domain-general control processes govern bilingual language control. In the next section (Section 4.2), I reviewed contradictory findings on the relationship between language control and executive control, and highlighted the need to carefully control for individual variability in regards to bilingual profiles. In the final section (Section 4.3), I explored literature for and against the ‘bilingual advantage’ debate, paying close attention to the role of proficiency and how it may act as a catalyst for enhancing executive control.

Against this background, it is likely that variation in how we define the bilingual experience and group bilinguals is in part responsible for the inconsistent findings in the area of bilingualism and general cognition. An intuitive solution would be to track the linguistic and cognitive experience of the bilinguals in a longitudinal manner, rather than treating bilinguals as a homogenous group and comparing their performances to that of the monolinguals. Such an approach can enlighten the field, indicating the ways in which the linguistic experience may interact with cognitive development, especially in the minds of children undergoing rapid linguistic and cognitive developmental changes. In a review of cognitive development in bilinguals, Barac, Bialystok, Castro, and Sanchez (2014, p.712) stress the importance of longitudinal studies in children:

The literature also lacks research examining the links between verbal and non-verbal skills in bilingual and monolingual children. Being able to explore these correlations has the potential to contribute to our understanding of how an essentially linguistic experience leads to changes in non-verbal cognitive development. Similarly, longitudinal research has the potential to capture how increasing command of languages relates to non-verbal skills, as well as to investigate the issue of reaching a certain threshold of language experience and/or proficiency to highlight changes in other cognitive areas.

In view of this, I examine whether there is any relationship between the *development* of language control and the *development* of executive control in bilingual

returnee children by testing them on a number of linguistic and non-linguistic tasks over the course of one year (Chapter 8). In like manner, Chapter 9 investigates the modulating effect of proficiency and language exposure on the *development* of their executive control. A longitudinal study on children can potentially help understand what may change as a function of bilingual experience, as well as when it may change, to what extent, and how.

5 Summary of the literature review and research questions

This chapter summarises the key points discussed in the previous three chapters and provides a general outline of the experimental studies and research questions that follow in Chapters 6 to 9.

In Chapter 2, I reviewed the effect of age (Section 2.1), language exposure (Section 2.2), and linguistic structure (Section 2.3) on L2 acquisition, as well as L1 and L2 attrition. Studies on age have provided most evidence, with the age of L2 onset playing a determining role in the level of ultimate L2 attainment and the degree of attrition in L1. However, in the context of L2 attrition, its effect is uncertain especially in the case of sequential bilinguals whose age of L2 onset varies considerably. Further questions relate to the modulating effect of language exposure on attrition, with several studies failing to find support for the ‘use it or lose it’ notion. Finally, in addition to variables relating to the language acquirers, the type of linguistic properties have been found to contribute to the variability in attrition. Specifically, structures that involve integration of linguistic and non-linguistic variables (e.g., syntax-discourse) are difficult to acquire and more vulnerable to attrition.

Chapter 3 discussed how bilinguals plan their speech, whether the two languages are activated during speech planning (Section 3.1), and why bilinguals are disadvantaged regarding language production (Section 3.2). Compelling evidence shows that bilinguals activate both their languages simultaneously, even when attending to the target language. In this sense, bilinguals may be slower than monolinguals in word production, since cross-linguistic activation requires them to suppress the activation of the other language (i.e., interference account). Alternatively and/or additionally, bilinguals may have a weaker link between a concept and the form of a word since they simply have less opportunity to use each language compared to monolinguals (i.e., the frequency-lag hypothesis). The interference account relates to

recent claims about the consequences of bilingualism for executive control, described in Chapter 4.

Chapter 4 examined the theoretical models of executive control proposed in the fields of cognitive psychology and linguistics to explain how domain-general control processes may be involved in language output (Section 4.1). The discussion in Chapter 3 (Section 3.2) was expanded, and I further reviewed empirical research claiming for and against partial interdependence between language control and executive control (Section 4.2). The elusive link between language control and executive control relates to the inconclusive findings on cognitive advantage in bilinguals (Section 4.3). This opened further questions into whether cognitive enhancement only appears as a function of specific aspects of the bilingual experience, such as proficiency or age of L2 onset. In light of this background, I formulated the following research questions and predictions:

1. What aspects of the linguistic structure are sensitive to changes in language environment in bilingual returnee children? (Chapter 6)
2. How do various dimensions of bilingual experience (age of L2 onset; L2 exposure; L2 proficiency; length of L2 residence) influence change in lexical access in bilingual returnee children? (Chapter 7)
3. How do L2 exposure and development of executive control influence the development of language control in bilingual returnee children? (Chapter 8)
4. How do various dimensions of bilingual experience (L2 proficiency; L2 exposure; and age of L2 onset) influence the development of executive control in bilingual returnee children? (Chapter 9)

The predictions for each study are developed as follows:

1. I predict that a linguistic property (genitives) that (a) involves a partial structural overlap (English has two forms for a genitive expression: *the table's leg* versus *the leg of the table*, while Japanese only has one: *teeburu no ashi*, *the table's leg*) (Müller & Hulk, 2001), and (b) involve integration of multiple sources of information (one has to understand semantic and discourse related constraints to choose the 'appropriate' genitive form) (Sorace, 2004), undergo

effects of attrition. Specifically, the proportion of *s*-genitives should increase as a function of stronger cross-linguistic effect from L1 Japanese to L2 English (the language that has one form affects the other that has two), relative to the children returning to Japan who receive the majority of their input in Japanese.

2. I predict that the length of residence in the L2-dominant environment modulates L2 lexical maintenance in returnee children, in line with the maturational account that some time is required for the language knowledge to consolidate in the speaker's mind. L2 exposure may also play a role, according to the weaker links hypothesis (Gollan & Acenas, 2004; Gollan, Montoya, & Bonanni, 2005; Gollan & Silverberg, 2001) and the ATH (Paradis, 1993): recency and frequency of contact determines how efficiently the speaker can access lexical items.
3. I predict that both L2 exposure and executive control influence the development of language control. That is, children who receive more L2 exposure and improve their performance in the executive control task are also predicted to develop their performance more efficiently in the language control task. Development in the language-switching task (designed to measure language control) and the executive control task can be manifested through faster overall reaction time or smaller performance costs.
4. Since the variable of L2 exposure is expected to change considerably due to shift in the language environment, I predict that children who continue to receive more L2 exposure over the effects of L2 onset and L2 proficiency will show greater performance improvement in the executive control tasks over time.

In what follows, I present four studies that address these questions. The participants in these studies are Japanese–English returnee children (aged 7 to 13) who were born in Japan and moved to an English-speaking environment for some years, and have recently returned to Japan. Their parents are all native Japanese speakers, and these children are attending Japanese schools after their return to Japan. Thus, most of their contact with English has been interrupted since returning to Japan (i.e., their English exposure rate has decreased from 46.8% to 4.5%). I have tracked the linguistic

and cognitive development of these children over the course of one year: the first test session took place when they had just returned to Japan, and the second a year after.

Chapter 6 examines the bilingual children's preferences for different forms of the English genitive (*s*-genitive versus *of*-genitive), a choice that requires an understanding of semantic and discourse-related constraints, hypothesised to be particularly sensitive to changes resulting from exposure to another language (Sorace, 2011). The results demonstrate that bilinguals behave differently from their monolingual peers in interpreting semantic constraints that exhibit conflicts with one another. Furthermore, the evaluation of genitive forms that are affected by such conflicts *and* are subject to the effects of cross-linguistic transfer from L1 (Japanese) underwent change over time within the bilinguals. Together, these findings suggest that bilinguals have difficulty processing linguistic structures that involve conflicts between constraints. These structures may then be specifically vulnerable to changes in activation levels caused by the shift in language environment.

Chapter 7 looks at changes in bilingual returnee children's lexical access, measured by a verbal fluency task. The aim of this study was to uncover the modulating effect of individual variables: age of L2 onset, age of return, length of L2 residence, L2 exposure since return, and proficiency. My study shows that the age of L2 onset and/or the length of L2 residence—but not proficiency or L2 exposure—correlate with the degree of L2 lexical maintenance. In other words, children with an *earlier* age of L2 onset and a *longer* length of L2 residence were able to maintain and even improve their L2 verbal fluency performance upon their return to the L1 environment. This result is partially in line with the maturational account: children require some time to consolidate their language knowledge for it to become resistant to input reduction. In other words, the longer the time (i.e., the longer their length of L2 residence) the children had to stabilise their language knowledge, the less they are affected by attrition.

Chapter 8 investigates how bilingual returnee children's language control (measured by the language-switching task) changes over time. It also examines whether such changes can be predicted by language exposure and executive control development. The findings reveal that the more exposure to English these children

have when they return to Japan, the better they maintain their lexical access in a condition where English is relevant across all trials. In contrast, the development of their English naming performance in a condition where they have to switch between English and Japanese is predicted by executive control development. In other words, children who advanced their performance in the executive control task named English items faster in the mixed language block. Taken together, these results suggest the dual effects of language exposure and executive control development on changes in language control.

Chapter 9 focuses on the development of executive control (rather than linguistic aspects) and examines the modulating role of language exposure, proficiency, and age of L2 onset on the development of executive control in bilingual returnee children. The findings show that the level of proficiency predicts the degree of development in all three cognitive tasks employed to measure inhibition, shifting, and updating skills. Global reaction times in the three cognitive tasks improved the most in advanced bilinguals. This finding confirms the prominent role of proficiency in children's cognitive development.

Chapter 10 summarises the main findings of the four studies (Section 10.1) and provides a general discussion of these results and directions for further research (Section 10.2). I briefly touch on the limitations of my research (Section 10.3), and finish with a general conclusion (Section 10.4).

6 A longitudinal study of genitive preferences in Japanese-English bilingual returnee children

6.1 Introduction

Studies on cross-linguistic transfer provide valuable information in the field of second language acquisition by investigating how the first language (L1) influences the acquisition of the second language (L2). In the present study, we define cross-linguistic transfer as a language behaviour exhibited by bilinguals that (a) is influenced by the other language and (b) cannot be explained by developmental processes in monolingual language acquisition (whether it is delay or acceleration). For example, Japanese learners of English may produce incorrect phrases such as *my today's homework*—an error that is rarely observed in any developmental stage of English monolingual speakers. This error is most likely a result of cross-linguistic transfer from L1 Japanese to L2 English, due to the fact that analogous constructions with multiple prenominal genitives are allowed in Japanese.

A body of literature in various language domains including phonology, morphology, and syntax has been examining the question of the circumstances in which cross-linguistic transfer occurs between the two languages of a bilingual. The first explanation is language dominance or proficiency. Studies have shown cross-linguistic transfer to take place from the dominant language to the non-dominant language (Argyri & Sorace, 2007; Yip & Matthews, 2000). Other studies (Müller & Hulk, 2001; Paradis & Navarro, 2003; Sorace & Filiaci, 2006), however, suggest that language dominance alone cannot explain cross-linguistic transfer; and instead propose that the internal structure of the two languages determines the occurrence and the directionality of cross-linguistic transfer.

However, it is difficult to tease apart the effect of language development and cross-linguistic transfer. For instance, ungrammatical constructions produced by

bilingual children but not by age-matched monolinguals may be due to a developmental delay. Secondly, when testing the effect of language dominance on cross-linguistic transfer, many studies (Argyri & Sorace, 2007; Serratrice et al., 2009; Sorace et al., 2009) compare two groups of bilinguals that differ in their dominant language (e.g., Japanese-English bilinguals in Japan vs. in the US). However, this kind of design may not be enough to isolate the effect of cross-linguistic transfer, as the two groups may vary with respect to past language experiences and exposure.

The current study examines the effect of language dominance on cross-linguistic transfer in Japanese-English bilingual returnee children, whose language environment changed from second language dominant (English-speaking countries) to first language dominant (Japan). This experimental design allows us to control for the aforementioned issues. By testing the bilingual children longitudinally, at different points after their return to the L1 environment, we can better control for the amount of L2 exposure they get, which is expected to be minimal. Thus, we can be fairly confident that any changes we observe over the period of a year from their return to Japan is not a result of L2 development, but due to other factors such as L1 cross-linguistic transfer or L2 attrition. Moreover, by testing the same group of bilinguals twice, we can control for the confounding factors (such as past language experiences, motivation, aptitude, cognitive abilities) that emerge when comparing two different groups of bilinguals.

The syntactic phenomenon that the study focuses on is the choice of genitive forms. In English, there are two ways to express a possessive relationship; namely the pre-nominal possessive form—*s*-genitive (e.g., the table's leg)—and the post-nominal possessive form—*of*-genitive (e.g., the leg of the table). In Japanese, there is only a pre-nominal genitive, where the pre-nominal possessive is marked with the particle *no* (e.g., *Hanako no koppu*; Hanako's cup). In English the choice between the two genitive forms is conditioned by semantic and pragmatic factors, and thus is hypothesised to be sensitive to transfer effects from the L1 (Müller & Hulk, 2001; Sorace, 2011). In the next sections, we will further discuss possible explanations of cross-linguistic transfer, followed by descriptions about the genitive forms in English and Japanese.

6.1.1 *Explaining cross-linguistic transfer*

Since many bilingual children are more proficient in or more exposed to one language than the other, some studies have argued that cross-linguistic transfer takes place from the dominant to the non-dominant language (Argyri & Sorace, 2007; Kupisch, 2007; Nicoladis, 2012; Paradis, 2001; Yip & Matthews, 2000). For example, the study by Argyri and Sorace (2007) found that cross-linguistic transfer in syntactic structures occurred from English to Greek among bilingual children, but this effect was found only among bilinguals who were dominant in English, not in children who were dominant in Greek. It should be noted that ‘dominance’ is defined in a number of different ways in the literature. For example, Argyri and Sorace (2007) as well as Serratrice et al. (2009) operationalized dominance as the relative amount of language exposure the children get, while Yip and Matthews (2000) and Nicoladis (2012) used proficiency measures such as mean length of utterance (MLU) or Peabody Picture Vocabulary Test (PPVT) to determine the dominant language of bilingual children. It remains the case that no uniform definition exists for this term (for further discussion see Treffers-Daller & Silva-Corvalán, 2015); here we will follow the studies that define language dominance in terms of the amount of language exposure the child receives in each language.

An influential alternative hypothesis for explaining cross-linguistic transfer was first proposed by Müller and Hulk (2001), suggesting that two languages must have similar structures but also be ‘ambiguous’ for cross-linguistic transfer to occur. Here, ambiguity refers to cases when one language allows only one form to express a particular function, whereas the other language has two. This also determines the directionality of cross-linguistic transfer: the language with one form influences the language with two forms. Complementing this idea, Sorace and Filiaci (2006) later proposed the Interface Hypothesis, which hypothesized that structures that are conditioned by pragmatic functions are especially difficult to acquire and are also more vulnerable to effects of attrition than structures that only involve syntactic aspects of the language. The principal empirical testbed for this hypothesis has been the distribution of pronominal forms. For example, in Italian, there are two ways to express pronominal subjects: overt and null pronouns. The choice of these two forms is

governed by non-syntactic pragmatic factors— a null pronoun is used when referring to the topic of the sentence, whereas an overt pronoun is used when there is a non-topical antecedent and marks a topic shift. In contrast to Italian, English only has one form, overt pronouns (e.g., he, she) to express the same function. Thus, cross-linguistic transfer is predicted to occur from English (one form; overt pronoun) to Italian (two forms: overt and null pronoun), and this effect may be manifested in the overuse of overt pronouns in Italian in bilingual children. For instance, Serratrice et al. (2004) investigated subject and object realizations among English-Italian bilingual children as well as English and Italian monolingual children. The results showed that the bilingual children overextended the use of overt pronominal subjects in Italian when compared to the Italian monolingual children. However, no effect from Italian to English was found: the bilingual children did not overuse null pronouns in their English production compared to their English monolingual peers. Taken together, these explanations for the occurrence and directionality of cross-linguistic transfer are based on the internal structure of the languages (rather than factors relating to individual speakers, such as language dominance). For convenience, we refer to such explanation as ‘structurally-based account’ of cross-linguistic transfer.

In order to investigate the relative influence of factors such as type of language structure and language dominance, a large-scale study was conducted by Sorace et al. (2009) and Serratrice et al. (2009) on monolingual and bilingual children. They used grammaticality judgment task to test two constructions that involve different interfaces: subject pronouns (syntax-pragmatics interface) and definite articles with plural noun phrases (syntax-semantics interface). The language combinations under investigation were English-Italian and Spanish-Italian—language combinations that have ambiguous and unambiguous structures respectively (Spanish and Italian share similar structure in terms of pronominal forms and plural noun phrases). These studies also manipulated language dominance by testing English-Italian bilingual children living in the UK (English-dominant) and in Italy (Italian-dominant). Each group of bilinguals (i.e., English-Italian in UK, English-Italian in Italy, and Spanish-Italian bilinguals) and monolinguals (i.e., English and Italian monolinguals) were divided into two age groups: younger (6-7 years old) and older (8-10 years old) children. As for the structures hypothesised to show reflexes of the syntax-semantics interface (the

distribution of definite determiners in plural noun phrases), only the English-Italian bilingual children living in the UK accepted significantly more ungrammatical bare plural noun phrases in generic contexts in Italian than their Italian monolingual peers. Thus, it appears to be the case that language dominance played an important role in explaining the directionality of cross-linguistic transfer for the evaluation of structures at the syntax-semantics interface. However, the question remains open as to whether the syntax-semantics interface is as sensitive to variability in the input as the syntax-pragmatics interface. Sorace (2011) points out that properties at the syntax-semantics interface are not necessarily ‘immune’ to problems, but may diverge from those associated with the syntax-pragmatics interface in terms of how the structure is cognitively processed by bilinguals.

Their findings relating to the syntax-pragmatics interface structure showed that the younger English-Italian bilinguals in the UK accepted more redundant overt subject pronouns in Italian than the bilinguals in the same age group living in Italy. Moreover, English-Italian and Spanish-Italian bilinguals both overextended the use of overt-subjects in Italian and behaved differently from their monolingual counterparts. This result suggested that the overextended use of overt subject-pronouns is not caused by a transfer effect from L1, but is an effect of bilingualism per se. Sorace (2011) later proposed that integration of pragmatic and contextual conditions (as in the case of pronominal form), may be particularly difficult to process for the bilinguals due to the extra cognitive demands. In other words, bilinguals may not be as efficient as monolinguals in processing multi-faceted information, as they also need to use their mental resources to suppress the unwanted language while simultaneously processing linguistic information in the target language.

The role of language dominance on cross-linguistic transfer has also been studied in the field of language attrition. Although the term ‘attrition’ is generally defined as a gradual change of language abilities, there is no uniformity in the literature as to what type of ‘change’ may be involved—it has been variously defined as an increase in errors, slower reaction time, or a difference in structural preference when compared to monolingual counterparts. As Yilmaz and Schmid (2012) stress, attrition can manifest itself in various phenomena in the target language. Among these, interference from the dominant to non-dominant language is the most studied

phenomenon in attrition research (Köpke, 2002; Pavlenko, 2009; Schmid & Jarvis, 2014; Yilmaz & Schmid, 2012). Moreover, recent studies have shown that attrition first affects structures interfacing with non-syntactic domains (Sorace, 2011). It is important to note that there may only be a difference in terminology between “language interference in attrition” on the one hand, and “the influence of language dominance on cross-linguistic transfer” on the other. Essentially, both fields of research examine how the differences in input, exposure, or proficiency affect interference from one language to the other. Tomiyama (1999, 2000) is an example of an L2 attrition study that found evidence of L1 cross-linguistic transfer. In this study, Tomiyama tracked L2 English progress of a Japanese returnee longitudinally over the course of 33 months. The subject was eight years old at the time of his return to Japan and data was collected once a month using free conversation and a story-telling task. In the second stage of data collection (from 20 months to 33 months), the subject used erroneous *s*-genitive forms such as ‘*the window’s place’. She concluded that the inappropriate use of the *s*-genitive is an indicator of L1 transfer, since the genitive form in Japanese resembles the linear structure of *s*-genitive in English.

So far, we have discussed possible explanations for cross-linguistic transfer in bilingual children, focusing on language dominance and structurally-based accounts. The current study examines whether difference in genitive preference between monolingual and bilingual children can be explained by the structurally-based account, and also whether divergence in genitive preference over time within the bilinguals is predicted by change in language dominance. In order to make it clear how we investigated these questions in our study, we now need to give some background on the syntactic phenomenon that we focused on: genitive forms in English and Japanese. In the next section, we will review the factors that affect the choice of genitive forms in English, and then describe the genitive form in Japanese.

6.1.2 *Genitive variation in English*

There is a wide range of debate in the literature as to what factors contribute to the choice between *of*-genitive and *s*-genitive. These include semantic properties such as animacy and the type of possessive relation, or discourse related factors such as topicality. Animacy is often regarded as the central factor in genitive choice

(Rosenbach, 2014). Several corpus studies (Gries, 2002; Jucker, 1993; Leech, Francis, & Xu, 1994; Rosenbach, 2005; Stefanowitsch, 2003) examined the relative frequency of the two genitive forms by operationalizing the degree of animacy of the possessor. For example these include binary categories: [\pm human] or more complex categorization such as ‘human’, ‘animal’, ‘company’, ‘time’, and ‘place’. The results of these studies revealed that animate possessors are more likely to be expressed by the *s*-genitive, while inanimate possessors are more likely to be realized with the *of*-genitive. Similarly, experimental studies such as Rosenbach (2005, 2012) and Wolk, Bresnan, Rosenbach, and Szmrecsanyi (2013) showed that the higher the referent in animacy is (e.g. human>animal>object), the more likely it is to occur as an *s*-genitive. Although extensive research has been conducted on the role of animacy in the genitive variation in English monolingual adults, the developmental process of how children acquire this linguistic constraint is still under-explored. One study by Skarabela and Serratrice (2009) investigated whether adults and four year-old English monolingual preschool children are aware of the animacy constraint, by using a picture-description syntactic priming task. Their results from the baseline task showed that children as well as adults preferred to use more *s*-genitive than *of*-genitive to express kinship relationship (e.g., the girl’s mother>the mother of the girl). This suggests that 4-year old children are aware of the animacy constraint in the choice of the two genitive forms. Moreover, this finding is accordance with Bannard and Matthews (2008) that English-speaking children are aware of the two genitive forms around the age of four.

Other research (Anschutz, 1997; Hinrichs & Szmrecsanyi, 2007; Rosenbach, 2001, 2005, 2012) has suggested that givenness or the topicality of the possessor influences the choice of genitive forms. Rosenbach (2001, 2003, 2012) proposed that [+givenness] and [+definite] referents have a higher likelihood to be expressed using *s*-genitive. It follows from this that English native speakers are more inclined to use *s*-genitive for a second mentioned possessor with a definite article (e.g., the woman’s body), and *of*-genitive for a first mentioned possessor with an indefinite article (e.g., the body of a woman).

Another relevant factor is the semantic relationship between the possessor and the possessum. According to Rosenbach (2014, p.229), this is the “toughest nut” to define, and “to this day there is no exhaustive and mutually exclusive list of these

relations available in the literature”. However, Rosenbach (2001, p.279) offers a binary categorisation of the possessive relationship: (a) prototypical relationships which consists of kin terms (e.g., doctor’s son), body parts (e.g., girl’s hand) and permanent ownership of concrete things e.g., (e.g., father’s car), and (b) non-prototypical relationships, which cover the remaining possessive cases, including social relations (e.g., Saint Paul’s teacher), mental/physical states (e.g., the girl’s excitement) and abstract possession (e.g., the man’s name). Prototypical relationships have a higher likelihood of being expressed by the *s*-genitive, while non-prototypical relationships are more likely to be realized by the *of*-genitive.

It has been the central focus of researchers to tease apart the interplay of these factors to determine which have the greatest and which the least influence on the choice of genitives (Rosenbach, 2014). The framework established by Rosenbach (2001) tested the relative influence of the factors by combining the three factors (animacy, topicality, and possessive relationship) in a hierarchical structure of cells. The summary of the framework is provided in Table 6.1.

Table 6.1 Genitive framework from Rosenbach (2001)

[+animate]				[-animate]			
[+topical]		[-topical]		[+topical]		[-topical]	
[+proto]	[-proto]	[+proto]	[-proto]	[+proto]	[-proto]	[+proto]	[-proto]
the boy’s eyes/ the eyes of the boy	the mother’s future/ the future of the mother	A girl’s face/ the face of a girl	a woman’s shadow/ the shadow of a woman	the chair’s frame/ the frame of the chair	the bag’s content / the content of the bag	a lorry’s wheels/ the wheels of a lorry	a car’s fumes/ the fumes of a car

Here, animacy is ranked at the top as the first factor, followed by topicality, and then the type of possessive relationship. Under this framework, the relative frequency of the *s*-genitive is expected to gradually decrease from the far left condition [+animate, +topical, +proto] to the far right [-animate, -topical, -proto] and vice-versa for the *of*-genitive. Rosenbach (2001) conducted an empirical study on 56 British native speakers of English to test the reliability of this hierarchy. She created a forced-

choice task between *of*- and *s*-genitive and controlled for the number of examples for each condition and for the other possible factors that influence the genitive choice. The results confirmed her prediction: there was a steady decrease in the proportion of *s*-genitives from the left to right along the genitive framework.

6.1.3 *Genitive structure in Japanese*

While English has two genitive constructions, with the choice between them governed by various factors as just discussed, Japanese has only one construction: the pre-nominal *no* construction. The genitive case marker *no* stands between the possessor and the possessum (e.g. ‘Hanako *no* penn’ ‘Hanako’s pen’) and thus the construction has a similar linear order to the *s*-genitive in English. There are more than fifteen types of semantic relationships that hold between the two nouns in the Japanese genitive construction. For example, not only does it include possessive relationships but also metaphors e.g. (‘tetsu *no* onna’ ‘iron lady’) and locational phrases (‘tsukue *no* ue’ ‘on top of chair’) (Teramura, 1991).

Japanese children start producing the *no*-genitive at an early stage (2;2-2;4), and it is one of the earliest case particles that they acquire (Clancy, 1985). According to the systematic review of acquisition order of grammatical morphemes in Luk and Shirai (2009), Japanese learners of English acquire the *s*-genitive construction at an earlier stage than other grammatical morphemes such as the article, past-tense morpheme in regular verbs, and third person singular *-s*. This finding has been obtained in studies with Japanese-English children (Hakuta, 1976) as well as adults (Nuibe, 1986; Shirahata, 1988). The authors concluded that the linear similarity between the English *s*-genitive and Japanese *no*-genitive allowed for positive L1 transfer to occur from Japanese to English. In contrast, Spanish learners of English acquired the *s*-genitive structure much later than the Japanese learners, since in Spanish the possessum is placed before the possessor, resembling the linear position of the *of*-genitive construction in English. As Spanish only allows the post-nominal genitive construction, a negative transfer from the L1 occurred, resulting in the delay of acquisition of the *s*-genitive form. Returning then to Japanese and English, the genitives in these languages have an ambiguous structural overlap as defined by Müller

and Hulk (see section ‘Explaining cross-linguistic transfer’ above). Furthermore, the factors that affect the choice between the English genitive forms relate to different types of information: mainly semantic, but also discourse-related (see Sorace, 2011 for the general argument).

Although some studies have examined whether cross-linguistic transfer occurs at the syntax-semantics interface (for a review see Slabakova, 2006), only a small number of them have looked at the possessive construction. One study by Nicoladis (2012) investigated the preference for the *of*-genitive and *s*-genitive structures in French-English bilingual preschool children, as well as their monolingual peers. In French (as just described for Spanish), the possessive construction is similar to the *of*-genitive structure in English with a post-nominal construction. Nicoladis used a picture description task which elicited the possessive construction in English and French with animate possessors. The finding revealed that bilingual children behaved differently from their monolingual counterparts in both languages. In English, they produced significantly more post-nominal forms (e.g., the hat of the dog), and in French they used more ungrammatical prenominal forms (e.g., *le chien de chapeau*, literally: the dog of hat) than their respective monolingual groups. However, they only found weak influence of language proficiency on the degree of cross-linguistic transfer.

6.1.4 *The present study*

The present study examines the bilinguals’ (Japanese-English) and monolinguals’ (English) knowledge of English genitive constructions. We first compared the genitive preference (*s*-genitive versus *of*-genitive) of English monolinguals to the Japanese-English bilinguals to see whether there are any differences in their evaluation of genitive forms, and if so, in what contexts. We then conducted a within-subject analysis by testing the bilinguals twice: when they had just returned to their L1 environment and a year later. The results of these two rounds of testing were compared to examine whether there is a divergence in the choice of genitive forms after the bilinguals had been re-immersed in the L1-dominant environment. In order to assess their preference for genitive forms, we used the framework established by Rosenbach (2001). For reasons of feasibility, we used four out of eight conditions in the

framework by using the two conditions on the far left and two conditions on the far right of the genitive framework in Table 6.1: [+animate, +topical, +proto], [+animate, +topical, -proto], [-animate, -topical, +proto], [-animate, -topical, -proto]. The test conditions and items in the present study are discussed in detail in the methodology section. Against the background discussed above, the following research questions were as follows:

1. Do Japanese-English returnee children behave like their monolingual English peers in the choice of the two genitive forms? How native-like are they in their distribution of the two genitive forms across the four conditions?
2. How does the Japanese-English returnee children's choice of genitives change over time after being removed from the L2 (English) environment and re-immersed in an L1 (Japanese) environment? How does their distribution of the two genitive forms change across the four conditions?
3. Does the structurally-based account of cross-linguistic transfer explain the differences in the distribution of the two genitive forms across the four conditions between Japanese-English bilinguals and English monolinguals?
4. Does the language dominance account of cross-linguistic transfer explain the change in the distribution of the two genitive forms across the four conditions overtime for the Japanese-English returnee children?

According to the structurally-based account of cross-linguistic transfer (Müller & Hulk, 2001; Sorace, 2011), bilinguals should behave differently from the monolinguals since genitive forms in Japanese and English share structural overlap, and their evaluation requires integration of multiple layers of information (both semantic and discourse-related). In particular, this account predicts that overextension of *s*-genitives will manifest in the conditions where native speakers favour the use of *of*-genitive (i.e., [-animate, -topical, +proto] and [-animate, -topical, -proto]), as in the study by Sorace et al. (2009) which found that the use of overt pronoun was extended to the non-topical context.

If cross-linguistic transfer can be explained by language dominance, then the prediction is that there should be a unidirectional transfer from L1 Japanese to L2 English in bilingual returnee children that will increase over time after return to the Japanese environment. This is because L1 Japanese becomes more dominant after their return to the L1 environment (there is greatly increased L1 exposure). Since the Japanese *no*-genitive resembles the linear structure of *s*-genitive in English, we expect the preference for *s*-genitives to increase across the four conditions.

To sum up, if the internal structure of the two languages determines the presence of cross-linguistic transfer, then the bilinguals' preferences for genitive forms should be different from those of monolinguals, even at the stage when the bilinguals had just returned to their L1 environment. In addition to this, if language dominance plays a role in cross-linguistic transfer, then we should also observe an increased preference for *s*-genitives, as the dominance of the L1 increases for the bilinguals.

6.2 Methodology

6.2.1 Participants

The bilingual group consisted of 36 Japanese-English bilingual children (21 female; 15 male), who acquired English as a second language in a country outside Japan. All of the bilingual participants had very minimal exposure to English before leaving Japan. All of the bilingual children's parents speak Japanese as their native language and the children have been exposed to Japanese from birth. Thus the age of onset of L2 acquisition was the point at which the bilinguals moved to the foreign environment: the average was five years old (range 1;0-9;6, $SD=2.5$). Unlike typical Japanese children, the participants have learned English through living in a foreign country and attending schools with English as a medium of instruction. Eighteen participants had been living in a country where English is the majority language (e.g., USA, UK, Canada), and the other 18 participants attended international schools in countries where English is not the official language (e.g., Netherland, China, Poland). The average length of residence in the foreign country was four years (range 2;0-9;9, $SD=2.0$). Thus, the bilingual children in the current study were returnees: children

who returned to their L1 environment after a period living in an L2-dominant environment.

The first data was collected a few months after the participants had returned to Japan from abroad. The average time elapsed since their return until the time of first test session was three months (range 0;1-0;5, $SD=0.1$). The second test session took place approximately a year after the first test session. In the first test session, the average age of the bilinguals was 9;8 (range 7;6-13;0, $SD=1.42$) and in the second test session 10;8 (range 8;6-14;0, $SD=1.42$).

The bilingual participants were recruited from an English maintenance course offered from JOES (Japan Overseas Educational Services). Prior to the study, they were assessed on their English proficiency (listening, speaking, reading, and writing) by JOES, in order to group them into appropriate English classes. The participants were grouped into one of the three proficiency groups within their age range: basic, intermediate, or advanced. All of the bilingual participants attended the English maintenance course once a week for 90 minutes.

The Bilingual Language Experience Calculator (BiLEC) was administered to the parents in order to elicit information about quantitative language exposure of the children in each language and history of language use (Unsworth, 2016b). Table 6.2 shows the average exposure at home as well as home and school in the first round of testing (i.e., when the children lived abroad) and second round of testing (i.e., after a year of immersion in Japan) in English and Japanese.

Table 6.2 Summary of BiLEC variables split by Language

Round 1 indicates language exposures of when the children lived abroad and Round 2 indicates exposures of when the children returned to Japan (the numbers are in percentages)

English (L2)				
	Round1	Round2	Round 1	Round 2
	Home	Home	Home+	Home+
			School	School
Mean	14.4	3.2	46.8	4.5
Min	0	0	26.5	0
Max	62.6	32.2	82.4	20.5
SD	18.2	7.9	12.1	5.6
Japanese (L1)				
Mean	85.4	96.8	53.2	95.5
Min	43.5	67.7	35.4	58.0
Max	100	100	89.2	100
SD	19.9	12.6	10.8	8.5

As shown in Table 6.2, the children’s average English exposure at home and school decreased dramatically by 42.3% from the first to the second test session. In contrast, their Japanese exposure at home and school increased from 53.2% to 95.5%. It also appeared to be the case that the bilingual children spoke predominantly Japanese at home, even when they lived in a foreign environment.

The monolingual group consisted of 35 children (Mean age = 9;4, range 7;0–13;9, *SD* = 1.6, 15 female). The monolingual children spoke English as their L1 and had very minimal exposure to L2 (only in language classes at school once a week). The monolingual group was matched to the bilingual group in terms of Socio-Economic Status (SES), which was measured by the mother’s final education.

6.2.2 Instruments and Procedure

An untimed, binary grammaticality judgment task was developed by the researchers. The task consisted of 16 experimental items and 16 fillers. We describe the experimental items first. Eight out of four genitive conditions (i.e., [+animate][+topical][+proto], [+animate][+topical][-proto], [+animate][-

topical][+proto], [+animate][-topical][-proto]) from Rosenbach’s (2001) genitive framework were used in this study. We only used four conditions since having four items per eight conditions (32 experimental items in total) would have resulted in a long task that would have been too demanding for the children.

Examples of each condition are presented in Table 6.3. In the [+animate][+topical][+proto] example, the possessor is animate (i.e., girl) and topical (mentioned in the previous sentence). Moreover, the relationship between the possessor and the possessum (i.e., hand) is prototypical as it expresses the “possession” of body parts. In the [+animate][+topical][-proto] example, the possessor is animate and also topical, but the relationship is non-prototypical as the possessum is an abstract object (i.e., name). The same logic applies for the other two conditions. For convenience, we will label the [+animate][+topical][+proto] as ‘strong *s*-genitive’, [+animate][+topical][-proto] as ‘weak *s*-genitive’, [-animate][-topical][+proto] as ‘weak *of*-genitive’, and [-animate][-topical][-proto] as ‘strong *of*-genitive’ condition.

Table 6.3 Examples of experimental genitive items

Conditions			
[+animate] [+topical] [+proto]	[+animate] [+topical] [-proto]	[-animate] [-topical] [+proto]	[-animate] [-topical] [-proto]
strong <i>s</i>-genitive	weak <i>s</i>-genitive	weak <i>of</i>-genitive	strong <i>of</i>-genitive
<i>s</i> -genitive: A bee stung a girl. <u>The girl's hand</u> was swollen for many days.	<i>s</i> -genitive: A new teacher came to our school. But nobody knew <u>the teacher's name</u> .	<i>s</i> -genitive: I banged my toe on <u>a table's leg</u> and it hurts a lot.	<i>s</i> -genitive: It's annoying when people start laughing before <u>a joke's end</u> .
<i>of</i> -genitive: A bee stung a girl. <u>The hand of the girl</u> was swollen for many days.	<i>of</i> -genitive: A new teacher came to our school. But nobody knew <u>the name of the teacher</u> .	<i>of</i> -genitive: I banged my toe on <u>the leg of a table</u> and it hurts a lot.	<i>of</i> -genitive: It's annoying when people start laughing before <u>the end of a joke</u> .

The filler items were grouped into four conditions, with four items for each condition, with various word orders. The erroneous/alternative word order sentences were created by manipulating the position of the subject, verb, and the object (O: object; DO: direct object; IO: indirect object) as presented in the examples in Table 6.4. These word orders (with the exception of SVDOIO) are grammatical in Japanese. However, we do not expect monolinguals and bilinguals to behave differently on their responses for the filler items. This is because these aspects of word order in Japanese and English are unaffected by conditions of non-grammatical nature. In the experimental items (genitive forms), the children need to understand multiple non-syntactic factors that influence the choice of the two genitive forms. However, in the filler items, the knowledge that is required to process word order is that in English, subject comes first followed by verb and object (indirect object-direct object)¹. Therefore, the speaker is not required to integrate multiple sources of information to interpret the sentences in the filler items.

Table 6.4 Examples of filler items

Conditions			
SOV	OSV	SIODOV	SVDOIO
SVO: My dad reads newspapers everyday.	SVO: I don't like apples, but I'll eat oranges.	SVIO DO: My uncle bought me a bag last week.	SVIO DO: Our teacher taught us the alphabet today.
*SOV: My dad reads newspapers everyday.	?OSV: I don't like apples, but oranges I'll eat.	*SIODOV: My uncle me a bag last week bought.	*SVDOIO: Our teacher taught the alphabet us today.

¹ It should be noted here that the OSV word order (e.g., I don't like apples, but oranges I'll eat) in English is grammatical, whereas the other word orders (SOV, SIODOV, SVDOIO) are ungrammatical. In fact, OSV word order involve fronting that has been argued to be appropriate only in particular discourse contexts (Pullum, 1997). Thus, we cannot be certain that the interpretation of OSV word order in our experiment does not involve more than one module of grammar (i.e., syntax). However, we suggest that genitive forms and word orders clearly differ in terms of the extent of module overlap.

However, if the change in language dominance influences the grammatical judgement of bilinguals between the first and the second round of testing, we expect to observe an effect of cross-linguistic transfer from L1 Japanese to L2 English also on the filler items. This is because the language dominance account does not make any claims in regards to the structures of the languages. Simply put, the dominant language influences the less dominant language, regardless of the available number of forms in each language. Thus, according to the dominant language account, both conditions (filler and experimental) are subject to cross-linguistic transfer. In specific, word orders that are grammatical in Japanese but ungrammatical/less preferred in English (SOV, OSV, SIODOV) may be influenced by L1 cross-linguistic transfer. That is, bilinguals may accept more erroneous/alternative word orders in English over time, due to increased L1 Japanese cross-linguistic influence.

Two puppets, a male and a female, were presented on a PowerPoint screen as in Figure 6.1 PowerPoint presentation of the grammaticality judgement task. Each puppet read the target sentence using either *of-* or *s-*genitive structure for the experimental genitive items. For example, the female puppet would say: “A room's darkness can make little children scared”, whereas the male puppet would say: “The darkness of a room can make little children scared”. The same procedure was taken for the filler items. In the first round of testing for the bilingual group as well as the monolingual group, the sentences spoken by the male puppet were recorded by a male native speaker of American English, whereas the female puppet was voiced by a female native speaker of British English. We used speakers of different dialects since some children in the bilingual group were educated through the British system, while others attended schools with American educational system. In the second round of testing for the bilingual group, lexical changes were made for each item in order to avoid learning effects. For example, “The darkness of a room/a room’s darkness can make little children scared” was changed to “The darkness of a room/a room’s darkness can make people anxious”. The target phrase (e.g., the darkness of a room/the room’s darkness) remained the same in the first and the second test. In the second test, a female native speaker of Canadian English voiced the female puppet and a male native speaker of British English the male puppet. The bilinguals’ first round of testing

was conducted in summer 2016 and the second in summer 2017. The monolinguals' data was collected in fall 2016.

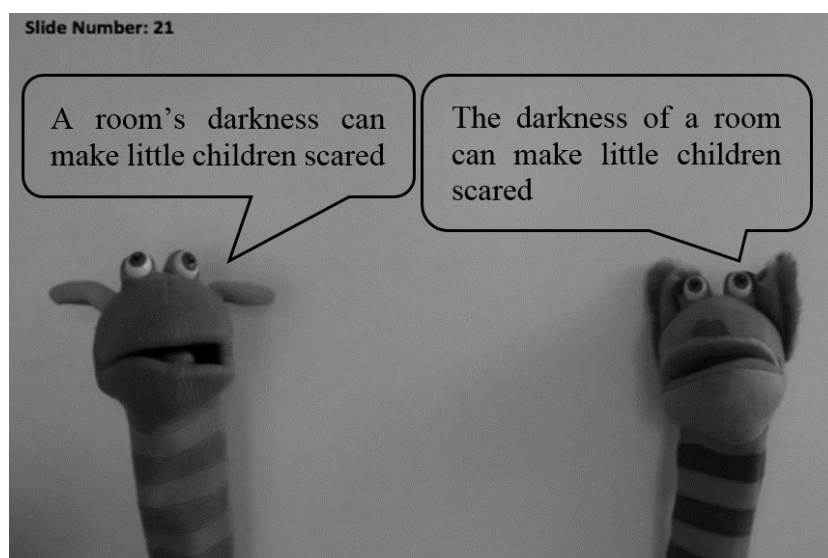


Figure 6.1 PowerPoint presentation of the grammaticality judgement task

All participants were seen individually in a quiet room, either at home or at school by the researcher. They were placed in front of a computer screen with a PowerPoint presentation. They were then asked to listen to the pre-recorded instructions and have one practice trial. During the practice trial, they were asked to choose the puppet that spoke better English. The children were reminded to not base their decisions on phonological factors such as accent or pronunciation. In the practice trials, they were asked to explain their decisions, and if the children's explanations were related to phonological factors, they were reminded again to focus on what the puppet actually said, and not on how he/she said it. They were also allowed to hear the sentences again if they wished to, but not more than twice. Following the practice trial, 32 trials (16 experimental and 16 fillers) were presented in random order. All of the responses were recorded on paper by the investigator. The position of the puppets (i.e. left or right of the screen), the puppet that starts speaking first, and the amount of *of*- and *s*-genitive examples spoken by each puppet were all counterbalanced.

6.2.3 Analysis

In order to examine whether there are differences in the choice of genitives between monolinguals and bilinguals and within bilinguals (first and second round of testing), we constructed two models using Generalised Linear Mixed Effect Model (GLMM) with logit link. We used GLMM in our study instead of using ANOVA or regression, since this allows us to include random-effect variables in the model. The random-effect variables take into account the individual differences that arise from having participants or items with unknown properties that influence the measurements. It also allows inclusion of repeated observations so there is no need to aggregate the means of the dependent variable by participant or item.

Both models included Accuracy as a dependent variable and Group (Model 1: bilinguals and monolinguals; Model 2: bilinguals in first and second rounds of testing) and Condition (eight levels in total; experimental: strong-s, weak-s, strong-o, weak-o and filler: SOV, OSV, SIODOV, SVDOIO) as predictors and Age as a control variable. The outcome variable for Accuracy was coded binary. For the experimental items, *s*-genitive responses were coded as 1 and *of*-genitive for 0. For the filler items, SVO and SVIODO were coded as 1 and others as 0. When running the GLMM model, the ‘bobyqa’ optimizer was specified to produce a stable model.

6.3 Results

6.3.1 Monolinguals vs. Bilinguals

First, we will discuss the results of the model that compares *between* subjects: monolinguals, and bilinguals from the first round of testing. The mean percentages of *s*-genitives for the experimental condition and mean percentages of correct structure choices (SVO or SVIODO) for the filler conditions split by group are illustrated in Figure 6.2.

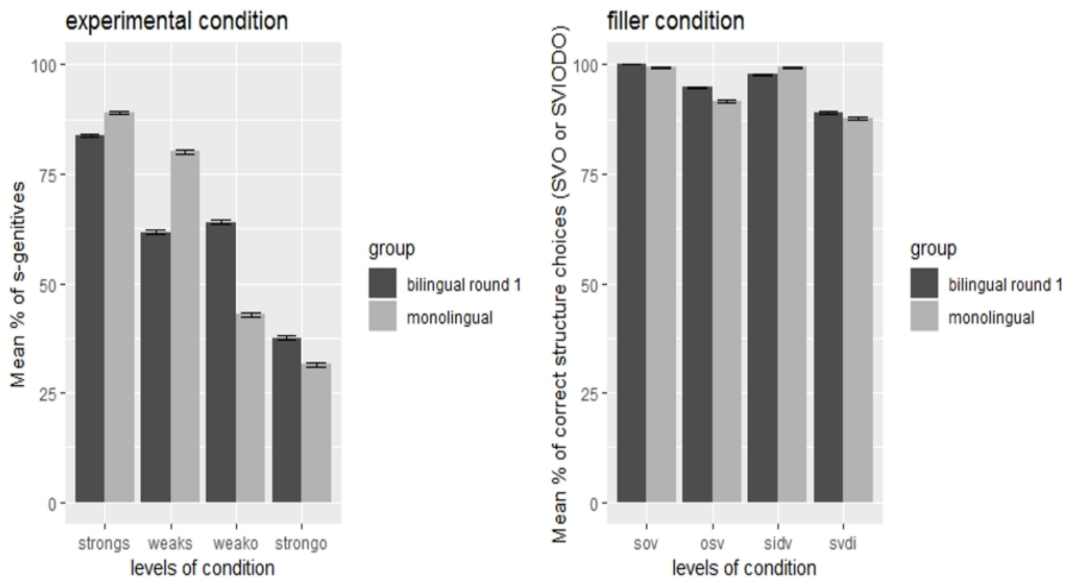


Figure 6.2 Performance on the grammaticality judgment task split by group (monolinguals and bilinguals from first round of testing) and condition error bars = standard error

Estimates from the final model are summarized in Table 6.5. We excluded the main effect of Group as well as Condition, as we are interested the interactions between Group and Condition. The baseline intercept was set to ‘Bilinguals’ and ‘Strong-o’ level. The values that we are particularly interested in are the interactions between Group and Condition. Examining the interaction informs us whether there is a significant difference between the groups in question within a specific condition. There was a significant interaction between Group and Condition, demonstrating that the bilinguals used more *s*-genitives in the weak *of*-genitive condition than the monolinguals ($E = -.98, z = -2.19, p = .04$). In contrast, the monolinguals’ preference for *s*-genitive was higher than the bilinguals in the weak *s*-genitive condition ($E = 1.27, z = 3.38, p < .001$).

As shown in Figure 6.2, the performance on the filler condition was at ceiling for both groups. All the interactions between Group and Condition were not significant for the filler conditions (p 's $> .18$). That is, there were no differences between monolinguals and bilinguals on performance in the filler conditions.

Table 6.5 Estimated coefficients of between-subject analysis on performance of grammaticality judgement task

Monolingual vs. Bilingual				
Fixed effects	Estimate	Standard error	<i>z</i>	<i>p</i>
Intercept	-.54	.33	-1.63	.10
Age	.03	.07	.50	.59
Mono x strong-s	.77	.43	1.76	.07
Mono x weak-s	1.27	.37	3.38	<.001***
Mono x weak-o	-.98	.35	-2.19	.04*
Mono x sov	-13.09	29.87	-.43	.66
Mono x osv	-.23	.54	-.44	.65
Mono x sidv	1.54	1.17	1.31	.18
Mono x svdi	.16	.45	.36	.71
Random effects	Variance	SD		
Subject	.11	.33		
Item	.29	.53		

Note. **p* < .05; ***p* < .01; ****p* < .001

6.3.2 Within Bilinguals

Next, we conducted a within-subject analysis by comparing the results of bilinguals from first to second round of testing. The mean percentages of *s*-genitives for the experimental condition and mean percentages of correct structure choices for the filler conditions split by time (first and second round of testing) and condition are graphed in Figure 6.3.

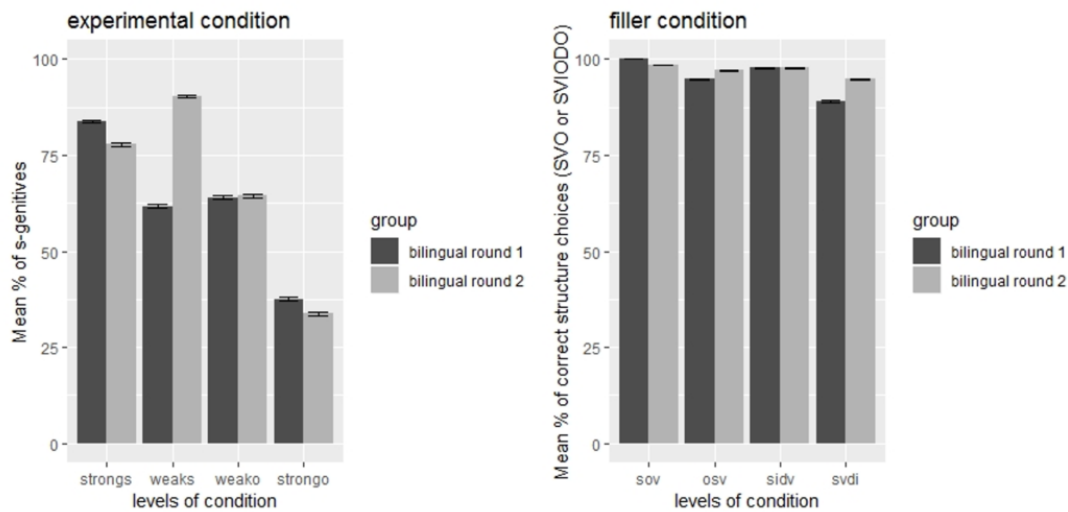


Figure 6.3 Performance on the grammaticality judgment task split by time (bilinguals from first and second round of testing) and condition error bars = standard error

Estimates from the final model are summarized in Table 6.6. Similar to the between-subject analysis, we excluded the main effect of Time as well as Condition. The baseline intercept was set to ‘Bilingual round 1’ and ‘Strong-o’ level. There was a significant interaction between Round and Condition—the only difference found between the first and second round of testing within the bilinguals is their responses for the weak *s*-genitive condition ($E = 2.02, z = 4.66, p < .001$). The bilinguals showed a greater use of the *s*-genitive in the weak *s*-genitive condition after a year spent back in the Japanese environment (Figure 6.3). All the interactions between Time and Condition were not significant for the filler conditions (p 's $> .06$). That is, bilinguals' performance on the filler condition did not change over time.

Table 6.6 Estimated coefficients of within-subject analysis on performance of grammaticality judgement task

Round 1 vs. Round 2				
Fixed effects	Estimate	Standard error	<i>z</i>	<i>p</i>
Intercept	-.63	.26	-2.38	.01
Age	-.22	.10	-1.96	.06
Round2 x strong-s	-.25	.41	-.61	.53
Round2 x weak-s	2.02	.43	4.66	<.001***
Round2 x weak-o	.19	.37	.51	.60
Round2 x sov	-14.0	59.52	-.23	.81
Round2 x osv	.76	.68	1.10	.26
Round2 x sidv	.17	.86	.20	.84
Round2 x svdi	1.01	.54	1.87	.06
Random effects	Variance	SD		
Subject	.16	.41		
Item	.12	.35		

Note. **p* < .05; ***p* < .01; ****p* < .001

6.4 Discussion

The aim of the present study was two-fold. First, we compared the genitive choice between bilinguals and monolinguals in order to investigate whether internal language structure plays a role in cross-linguistic transfer. Second, we tracked the genitive choice of bilingual returnee children over time to test whether change in language dominance has any effect on cross-linguistic transfer.

The structurally-based account predicted that bilinguals would behave differently from monolinguals even in the first round of testing when they had just returned to their L1 environment. Specifically, it was predicted that bilinguals would over-extend *s*-genitives in contexts that favour the use of *of*-genitives, compared to their monolingual counterparts. Our finding did not support the prediction—bilinguals preferred to use *more s*-genitive in the weak *of*-genitive condition, but they also chose *less s*-genitive in the weak *s*-genitive condition when compared to the monolinguals. That is, bilinguals behaved differently from monolinguals in the two “weak” conditions—those which for monolinguals weakly favour either the *s*-genitive or the *of*-genitive, respectively—but did not differ in the “strong” conditions.

These results suggest that bilinguals were able to choose the “correct” genitive form in the “strong” conditions, regardless of whether it is a context that induces a strong preference for the *s*-genitive or for the *of*-genitive. That is, in the conditions that have consistent [+factors] or [-factors] (i.e., strong *of*-genitive: [-animate][-topical][-proto] or strong *s*-genitive: [+animate][+topical][+proto]), the bilinguals are not different from the monolinguals in their choice of genitives. However, when one factor (prototypicality) is in conflict with the other factors (topicality and animacy) as in the weak conditions (weak *of*-genitive: [-animate][-topical][+proto] or weak *s*-genitive: [+animate][+topical][-proto]), the bilinguals appear to have more difficulties in selecting the preferred structure. Taken together, the findings do not indicate overextension of *s*-genitives, as predicted by the structurally-based account, but rather demonstrate that the bilinguals behave differently from monolinguals in conditions that require processing of conflicted semantic factors. Consequently, this suggests that the differences in the choices of bilinguals and monolinguals cannot solely be attributed to cross-linguistic transfer due to the internal structure of the two languages.

Our results here are instead more in line with the account proposed by Sorace (2011): namely, that the coordination of multiple factors that is involved in the process of choosing one structure over another is a demanding task for bilinguals. In the current study, integrating three factors that govern the choice of genitives—animacy, topicality, and prototypicality—may be particularly taxing for bilingual children. In the “strong” conditions, all three factors are aligned—for example, in the strong *s*-genitive condition, all the three factors favour the same form: *s*-genitive. When these factors are aligned, bilinguals may have enough mental resources to process this information. However, when one factor is in conflict with the other two, the bilinguals may be less efficient at resolving these conflicts than the monolinguals. For instance, the weak *s*-genitive condition involves two factors (i.e., [+animate] and [+topical]) that favour the *s*-genitive form, and one factor (i.e., [-proto]) that favours the *of*-genitive form. In this case, the bilinguals need to quickly process factors that are in conflict with one another. Processing these conflicting factors may be more difficult for bilingual children, given that they also need to simultaneously inhibit the non-target language. In other words, allocating general cognitive resources to resolve such conflicts becomes a demanding task, since bilinguals have to manage the target

language while suppressing the language that is not in use (Green, 1998; Linck, Kroll, & Sunderman, 2009; Meuter & Allport, 1999). Furthermore, suppressing the dominant language (i.e., Japanese) may be more costly in terms of mental resources. This finding adds on a new perspective to the hypothesis postulated by Sorace (2011) that integrating information from multiple linguistic domains imposes a cognitive load. Our results show that in addition to this, resolving conflicts between semantic constraints may also be cognitively demanding and thus particularly difficult to accomplish for bilingual children. Following this idea, it may be worthwhile to investigate other linguistic constraints that exhibit conflicts, and this may open a new discussion to examining a wide range of linguistic sources that cause processing difficulties in bilinguals.

In regards to the filler conditions, there were no significant differences between monolinguals and bilinguals or within bilinguals between the first and second rounds of testing. As discussed above, the items from the filler conditions were formed by varying the word order of a subject, verb, and an object. This type of word order is considered as ‘narrow syntax’ or ‘internal structure’, as it involves analysis of mainly syntactic properties (Sorace, 2011). Processing the word order of S, V, DO and IO may not require the same amount of cognitive load as genitive forms, which require integrating multiple semantic/discourse factors. Since the processing task here is relatively easy, bilinguals may have been as efficient as monolinguals in parsing syntactic information. Similar findings have been obtained in L1 attrition study; attrition effects were only found in structures that involve syntax-pragmatics interface, and not in structures that involve formal, purely syntactic features (Tsimpli et al., 2004; Wilson et al., 2009). Moreover, there were no changes in the performance of filler conditions over time for the bilinguals. This suggests that basic English word order was fully acquired by the bilinguals and that this knowledge remained intact. We therefore hypothesize that we did not observe any changes in the word order evaluation because processing of syntactic constraints are fast, automatic, and less vulnerable to interference from the non-target language. However, it should be noted that testing this hypothesis will require further research by using online-methods to uncover the processing strategies involved in the evaluation of word order vs. genitive forms. Using online as well as offline methods can provide insights into whether attrition

affects either processing or the actual knowledge representations of interface structures (Chamorro et al., 2016; Sorace, 2011).

We now turn to our second research question: to what extent does the bilinguals' choice of genitives change over time after moving from an L2-dominant to an L1-dominant environment? If cross-linguistic transfer effects correlate with L1 dominance, this predicts that we would observe an overall increase of *s*-genitive choice across the genitive conditions over time. Our results did show that preference for *s*-genitive in the weak *s*-genitive condition increased from first to second round of testing; however, this result does not support the language dominance account, as it was only in this one condition that we observed an increase in *s*-genitive (there was no general increase of *s*-genitives). Interpreting this result from a general cognitive perspective, being re-immersed in the L1 environment with little L2 exposure may require bilinguals to more strongly inhibit their L1 when L2 is in use. If bilinguals experience more processing difficulties due to stronger inhibition of the L1, then the “weak” conditions are expected to be more vulnerable to change than the “strong” conditions. This is because processing *inconsistent* factors involve heavier cognitive load than processing *consistent* factors. Our results do not support this account of the change in the bilinguals' preferences over time either, as there was a change in the weak *s*-genitive condition, but no difference in the weak *of*-genitive condition.

If neither account—cross-linguistic transfer or cognitive load—can fully explain our data, then how can this selective effect be explained? We suggest that both effects were in play. Refer to Figure 6.4. Recall that the “+” factors favour the *s*-genitive and the “-“ factors favour the *of*-genitive. While animacy and topicality are never in conflict with one another (i.e., [+animate][+topical] or [-animate] [-topical]), the [-proto] and [+proto] in the weak *s*-genitive and weak *of*-genitive conditions favour a different form when compared to the other two factors. The two “weak” conditions are similar in this. On the other hand, our results show that the proportion of *s*-genitives increased for the weak *s*-genitive condition only. We suggest that this difference is due to the fact that there was an effect of L1 transfer, which was limited to this one condition. The “-“ factor in the prototypicality in weak *s*-genitive condition was *pulled* towards *s*-genitive realization as a result of L1 transfer, and this is illustrated in the grey dotted arrow in Figure 6.4.

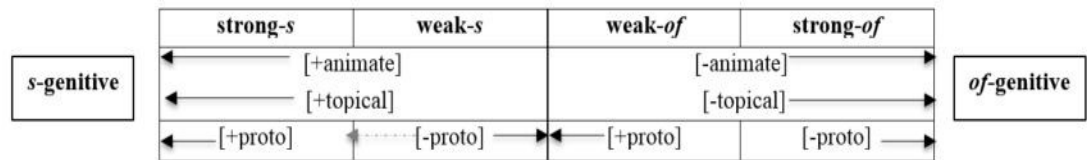


Figure 6.4 Semantic factors involved in the genitive conditions

First, we assume that conditions in which the semantic/discourse factors conflict (the “weak” conditions) were more susceptible to changes in the input due to greater processing demands. In addition to the vulnerability of the “weak” conditions, the “-“ factor in the prototypicality in the weak *s*-genitive condition may have been especially responsive to L1 cross-linguistic transfer, as the “-“ factors prefer the use of *of*-genitive—a postnominal form that is different from the Japanese prenominal genitive structure. In contrast, “+“ factor in the prototypicality in the weak *of*-genitive condition may not have been affected by cross-linguistic transfer effects from Japanese, since it is realized with the *s*-genitive—a prenominal form that resembles the linear structure of Japanese *no*-genitive.

To sum up, the dual effect of processing complexity and cross-linguistic transfer may have resulted in the selective differences in genitive choice in bilinguals as opposed to monolinguals, and also the changes within the bilinguals over time. As mentioned above, it was not feasible to include all eight conditions from Rosenbach’s (2001) framework in the present study. It is of further interest to examine how the monolinguals and bilinguals behave in regards to the other four conditions that exhibit further conflicts among the three factors: [+animate][-topical][+proto], [+animate][-topical][-proto], [-animate][+topical][-proto], and [-animate][+topical][+proto]. If general processing limitation explains the difference between monolinguals and bilinguals, then bilinguals should behave differently from monolinguals in these conditions as well, as they require processing of conflicted factors. Further research into this question may provide further insights into the role of processing on cross-linguistic transfer in bilingual children.

6.5 Conclusion

There were two objectives in our study. First, we compared relative preferences for the two genitive forms of English between Japanese-English bilinguals and English monolinguals, to examine whether there are any cross-linguistic effects from L1 Japanese to L2 English. The results showed that bilinguals differed from monolinguals only in the conditions in which the bilinguals need to process semantic factors that are in conflict. Our finding suggests that general processing difficulties in resolving such conflicts provide a better explanation for the observed behavior than does cross-linguistic transfer from L1 to L2. The second objective of our study was to investigate how changes in language input affect the bilinguals' grammar. If there was a change in the evaluation of genitive forms, we were interested in examining whether this change could be explained by the language dominance account. Our results showed that there was a change in the preferences over time, but that this change was restricted to a single condition. We proposed that in addition the general cognitive effects of bilingualism, L1 cross-linguistic transfer is in play. This study opens up some new lines of inquiry that could be further explored to test our conclusion concerning the interplay of transfer and cognitive load. One obvious follow-up would be to examine genitive preference in French-English bilinguals, given that French, like Japanese, has only one genitive construction, but is the "mirror image" of Japanese in that French has only a post-nominal genitive. A further extension would be to introduce offline, as well as online, tasks.

7 Individual differences in second language attrition in bilingual returnee children

7.1 Introduction

Studies on language attrition have mainly focused on examining the process of change in a speaker's native language—first language (L1) attrition. In comparison, very few studies have explored the nature of second language (L2) attrition. Although 'attrition' was originally used as a term to describe the progressive loss of a language, recent research has redefined the term more broadly as a change in one's native language due to protracted exposure to a second language, often in an L2-speaking environment (Schmid & Köpke, 2017). L2 attrition, under this definition, is the change in one's L2 that occurs due to the detachment from the L2-dominant environment.

In the field of L1 attrition, many studies have examined what factors affect language change and what the underlying mechanisms for this change are. Some research explored the influence of age (Bylund, 2009a; Goral, Libben, Obler, Jarema, & Ohayon, 2008; Hopp & Schmid, 2013), while others examined the amount of language exposure (Schmid, 2002; Schmid & Dusseldorp, 2010) and sociolinguistic factors such as motivation and aptitude (Bylund, Abrahamsson, & Hyltenstam, 2009; Cherciov, 2013; Kim & Starks, 2008). However, its relative contribution to attrition is an underexplored area of research, especially in the context of L2 attrition.

The goal of the current study is to examine the influence of individual variables on L2 attrition. In L2 attrition, the speakers experience reduced contact in both their L1 and L2. First, being immersed in a L2 dominant environment interrupts their L1 contact. Subsequently, returning to their native language environment reduces their L2 use. Therefore, in most cases the speakers undergo a double process of both L1 and L2 attrition. The frequent and drastic transitions of language environment may contribute to instability in not only their L2 but also in their L1. Thus, it is important

to track the progress of *both* languages over time, rather than only focusing on the target L2. This is especially relevant for research concerning the attrition of children who undergo fluid changes in both of their languages over time. Taken together, a focus on changes in the L1 in addition to changes in the target L2 can provide a more comprehensive picture of the processes involved in attrition.

This study aims to investigate the factors that influence language change by tracking the development of lexical access in 36 children's L1 Japanese and L2 English over the period of one year, from the point when they returned to their L1 environment. Examining a relatively homogenous group of participants from the point of return to the L1 environment allows us to gather quantitative evidence for language change. As Schmid and Mehotcheva (2012, p.105) point out in their review of literature on L2/foreign language attrition, "there is need to confirm the validity of the existing findings since they are based on a very limited number of studies and target languages... and it should be further established what factor(s) and/or combination of factors influence the processes of attrition and how". In the following sections, we will discuss the specific individual factors affecting language attrition that are relevant for this study, drawing from findings in L1 and L2 attrition studies.

7.1.1 Age and length of residence

The interaction between age and language development has been extensively debated, in L1 and L2, and in both acquisition and attrition studies. Studies in L1 attrition have found some evidence pointing to the effect of age of L2 acquisition on susceptibility to attrition. In the case of L1 attrition, it has been suggested that the later the interrupted contact to L1 is, the better speakers can retain their native language. For instance, Yeni-Komshian, Flege, and Liu (2000) found that the later the Korean-English bilinguals moved to an English-dominant environment, the better they performed on the Korean pronunciation task rated by native speakers of Korean. Hakuta and d'Andrea (1992) also found a negative correlation between age of removal from the L1 environment and the degree of L1 attrition among Spanish learners of English.

One relevant point to keep in mind here is that in many cases the age of L2 acquisition and age of reduced L1 contact overlap in L1 attrition research. Especially

in the case of child L1 attrition, the age when children left their native language environment is also the age when they started learning their L2 in a new language environment. In fact, Köpke and Schmid (2004) suggest that early and continued exposure to L1 up until the onset of puberty is important to minimize the effect of attrition. Bylund (2009b) also suggests age of reduced language contact as one of the most important variables in L1 attrition.

In L2 attrition studies, Flores (2010, 2012) investigated the effect of age on the L2 syntactic attrition in simultaneous bilingual returnees who spoke Portuguese as L1 and German as L2. The bilingual children in her study were early bilinguals who were born in the L2 German environment and raised in L1 Portuguese families. One study tested the children's knowledge on verb placement and main and embedded clauses (Flores, 2010), and the other examined verb placement and object expressions (Flores, 2012). Both findings showed the effect of age of reduced L2 contact on the returnees' syntactic knowledge—returnees who lost L2 contact before puberty (age 10-12) showed greater signs of attrition than the others who left the L2 environment post-puberty. Flores explains that this age effect is related to a maturational constraint: reduced contact to L2 during the period of language consolidation and stabilization increases its vulnerability to change. Thus, this stabilization period is crucial for building resistance to language change.

In most cases, age of reduced L1 contact correlates with the length of residence in the L2 language environment (i.e., length of L2 residence). In the case of L1 attrition, the L1 is acquired from birth, and therefore the length of residence in the L1 environment determines the age of reduced contact. If the length of residence in the L1 environment is twelve years, this consequently means that the age of reduced L1 contact is also 12 years. However, this relationship may not be so clear-cut in L2 attrition; some returnees may have left the L2 environment at the age of 12 but have only had two years of residency in the L2 environment, whereas others could have left the L2 environment at 7 but still have had five years of L2 experience.

In fact, studies on L2 attrition in siblings provide valuable insights into distinguishing the two factors: age and length of residence. Siblings have the same length of residence in the target language environment, but their age of reduced L2

contact differs. This allows research to tease apart the effects of age of reduced contact from length of residence, which are often regarded as interdependent factors. For example, a study by Tomiyama (2008) which tracked L2 attrition of two Japanese-English returnee siblings over the period of 31 months showed that the younger sibling, who lost L2 contact at the age of 7;0 showed greater instability and fluctuation in lexical complexity and productivity than her older brother who came back to Japan at the age of 10;0. Moreover, Hansen-Strain (1990) found in her study of four English-Japanese returnee children (ages include: 3;0, 4;0, 7;0, 9;0) that the two younger children's scores on the production task decreased dramatically after two months of return to their L1 environment. In contrast, the two older children were able to maintain their lexical knowledge even after six months had passed upon their return to the US. Taken together, the qualitative studies of siblings in L2 attrition suggest that age of reduced L2 contact contributes to the degree of L2 attrition, even though the length of residence was kept consistent between/among the siblings.

7.1.2 Proficiency and length of residence

As in the case of age and length of residence, it is difficult to tease apart the variables that influence attrition, since there appears to be strong interdependence among them (Schmid & Dusseldorp, 2010). Another example is that proficiency may correlate with age, as older children tend to have higher proficiency and literacy skills than younger children. Moreover, proficiency and length of residence usually exhibit a strong correlation. The longer the speakers have stayed in the target language environment, the more their proficiency develops over time. In fact, Nagasawa (1999) found in her study on L2 Japanese attrition among English native speakers that a longer period of formal study in Japan facilitated the development of Japanese, which consequently lead to lower degree of attrition in their L2. Similar results were obtained by Hansen (1999), who found the length of stay in Japan to be a significant factor in the degree of attrition of Japanese syntactic negation among English-Japanese bilingual missionaries.

Reetz-Kurashige (1999) investigated the retention rate in productive and receptive verb forms among Japanese-English returnees. This study involved three

groups of elementary school age children: Japanese children who had returned to Japan from an English-environment (n=18), Japanese children residing in an English environment (Honolulu; n=10), and native-English speaking children (n=14). The results showed that high proficiency at study onset was more predictive of L2 retention than factors such as length of time abroad, personal characteristics, or age. Another study by Hansen and Chantrill (1999) stressed the influence of literacy on L2 attrition, as their study on L2 Japanese and Chinese learners shows that the amount of Chinese characters (or kanji) acquired was the strongest predictor for the decline in their L2 oral skills.

Although the aforementioned studies suggest the influence of proficiency on L2 attrition, we must be aware of the fact that the term *proficiency* encompasses various aspects of the language knowledge. For example, while Reetz-Kurashige (1999) used target-like usage of verb forms, Hansen and Chantrill (1999) used literacy as their baseline proficiency. These are indeed different measures of linguistic ability, making it difficult to compare the findings across multiple studies.

7.1.3 *Current exposure and length of residence*

Earlier works in L1 attrition intuitively assumed language exposure to be the strongest predictor in attrition, suggesting that longer length of residence (i.e., cumulative exposure) in the L2 environment and more opportunity to use the L1 (i.e., current language exposure) contributes to greater degree of L1 attrition. Nevertheless, empirical evidence appear to be at odds with this account, with many studies failing to observe a link between current or cumulative exposure and attrition (for a systematic review see Schmid, Forthcoming). For instance, Schmid and Dusseldorp, (2010) examined the predictive power of L1 use and L2 exposure on L1 attrition in German. Their results showed that both factors did not affect the degree of L1 attrition. Similarly, findings of Schmid and Jarvis (2014) on L1 lexical attrition among German-Dutch and German-English bilinguals showed that the use of L1 in various settings as well as length of residence in the L2 environment did not have any impact on their L1 lexical access and lexical diversity. Furthermore, in a small-scale meta-analysis,

Schmid (Forthcoming) found that nearly half of the studies that investigated the effect of L1 use reported non-significant results.

The role of language exposure on L2 attrition is an unexplored area of research, owing to the fact that its contribution was surmised to be self-evident based on its theoretical underpinnings. Following this, empirical studies often overlook the effect of L2 exposure, and thus, the quantity let alone the quality of L2 exposure is rarely measured or reported. What also complicates the picture is that most studies on L2 attrition involve a small number of participants, thereby making it difficult to tease apart the interplay of factors by utilising statistical analyses. To our knowledge, the only study that looked into this from a quantitative perspective was by Flores (2010) on 16 Portuguese-German returnees, which found no modulating effect of the time away from the L2 environment on the degree of L2 syntactic deviations.

7.1.4 Second language lexical attrition

Lexical attrition, or change in vocabulary access and retrieval, is perhaps the most studied domain in language attrition. It is assumed from previous research (Köpke & Schmid, 2004; Montrul, 2008; Tomiyama, 2000) that lexical-semantic knowledge is “the most vulnerable part of the linguistic repertoire” (Schmid & Jarvis, 2014, p.43) and tends to be affected by attrition at early stages (Linck et al., 2009). A wide range of measures has been taken to define the extent of language attrition: from assessing vocabulary size, lexical diversity and complexity, to experimentally testing lexical access and retrieval.

Among several studies on L2 lexical attrition, those most relevant to the current investigation are Reetz-Kurashige (1999), Tomiyama (1999, 2000), and Yoshitomi (1999) on Japanese-English returnee children. Reetz-Kurashige (1999) conducted a cross-sectional study on 18 returnees (age range from 6;5 to 13;7) and measured their vocabulary diversity based on type-token counts. Her results showed no difference between the English monolingual control and the returnee group in terms of productive lexical diversity. However, this may be due to the fact that twelve children (out of the eighteen participants) had only been back in Japan for less than three months at the time of testing. This period of L2 non-use may not have been long enough to observe

a change in the returnee's productive vocabulary. Tomiyama's (1999, 2000) study followed the English regression of a Japanese returnee child (8:0 at the onset of the study) longitudinally for 33 months. The data were collected once a month through numbers of instruments, including: free conversation, the Peabody Picture Vocabulary Test (PPVT), the Bilingual Syntax Measure (BSM), and story telling. Lexical retrieval difficulty, measured by the amount of code switching, long pauses, and other compensatory strategies, was observed in the first 19 months of the study. However, there were no signs of attrition in the child's receptive lexicon measured by PPVT. Finally, Yoshitomi (1999) also investigated L2 English attrition among four Japanese returnee children through administration of multiple language tasks. The type-token ratio of open-class vocabulary elicited in the free interaction task did not change over the period of one year, suggesting that the returnees exhibited very little L2 lexical attrition over the four data collection sessions.

In sum, past studies on Japanese returnees have found mixed results in terms of the degree of L2 lexical attrition. The authors attribute the inconsistent findings to a variety of factors, such as the varying length of L2 residence and different measures of lexical knowledge. Nonetheless, it is yet unclear as to what degree these factors contribute to the individual differences in L2 attrition.

7.1.5 The present study

Against this background, it is still unclear how the individual factors—age, proficiency, length of residence, and exposure—relate to one another and influence the degree of language change in the L2. Our study examines the predictive power of these individual factors on the degree of L2 lexical attrition in Japanese-English returnee children. In order to track changes in speakers' language knowledge longitudinally, speakers must be constantly available over a long period of time. Establishment of a baseline data is essential in attrition research and the complication involved in the data collection procedure contributes to the prevalence of qualitative methods within this research area. The present research is one of the first to provide quantitative evidence by testing 36 bilingual children over a period of one year—shortly after their return to Japan and a year later. This longitudinal data collection procedure allows us to

establish the children's baseline L2 lexical access. Thus, the differences we observe between the performances on the two tests will be defined as the lexical change in their L2. In addition to investigating the change in their L2, we tested their L1 lexical access in parallel to attain a comprehensive picture of attrition in their bilingual competence.

According to the idea that the stabilization period of the language knowledge is crucial for it to become resistant to change (Flores, 2010, 2012), we predict that the length of residence in the L2 environment is a determining factor to the L2 lexical change in the bilingual returnee children. In other words, the longer period the children stayed in the L2 environment, the better they could stabilize their lexical access over time and maintain it even after they move back to their L1 environment. However, as previously discussed, length of L2 residence may be confounded with other variables such as age and proficiency. We predict that length of residence correlates with proficiency, as children who stayed longer in the L2 environment tend to have higher L2 proficiency. Thus, in our current study we first ran a correlation analysis to explain the relationship among these variables. After we examined the relationship among the independent variables, we included the relevant variables into further analysis to investigate the effect of each individual variable on the change in returnees' L2 lexical access.

7.2 Methodology

7.2.1 Participants

The participants in the current study were 36 Japanese-English bilingual returnee children, 38 bilingual children initially participated in the study, but 2 participants dropped out in the second round of data collection.

The bilingual children (21 female and 15 male) had all acquired English as a second language and both of their parents were native speakers of Japanese. All the bilingual children had very limited exposure to English before they left Japan. The only exposure they have had before moving to the L2 environment was through weekly

language classes at a private institution or at an elementary school. The participant information of the bilingual returnees is provided in Table 7.1.

Table 7.1 Summary of participant information
(Incubation period = elapsed time between return to Japan and first round of testing)

	Age of L2 acquisition	Length of L2 residence	Incubation period	Age at first round	Age at second round
Mean	5;0	4;0	0;3	9;8	10;8
Min	1;0	2;0	0;1	7;6	8;6
Max	9;6	9;9	0;5	13;0	14;0
SD	2.5	2.0	0.1	1.42	1.42

We will refer to the age of L2 acquisition as the age of onset of L2 English; or in other words, the age at which the returnee children moved to the English-speaking environment. These bilingual children attended schools with English as a medium of instruction in a foreign country. Thus, they had acquired English in a naturalistic setting. Half of the participants had lived in a country where English is the majority language (e.g., USA, UK, Australia), whereas the other half had lived in a country where English is not the official language (e.g., Malaysia, France, Netherlands). The children who were living in a country where English is not the official language were exposed to the dominant language of the country, but none of the participants could actually hold a conversation using that language. The participants were first tested when they had just returned to Japan from the foreign country. The average age of the bilinguals in the first test session was 9;8. The second test took place approximately a year after the first test and the average age of the bilinguals in the second test session was 10;8. There was a perfect correlation between age at first round and second round of testing ($r = .99, p < .001$).

The participants were recruited through Japan Overseas Educational Services, an organization that offers English maintenance courses for returnee children once a week. The English maintenance course lasts for 90 minutes and it focuses on developing the children's English skills through a communicative approach. The course is divided into three levels depending on the children's English proficiency:

advanced, intermediate, and beginner. The bilingual children in the current study attended the course offered in central Tokyo.

In order to quantify the bilingual children’s language exposure to each language, the Bilingual Language Experience Calculator (BiLEC) (Unsworth, 2016b) was administered to the parents individually by the researcher. Table 7.2 illustrates the quantified language exposure (in percentages) at home as well as home and school when they lived abroad (Round 1) and when they returned to Japan (Round 2).

Table 7.2 Summary of BiLEC variables split by Language
 Round 1 indicates when the children lived abroad and Round 2 indicates when they came back to Japan (Round 2) at home as well as at home and school.

English (L2)				
	Round1	Round2	Round 1	Round 2
	Home	Home	Home+ School	Home+ School
Mean	14.4	3.2	46.8	4.5
Min	0	0	26.5	0
Max	62.6	32.2	82.4	20.5
SD	18.2	7.9	12.1	5.6
Japanese (L1)				
Mean	85.6	96.8	53.2	95.5
Min	43.5	67.7	35.4	58.0
Max	100	100	89.2	100
SD	19.9	12.6	10.8	8.5

Note. Numbers all indicate percentages

As shown in Table 7.2, it appears to be the case that Japanese was the dominant home language regardless of the language environment. Although English was spoken more at home in the first round (14.4%) than the second round (3.2%), the percentages are generally low. There is a drastic decrease in the amount of English spoken at home and school from 46.8% to 4.5% from first to second round. Conversely, there is an increase in the amount of Japanese exposure at home and school over time from 53.2% to 95.5%. The L2 exposure measure at home and school for the second round was used for further analysis, as we expected children with more English exposure to better maintain their L2 lexical access.

7.2.2 *Instruments and Procedures*

Verbal fluency task

A verbal fluency task measures the speaker's verbal ability—specifically lexical access and retrieval—as it requires the speakers to access and retrieve the meaning and forms of a specific word from their mental lexicon (Levelt et al., 1999). When one produces a word, the semantic level is activated before reaching to the phonological level (Levelt, 1999). For example, when one wants to retrieve the word 'dog', the concept of the word (i.e., a domestic four-legged animal) must first be accessed to retrieve the word form and to produce it as a speech. However, since bilinguals have two word forms to express one concept (e.g., 'dog' in English and 'inu' in Japanese), they must inhibit the non-target language for appropriate selection of the word form (Green, 1998). In addition to the inhibition of the other language for the bilinguals, this task involves storing earlier responses in their working memory and inhibiting irrelevant concepts and repetitions, as well as switching between subcategories (Shao, Janse, Visser, & Meyer, 2014). Thus, the verbal fluency task is not only characterized by linguistic representations, but it also involves executive control.

The verbal fluency task generally consists of two different tasks: category fluency and letter fluency. Both tasks require the participants to name as many words as possible in one minute; either words within a semantic category (e.g. animals, or fruits and vegetables) or words starting with a specific letter of the alphabet. Findings of clinical and neuroimaging studies (Mahone, Koth, Cutting, Singer, & Denckla, 2001; Sauz on et al., 2011) suggest that category fluency relies primarily on linguistic representation, while executive control plays an important role in letter fluency. In the category fluency task, the participants have to retrieve words from established associations between related concepts. They can access words through semantic features, which is a process that is practiced every day. However, in the letter fluency task, the participants must access words from a certain phonemic category, which is not a common strategy that is used in daily word production. The letter fluency is more cognitively demanding than category fluency, since one must inhibit the semantically associated words and use an unacquainted word retrieval strategy (Shao et al., 2014).

Thus, studies with adults have found that monolinguals outperform the bilinguals in the category fluency task due to their advantage in vocabulary size, lexical access, and the absence of inhibiting corresponding words from the other language (Sandoval, Gollan, Ferreira, & Salmon, 2010). In contrast, bilinguals are found to perform better or on a par with the monolinguals on the letter fluency task as a result of their enhanced executive control (Bialystok, 2009).

In the present study, we only administered the category fluency task, as we expected to find a significant difference in the bilinguals' linguistic representation. We predicted that change in the language environment (from L2 to L1 dominant) induces stronger interference from the L1 to L2. The performance in the semantic task is expected to suffer more from cross-linguistic interference because the translation equivalents are easily activated through shared concepts. Moreover, the decrease in exposure to L2 weakens the link between form and concept, which is expected to result in less production of the categorical items.

The participants were asked to name either (1) animals or (2) fruits and vegetables in English or Japanese. Half of the bilinguals named animals in English and fruits and vegetables in Japanese, and vice-versa for the other half of bilingual participants. There was a small break in between the two tasks.

The category fluency task was administered in a quiet room and the participants were seen individually by a Japanese-English bilingual researcher. Half of the bilingual participants were asked to name the categories in Japanese first and then in English and vice-versa for the remaining half. The instructions were given in English for the English test session and in Japanese for the Japanese test session. For all participants, a timer was set to one minute by the researcher and the participants were all given approximately ten seconds after they listened to the instruction to start the task. They were all reminded not to repeat the words. Their responses were recorded on a voice-recorder and later transcribed by two research assistants. The total number of unique words was calculated for each participant. The test was conducted at the participant's home. The category fluency task was administered twice: in the summer of 2016 and in the summer of 2017. Identical measures were taken for the second test

session, including the order of the language, the combination between semantic categories and languages for each participant, and the language of instruction.

Proficiency test

The purpose of the English proficiency test was to establish baseline L2 proficiency in order to investigate whether the level of L2 attainment has any influence on the amount of lexical attrition in bilingual Japanese children. The proficiency test used in the current study was administered by JOES as a part of the entrance examination for their weekly English maintenance course. Since JOES did not test the bilingual children's baseline Japanese proficiency, we only have measurements of their English proficiency. It was conducted approximately two to three weeks before the administration of the verbal fluency task at a JOES school in central Tokyo. The bilingual returnees were tested on: (1) listening and speaking, (2) writing (3) reading and grammar. The proficiency test was marked out of 120 points, consisting of 30 points from listening and speaking, 40 points from writing, and 50 points from reading and grammar tests. The test lasted for approximately one hour in total.

Listening and speaking skills were assessed through individual interviews. Experienced teachers at the JOES interviewed each bilingual participant and gave them a score (out of 30) based on how well they could hold a day-to-day conversation and understand a short passage and discuss it. The interview lasted for approximately five minutes for each child. The participants were scored according to the following assessment grid: (1) introduction (2) giving information (3) listening and understanding (4) coherence. The interviewer gave marks on a scale of 1-4 for each section.

In the writing test, participants were given three topics and were asked to write a short essay about the topic that they chose. The participants were marked out of 50 points based on the following categories: (1) spelling and grammar (2) coherence and organisation (3) originality. Two trained teachers scored the essay and the scores were modulated.

The reading and grammar test lasted for 30 minutes and consisted of multiple sections: (1) spelling (i.e., choosing the correct spelling of a word) (2)

synonyms/antonyms (i.e., choosing the correct synonyms/antonyms of the target word) (3) vocabulary (i.e., filling in the missing word of a sentence) (4) word order (i.e., connecting the words in the correct word order) (5) reading comprehension (i.e., reading a short passage and answering multiple choice questions). Each section was marked out of 10 points and the sum of all sections was added up to obtain the total score (out of 50).

All the bilingual participants took the proficiency test on the same day at a test location provided by JOES. The order of the test was same for all participants: (1) reading and grammar (2) writing (3) listening and speaking. Table 7.3 represents the mean score of the each test sections and the total score. The total score was used for further analyses.

Table 7.3 Summary of the proficiency test results

	Listening & Speaking	Writing	Reading & Grammar	Total
Mean	18.1	27.0	35.0	80.3
Min	0	10	19	39
Max	30	40	47	117
SD	9	9.8	7.1	20.8

7.3 Results

7.3.1 Correlation of independent variables

Before running the mixed effect model, we examined the relationship among independent variables by running non-parametric correlations (Spearman's *rho*). The independent variables included: age at first round of testing; age of L2 (English) acquisition; age of return to L1 (Japanese) environment; length of residence in L2-dominant environment; current L2 exposure in Japan; L2 proficiency test scores. The correlation matrix is provided in Table 7.4 A very strong correlation was found between age at first round and age of return ($r = .99, p < .001$). This is due to the fact that the first round of testing took place immediately after the bilingual returnees

returned to Japan. There was also a strong negative correlation between age of L2 acquisition and length of L2 residence ($r = -.85, p < .001$). This indicates that the earlier the children started acquiring English in a foreign country, the longer they stayed there. Since there was a strong correlation ($r > .80$) between age at first round and age of return, age of return was excluded from further analysis. In similar vein, age of L2 acquisition was excluded from further analysis due to its high correlation with length of L2 residence. We included length of L2 residence in the model, due to the idea that stabilisation period of language knowledge is a crucial factor to attrition and maintenance. The theoretical motivation for excluding age of L2 acquisition instead of length of L2 residence will be further explained in the discussion section. The moderate to weak correlations of the other independent variables confirmed that these could be treated independently when running mixed effect models.

Table 7.4 Correlation matrix of independent variables
(AoT=age at first round of testing; AoA=age of L2 acquisition; AoR= age of return to L1 environment; LoR=length of residence in L2 environment; Exp=current L2 exposure in L1 environment; Prof= L2 proficiency)

Variables	AoT	AoA	AoR	LoR	Exp	Prof
AoT	1	.42*	.99***	.13	-.08	.05
AoA		1	.40*	-.85***	.22	-.14
AoR			1	.15	-.05	.09
LoR				1	-.35*	.28
Exp					1	.31*
Prof						1

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

7.3.2 *The influence of independent variables on the change in verbal fluency performance*

Linear mixed effect model was used to estimate the effect of individual factors on the change in verbal fluency performance among bilingual returnee children. Before

running the model, continuous predictors (Age at first round of testing; Length of L2 residence; L2 exposure; L2 proficiency scores) were centred around the mean. First, Time (first and second rounds of testing); Language (Japanese and English); Age at first round of testing; Country of residence in the L2 environment (English or non-English); Length of L2 residence; L2 exposure; L2 proficiency scores were included as fixed effects in the model with verbal fluency score as the dependent variable. Country of residence in the L2 environment was included as a control variable, as half of the children lived in an environment where English is not the majority language. Age of L2 acquisition and Age of return were excluded in both models due to issues of collinearity. The intercept was set to: 'first round of testing' for the Time variable, 'English' for the Language variable, and 'English-speaking country' for the Country variable. Subject was included in all models as random intercepts. A backward elimination was used for the regression analysis. A base model with all the fixed effects and interactions of interest (two way interaction between Time and predictor variables and three way interaction between Time, Language, and predictor variables) were included, and then in a stepwise fashion, variables that did not reach significance were removed from the model. The optimal model was determined by comparing nested models using maximum likelihood ratio tests (Baayen, Davidson, & Bates, 2008). The goodness of fit for each model was evaluated through obtaining marginal and conditional R squared values using the MuMIN package (Barton, 2018) in R (R Core Team, 2013). The model with Language, Time, Length of L2 residence, Age at first round, Country, two-way interaction between Country and Language, and a three way interaction between Language, Time, and Length of L2 residence (as well as the two-way interaction that comes with the computation of Language*Time*Length of L2 residence) was found to be optimal, as it had the lowest Akaike information criterion value of the models (803) and an appropriate marginal R squared value (27.9).

Table 7.5 Estimated coefficients of the individual variables on verbal fluency scores (AoT=age at first round of testing; LoR=length of residence in L2 environment)

	Estimate	Std. Error	<i>t</i>	<i>p</i>
Intercept	.040	3.79	.10	.91
Language	1.80	1.67	1.07	.28
Time	5.94	1.67	3.54	<.001***
LoR	.48	.28	1.73	.08
AoT	.09	.03	2.71	.01*
Country	1.37	1.16	1.18	.24
Country: Language	2.60	1.04	2.48	.01*
Time: LoR	.79	.29	.69	.008**
Language:LoR	-.0003	.29	-.001	.99
Language:Time	-3.64	2.37	-1.53	.12
Language:Time:LoR	-.78	.41	-2.12	.04*

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

The output of the optimal models is provided in Table 7.5. There was a significant effect of Time ($E = 5.94$, $t = 1.67$, $p < .001$) but no significant interaction was found between Language and Time ($E = -3.64$, $t = -1.53$, $p = .12$). This suggests that verbal fluency score increased from first to second round of testing, but the amount of increase in scores between Japanese and English did not differ. Age at first round had a significant positive effect on verbal fluency performance ($E = .09$, $t = 2.71$, $p = .01$); that is, the older the bilingual children were, the more items they named. There was also a significant interaction between Country and Language ($E = 2.60$, $t = 2.48$, $p = .01$), indicating that the gap in scores between English and Japanese were greater for children who lived in a foreign country. Most importantly, there was a significant interaction between Language, Time, and Length of L2 residence ($E = -.78$, $t = -2.12$, $p = .04$). As shown in Figure 7.1, the longer the length of L2 residence was, the more the bilingual returnee children increased their English verbal fluency performance over time. However, length of L2 residence does not seem to have a profound effect on the development in their Japanese verbal fluency performance. Regardless of the length of L2 residence (i.e., length of residence in the English speaking environment = period of detachment from the Japanese dominant environment), the bilingual returnee children were able to increase their Japanese verbal fluency performance over time.

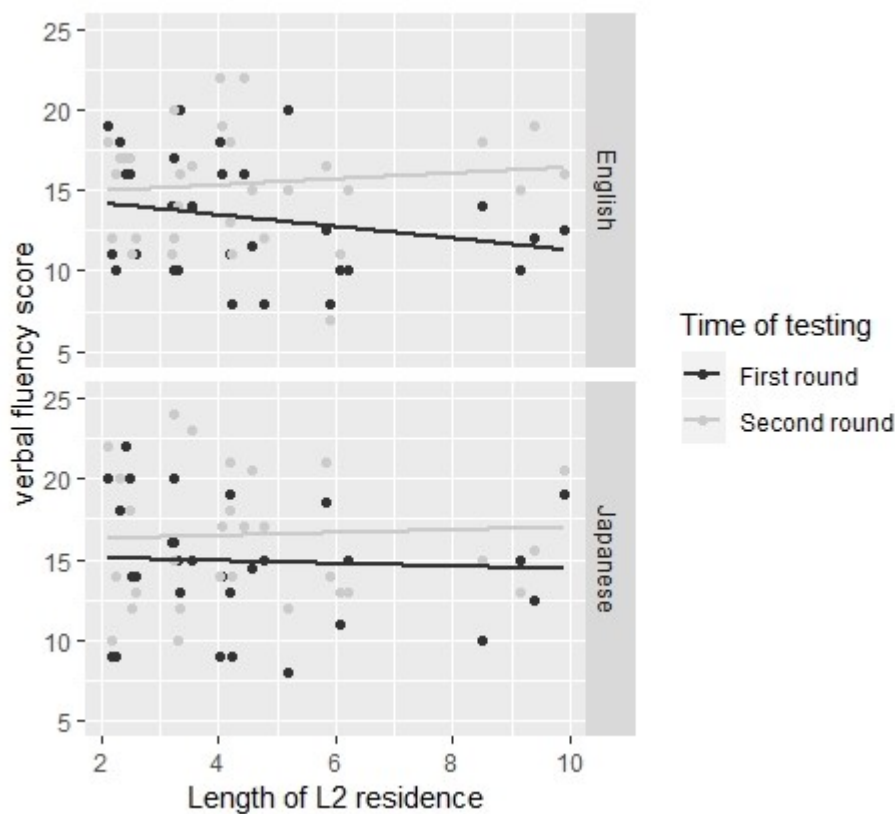


Figure 7.1 Interaction between length of L2 residence and time of testing on English and Japanese verbal fluency performance

7.4 Discussion

This study’s aim was to examine the effect of individual factors—age, length of residence, current language exposure, and proficiency—on changes in bilingual returnee children’s verbal fluency performance in L1 Japanese and L2 English. According to the hypothesis that language knowledge needs time to stabilize in development to become resistant to attrition, we predicted that length of L2 residence would have an effect on changes in returnee children’s L2 lexical access. The hypothesis predicts that the length of this ‘stabilization phase’ is an important predictor of language maintenance in returnee children.

Thirty-six bilingual returnee children were tested using a verbal fluency task. The test was conducted twice: first test was administered when the bilingual children

had just returned to Japan and the second test took place a year after the first test. During this time, the bilingual returnee children were immersed in their L1 Japanese environment through living in Japan and attending Japanese schools. The findings from the questionnaire also shows that the English exposure had decreased sharply from speaking 46.8 % at home and school to only 4.5% a year later. A few weeks before administering the first verbal fluency test, the bilingual children were also tested on their English knowledge (speaking and listening, writing, and reading) as baseline measures of their proficiency.

The analysis revealed that generally, the bilinguals were able to increase their verbal fluency score from first to second round of testing. However, the results also indicated that the relative increase for L1 Japanese and L2 English were indifferent, despite the children having reduced exposure to English. These results are in line with past studies (Reetz-Kurashige, 1999; Tomiyama, 1999, 2000; Yoshitomi, 1999)—Japanese bilingual returnee children showed minimal effects of lexical attrition in their L2 English, even after some years had passed since their return to the L1 environment. In the present study, the participants attended an English maintenance class every week for 90 minutes. Although the amount of exposure to L2 had decreased dramatically, the regular contact they had with English through the maintenance class may have contributed to the increase in their English vocabulary. Tomiyama (2000) also found in her longitudinal study of a Japanese returnee child that there was a fluctuation in the child's lexical knowledge. Some items that the child stopped producing had recovered in the later stages of child's production. Although the returnee children's L2 in the current study improved over time, we cannot be certain that this effect would continue in a linear manner. Further investigations of the returnees' lexical knowledge—after three, five, seven, and ten years upon their return to Japan—are necessary to examine how their verbal fluency performance changes and fluctuates over longer periods of time.

Alternatively, these results may be influenced by executive control. On this view, an improvement of the bilingual returnees' executive control may have offset their linguistic changes and enhanced their verbal fluency performance in both languages. Returning to the discussion of *which abilities* the verbal fluency task measures, there are two main components: (1) verbal ability (i.e., knowing the items

within a specific category and accessing it) (2) cognitive ability (i.e., inhibiting unwanted responses and storing formerly produced items in the Working Memory). It is possible that a boost in their cognitive abilities had a greater effect on the bilinguals' verbal fluency performance than the change in their linguistic abilities. This may be due to combination of factors including the developmental increase in executive control and the advancement effect from bilingualism. This opens up a new direction of research regarding the link between cognitive development and language maintenance in children.

The analyses from the linear mixed effect model revealed that length of L2 residence predicted the change in the bilingual children's English verbal fluency over time. In other words, the more time the children spent in the English environment, the better they could maintain their English verbal fluency performance after returning to Japan. Past studies (Bylund et al., 2009; Flores, 2010, 2012; Hakuta & d'Andrea, 1992; Pelc, 2001; Silva-Corvalán, 1994), however, found significant effects of age of return (rather than length of L2 residence) on the degree of language attrition. In a review of language attrition studies covering both early and late attriters, Bylund (2009b) suggested that there is a change in susceptibility to attrition around the age of twelve. If L1 contact is reduced before this age, greater degree of L1 attrition is observed. Nevertheless, it is important to note here that this hypothesis is based on the findings from L1 attrition. In L1 attrition, the target language is acquired from birth, however, in the case of L2 attrition in returnees, the target language is acquired at various ages. If the maturational constraint on language stabilization affects susceptibility to language attrition (Flores, 2010), then length of L2 residence should play a role in the context of L2 attrition. This is because it is unlikely that the children who acquired L2 at age ten and left the L2 environment at age twelve will have the same attrition effects as the children who acquired L2 at age four and left the L2 environment at age twelve. For example, studies by Flores (2010, 2012) on L2 attrition in Portuguese-German returnees found the effect of age of reduced L2 contact on syntactic attrition in German. However, the participants in her studies had all acquired their L2 German before the age of three. Moreover, the participants who emigrated to L2 environment after the age of three were excluded from the experiment in order to "rule out cases of late second language acquisition" (p.553). This means that the participants' age of reduced

L2 contact was the same as their length of L2 residence, as the returnees in Flores's studies were simultaneous bilinguals.

In the current study, the age of L2 acquisition of the bilinguals ranged from 1;0 to 9;6. Moreover, the age of L2 acquisition correlated highly with length of L2 residence. That is, the younger the children moved to the L2 environment, the longer they stayed there. The high correlation between these two variables may be influenced by the characteristics of the returnee families. The returnees in the current study were all children of Japanese expats. Japanese companies tend to ask younger employees to stay longer in the foreign environment; and younger employees are more likely to have younger children. This may be the reason to why we observed a very strong negative correlation between length of L2 residence and age of L2 acquisition—the younger children of younger Japanese employees tend to stay longer in the foreign environment.

It would have been ideal to include both variables—age of L2 acquisition and length of L2 residence—as independent factors in the statistical model, in order to tease apart the effects of these two variables. However, since there was a high correlation between age of L2 acquisition and length of L2 residence, we cannot be sure which of these two variables affects the degree of change in the returnees' L2 lexical access. With that said, it is plausible to assume that the longer these children stayed in the L2 environment, the more time they had to go through the 'stabilization phase'. If the period of this 'stabilization phase' is a crucial factor to language change and maintenance, then length of L2 residence should have a larger role in L2 attrition than the age of L2 acquisition. This is based on the idea that stabilization plays a crucial role in younger children who are going through the maturational phase. Regardless of the age that the children started acquiring their L2, it is the actual length of time that they have had to stabilize their language knowledge that contributes to language attrition and maintenance.

If we follow the theoretical idea that the length of residence is an important variable (rather than age of L2 acquisition), then our findings are in contrast to previous studies on L2 attrition in bilingual siblings (Hansen-Strain, 1990; Tomiyama, 2008). These studies have found that younger siblings undergo more changes in their L2 than older siblings, even though they spent the same number of years in the L2

environment. However, all of these studies do not give explanations to the mechanisms behind the observed age effects. It is also uncertain whether the age effect comes from the age of L2 acquisition or the age of L2 reduced contact. In order to further examine this question, we need to test a group of bilingual returnee children with low associations among the three factors: length of L2 residence, age of L2 reduced contact, and age of L2 acquisition. Since many studies on L2 attrition are on Japanese returnee children and this specific population usually exhibits a strong correlation between length of L2 residence and age of L2 acquisition, further research that investigates this topic with different returnee populations are in need.

Finally, in contrast to English, no modulating effect of individual variables was found for the improvement in Japanese verbal fluency performance. Regardless of the age or the period of reduced contact in the L1, the bilingual children unequivocally increased their Japanese verbal fluency performance once they were back in the L1 environment. Taken together, the findings indicate that the length of L2 residence and/or age of L2 acquisition affect the process of language attrition/maintenance in the L2, but does not appear to have an effect on the re-exposure to the L1.

7.5 Conclusion

The current study examined the L1 and L2 verbal fluency performances of Japanese-English bilingual returnee children over the course of one year. The main purpose of the study was to examine the effect of individual factors such as age, length of residence, current language exposure, and proficiency on the degree of L2 attrition. The results show that bilingual children were able to increase both their L1 and L2 verbal fluency performance over time. These findings suggest the enhancement in their verbal abilities, but also the possibility of the development in their general cognitive functions. However, further studies are in need to explain how language and general cognition interact developmentally in attrition. Most importantly, our results show that the length of L2 residence and/or age of L2 acquisition are significant variables that influence the degree of L2 attrition and maintenance. Although definite conclusions cannot be drawn due to the high correlation between these two variables, the length of

L2 residence is hypothesised to affect the change in L2 lexical access, as it conforms to the idea that children require a stabilization period to fully establish their language knowledge and build resistance to attrition effects. Moreover, our findings highlight the importance of differentiating L1 attrition from L2 attrition, as well as simultaneous from sequential bilinguals, when examining the effect of individual variables on attrition. While the age of reduced contact in the target language may be a decisive factor for L1 speakers and simultaneous bilinguals who had acquired the target language from birth (and thus has the same length of residence as the age of reduced contact), sequential bilinguals can have different years of length of residence and age of reduced contact as well as age of acquisition.

8 How bilingual experience and executive control modulate development in language control among bilingual children

8.1 Introduction

Bilinguals activate both of their languages even when confining their speech to the target language (Grosjean, 1989). One would then expect that there is constant interference from one language to the other. However, bilinguals efficiently keep the two languages separate, successfully attending to one language while resisting interference from the other—a phenomenon often referred to as language control. Theoretical accounts of bilingual language control share the idea that this phenomenon is mediated by domain-general executive control (Craig & Bialystok, 2006; Green, 1998; Green & Abutalebi, 2013). However, the link between the two control mechanisms have not been consistently found in empirical studies, and debates still persist as to what extent they overlap. Furthermore, no study has yet examined how language control and executive control dynamically interact as they develop during childhood. The current study investigated the extent of overlap between the two control mechanisms, and how bilingual experience influences language control over time in bilingual children's development.

The relationship between language control and executive control has been widely investigated using the switching paradigm (Meuter & Allport, 1999), in which the bilinguals are required to switch between languages as well as non-linguistic tasks. Both paradigms are set to measure mainly two costs: switch and mixing costs. Switch costs refer to the difference between switch and repetition trials in which the bilinguals have to switch to the other language/task or repeat in the same language/task within the same block. Mixing costs are the difference between repetition trials in the mixed language/task block and repetition trials in the single language/task block (i.e., single cue is tested across trials). Although debates persist in the literature as to what the

sources of these costs are, switch costs are often referred to as transient control processes whereas mixing costs reflect more sustained aspects of control (Bobb & Wodniecka, 2013). A number of studies have found the magnitude of switch and mixing costs in language-switching to correlate with their counterparts in task-switching (de Bruin et al., 2014; Declerck et al., 2017; Linck et al., 2012; Liu et al., 2016, 2014; Prior & Gollan, 2011) while others found weak or no associations (Branzi et al., 2016; Calabria et al., 2015; Jylkkä et al., 2018; Weissberger et al., 2012).

It is widely acknowledged that language control is dependent on language-specific processes: Language production involves a lexical selection process, in which the speakers must regulate the activation of lexical representations in order to choose the correct item that matches the intended meaning (Costa & Santesteban, 2004; Levelt et al., 1999). For example, when the intended meaning is the common four-legged domestic animal ‘dog’, speakers must choose the appropriate lemma *dog* out of other semantically related (and therefore activated) lemmas such as *cat* and *tail*—and this process occurs *within* the target language of a bilingual. Research based on the connectionist framework suggests that increased practice and use of the language creates stronger links between forms and concepts (Dijkstra, 2005; Kroll & Stewart, 1994; Michael & Gollan, 2005). Since bilinguals have less practice in each language than their respective monolinguals, their associative networks between words and concepts are weaker (i.e., “weaker links” hypothesis: Gollan & Acenas, 2004; Gollan, Montoya, & Bonanni, 2005; Gollan & Silverberg, 2001), hence potentially explaining why bilinguals are slower than monolinguals at naming pictures even in their dominant language (Gollan, Montoya, & Bonanni, 2005; Ivanova & Costa, 2008; Yan & Nicoladis, 2009). Thus, language-specific processes are dependent on bilingual experience (specifically language exposure), and so bilingual experience should play a crucial role in language control.

Not only does bilingual experience influence language control, but it also enhances executive control; as observed in research comparing executive control in bilinguals to monolinguals (see Bialystok, 2009 for review). In addition to the task-switching paradigm, a commonly used task to measure executive control is the Simon task, which measures how well one can inhibit unwanted responses by manipulating the position of the stimulus and the position of the button in which they are instructed

to press. In congruent trials, the position of the stimulus matches the position of the button, while the positions of the stimulus and the button do not match up in incongruent trials. The Simon effect is the difference in response time between congruent and incongruent trials. Unlike the Simon effect, which reflects inhibition *per se*, global response time (RT) (RTs of both congruent and incongruent trials) may reflect the ability to monitor competing sets of cues and selectively attend to the target cue (Martin-Rhee & Bialystok, 2008). Bilinguals outperform monolinguals on the Simon task as well as several other executive control tasks, and positive correlations have been reported between performance on the Simon task and language-switching (de Bruin et al., 2014; Linck et al., 2012). Although these findings speak to a ‘bilingual advantage’ in terms of executive control, direct comparison between language-switching and task-switching performance has generally found no or weak correlations (Calabria, Hernández, Branzi, & Costa, 2012; Klecha, 2013; Prior & Gollan, 2011), contributing to persisting debates on the reality of such a ‘bilingual advantage’ (for further discussion see Paap, Johnson, & Sawi, 2015).

This debate has also been approached developmentally by directly comparing the age-related changes in both language control and executive control (Calabria et al., 2015; Weissberger et al., 2012). Evidence for greater change across the life span in task-switching than language-switching suggests that language control may not be as affected by age-related decline as executive control (Calabria et al., 2015). In a similar vein, switch and mixing costs vary differently as a function of age depending on whether they involved switching between languages or non-linguistic tasks (Weissberger et al., 2012). Although such findings suggest that language control and executive control follow different developmental trajectories, bilingual experience was not carefully controlled in these studies, as they used self-rated proficiency scores and/or did not control for other bilingual experiences such as language use and exposure in each language. Therefore, it may be premature to draw any definite conclusions about potential differences between the developments of language control and executive control. For instance, smaller differences between older and younger bilinguals for language control than executive control may be confounded by variations in bilingual experience (exposure and use) with age.

The relationship between language control and executive control is also investigated through potential language dominance effects on the magnitude of switch and mixing costs. According to the Inhibitory Control Model (Green, 1998), switching from the less-dominant to the dominant language in unbalanced bilinguals requires more time than from the dominant to the less-dominant language, because bilinguals need to apply stronger inhibition to the dominant language, and subsequently resolving that inhibition takes more effort and time. Indeed, bilinguals have larger switch and mixing costs in their L1 or dominant-language than L2 (Costa et al., 2006; Linck et al., 2012; Meuter & Allport, 1999; Philipp et al., 2007; Schwieter & Sunderman, 2008). However, prior research has mainly focused on younger to older adults, and only a number of studies examined this phenomenon in bilingual children.

In addition, it is still unclear how language control and executive control interact developmentally. If the processes underlying these two control types overlap, then children who experience greater development in executive control should also do so in language control. What makes such investigation complex is that language control is largely influenced by bilingual experience (Bobb & Wodniecka, 2013). While executive control increases with age (for a review see Best & Miller, 2010), the bilingual experience is a fluid process, and does not increase in a linear manner with age. Some children may experience reduction in language exposure while others undergo increase in language input due to environmental or circumstantial changes. Thus, when examining the development of language control in children, the characteristics of the bilingual experience (in addition to executive control) must be taken into consideration.

Taken together, the development of language control, executive control, and bilingual experience appear to be deeply entangled with one another, especially among bilingual children as they often experience increase in both executive control and bilingual experience (Kohnert et al., 1999; Weissberger, Gollan, Bondi, Clark, & Wierenga, 2015). In contrast, executive control and bilingual experience can be more easily distinguished in children who lived in a L2 dominant environment for some years and returned to their L1 environment (“returnee” children), as these children, upon their return to the L1 environment, experience reduced input in their L2. Therefore, the present study strategically targets this specific population to further

examine how development in language control specifically relates to bilingual experience and executive control. This population enables us to examine how language control changes as children experience *reduction* in (current) bilingual exposure, a major departure from the ‘traditional’ approach focusing on how *increase* in bilingual exposure affects language control.

Specifically, we tracked language control and executive control abilities of Japanese-English returnee children over the course of one year, from the point when these children had returned to their L1 Japanese environment. By that time, the children’s language exposure changed dramatically from having exposure to two languages (Japanese and English) to mainly receiving only Japanese input. We tested children at two time points using the language-switching task to examine how language-switching performance changes over time and, more specifically, whether the observed changes could be explained by children’s bilingual experience, executive control, or both. If language control is influenced by bilingual experience (in our current study, we used exposure as a measure of bilingual experience), then language exposure should predict the change in bilinguals’ language control. Specifically, we predicted that children who received less English exposure in Japan (thus less bilingual exposure) would experience a smaller degree of improvement in language control (as measured by language switch and mixing costs) over time. Alternatively, if executive control also plays a role in the development of language control, then the bilinguals with greater performance improvement in the non-linguistic interference task should also show greater progress on the language-switching task.

8.2 Methodology

8.2.1 Participants

The participants were 36 Japanese-English bilingual returnee children. An additional two children dropped out in the second round of testing and were thus removed from the final sample. The participant information is provided in Table 8.1. All participants had acquired Japanese as their L1 and English as L2. The parents of the bilingual

children were all native speakers of Japanese. They all had similar socioeconomic status—all the mothers of the children had a bachelor or a post-graduate degree. Prior to moving away from Japan, the children had very limited exposure to English. All the parents reported that their children began acquiring English through daily exposure to English in a foreign environment. Children attended schools with English as a medium of instruction while abroad. Half of the participants lived in a country where English is the official language (e.g., USA, UK, Canada), while the other half lived in a country where the official language is not English (e.g., China, France, Germany) but still received education in English. Although the latter group was exposed to a third language other than Japanese and English, none of the parents reported that their children could actually hold a conversation in the third language. The first round of testing took place when the participants had just returned to Japan. The average time elapsed between their return to Japan and the first round of testing (i.e., incubation period) was three months (SD = 0.1). Upon their return to Japan, all participants attended Japanese schools that operated under the curriculum set by the Japanese Ministry of Education.

Table 8.1 Summary of participant information
(Incubation period = elapsed time between return to Japan and first round of testing)

	Age of L2 acquisition	Length of L2 residence	Incubation period	Age at first round	Age at second round
Mean	5;0	4;0	0;3	9;8	10;8
Min	1;0	2;0	0;1	7;6	8;6
Max	9;6	9;9	0;5	13;0	14;0
SD	2.5	2.0	0.1	1.42	1.42

Participants were recruited through Japan Overseas Educational Services (JOES). They were enrolled in an English maintenance course offered by JOES. The course took place every Saturday for 90 minutes in central Tokyo. Native English speakers taught the course and its aim was to maintain the children’s English ability after returning to Japan. The Bilingual Language Experience Calculator (BiLEC) (Unsworth, 2016b) was administered to the parents twice (first and second rounds of testing) to quantify the children’s language exposure when they were in a foreign

country and a year after their return to Japan. Table 8.2 illustrates the mean language exposure to English and Japanese for home only and home, school, and extra activities (labelled ‘Extra’) for the first round and second round of testing. Children were mainly exposed to Japanese at home, regardless of whether they lived in a foreign country (Round 1: 83.4%) or in Japan (Round 2: 93.8%). English exposure (i.e., Extra) decreased dramatically from 50.4% exposure rate to 9.9% by the second round of testing. In contrast, Japanese exposure increased from 49.6% to 90.1%.

Table 8.2 Summary of BiLEC variables split by Language

Round 1 indicates exposure when the children were abroad and Round 2 indicates exposure when the children came back to Japan; ‘Home’ indicates exposure at home and ‘Extra’ indicates exposures at home, school, and extra activities

Japanese (L1)				
	Round1 Home	Round2 Home	Round 1 Extra	Round 2 Extra
Mean	83.4	93.8	49.6	90.1
Min	37.3	35.3	15.7	32.6
Max	100	100	62.5	100
SD	19.9	12.6	12.8	11.3
English (L2)				
Mean	16.6	6.2	50.4	9.9
Min	0	0	29.5	1.8
Max	62.6	32.2	84.2	28.4
SD	19.9	7.9	13.5	8.6

Note. All numbers indicate percentages

8.2.2 Instruments

Language-switching task

The language-switching task was programmed using E-prime (Psychology Software Tools, 2016). It included a total of 84 trials in three blocks: two single language blocks (English and Japanese) and a mixed language block. In each trial, children had to name a picture presented on a computer screen in the language indicated by a visual cue.

Participants were instructed to name the picture in English if they saw a British flag besides the target picture and in Japanese if they saw a Japanese flag with the target picture. A total of 50 black line drawn pictures (40 for single language blocks and 10 for mixed language blocks) were used in the study (Cycowicz, Friedman, Rothstein, & Snodgrass, 1997). We used pictures that elicited more than 90% accuracy rate in the name agreement data of six to seven year old L1 English children. All pictures were optically scanned, edited, and presented as black-on-white line drawings.

A trial began by presenting a white screen with a central black fixation cross (500ms), and then the stimulus picture (bottom of the screen) with the target language flag (on top of the screen). Given the fact that some studies found asymmetrical switch costs for shorter response-to-stimulus interval (i.e., time elapsed between the response and the presentation of the next stimulus; Mosca & Clahsen, 2016; Philipp et al., 2007), the researcher immediately pressed the space button to proceed to the next trial when the children had given a response. This measure was taken to minimize the response-to-stimulus interval and increase its sensitivity to observing asymmetrical switch costs. The same investigator administered the task for all participants in both rounds of testing to minimize administrator bias in determining the end of the target response. Any trials in which the response-to-stimulus interval was more than 1500ms (including the 500ms for presentation of the fixation cross) were excluded from the analysis. In addition, any trials where the button was pressed before the child finished naming the target stimulus were excluded. According to these exclusion criteria, 2.6% (80 trials) of the data were omitted from further analysis.

The order of the single language blocks (Japanese-English or English-Japanese) was counterbalanced, but always preceded the mixed language block. Each single language block consisted of 20 test trials preceded by 5 practice trials. 20 different pictures were used in each single language block and the order of presentation was randomised. The mixed language block included 44 test trials divided into two sessions with 22 trials each, preceded by 16 practice trials. Eight target stimuli pictures were used in the mixed language block. That is, the same pictures were presented multiple times in a random order to the participants in the mixed language block. The mixed language block included both repetition trials (in which the language cue was the same as in the previous trial) and switch trials (in which the language cue differed from the

previous trial) trials. One-third of the trials were switch trials and the other two-third were repetition trials. There were equal numbers of repetition and switch trials for both languages. The language cue alternated on either every first, second, third, or fourth trial. The sequence of language cue was the same for every participant.

The participants were fitted with a microphone and a bilateral earphone set and seated in front of a computer screen. The instructions were given in the child's most comfortable language in either Japanese or English by a Japanese-English bilingual researcher. The participants were reminded before each block to name the picture as quickly as possible. There was a short break between each single language block and mixed language block. In the single block, participants were not aware of the pictures that appeared in the experimental trial (the practice trial involved naming *different* items from the experimental trial). However, in the practice trial for the mixed block, the participants were asked to name the eight pictures that appeared in the experimental trial in both English and Japanese. Participants proceeded to the mixed language block only after they correctly named the eight pictures in English and Japanese in the practice trial. It took around 15 minutes for children to complete the picture-naming task. Built-in voice key functions were not used to extract reaction time, as they are easily triggered by background noises and other interfering sounds (e.g., err, umm) prior to giving the actual response. Instead, naming latencies were measured by manually determining the onset of the word through Checkvocal, a program that assists with processing naming tasks data (Protopapas, 2007).

Simon task

The Simon task was constructed and administered using E-Prime (Psychology Software Tools, 2016). The Simon task was administered to measure children's ability to control interference and inhibit unwanted response. Participants were presented with a white-background screen with either a frog or shoe on the two bottom corners of the screen. The positions of the frog and the shoe were counterbalanced across participants. In each trial, a target (either frog or shoe) was presented at the top of the screen, either on the left or on the right. Participants were instructed to press the key that was located on the side of the response picture that matched the target. In congruent trials, the position of the target matched the position of the correct response picture (e.g., bottom

left side = shoe, upper left side = shoe). In incongruent trials, the target's position and that of the correct response picture did not match (e.g., bottom left side = shoe, upper right side = shoe). Thus, incongruent trials required inhibiting the location of the target in order to respond based on its identity.

Participants first completed 13 practice trials followed by a small break and the 40 test trials. One-third of the test trials were congruent and two-thirds incongruent. Targets disappeared after a certain amount of time, which was tailored to each participant's own response times in the practice trials, hence ensuring the task was equally challenging to all participants regardless of individual differences in processing and motor speeds. The limit was calculated by multiplying the mean reaction time in practice trials by 1.5. Instructions were conveyed in the language that the child was most comfortable with. The children were instructed to push the correct keyboard button as quickly as possible. It took around 5 minutes for children to complete the task. The Simon effect was calculated by subtracting the average reaction time on the congruent trials from the incongruent trials.

8.2.3 Procedure

The language-switching task was always administered prior to the Simon task. The participants were all seen individually in a quiet room at the participants' home by the investigator. The first round of testing took place in Summer 2016 and the second round of testing was administered a year later in Summer 2017. The exact same procedures were taken for the second round of testing. Since the current study was part of a larger project testing language attrition in bilingual children, other tasks not reported here were administered on the same day.

8.2.4 Data Analysis

In order to examine whether there was a significant change in RT for Simon and language-switching over time, we analysed the data using a linear mixed effect model available in the lme4 package (Baayen et al., 2008) in R (R Core Team, 2013). Before running the model, RTs were log-transformed to correct for normality. Inaccurate trials

were also excluded from the dataset and RTs that were over or below three standard deviation from the mean were also omitted.

8.3 Results

8.3.1 Simon task

The mean RTs and accuracy of congruent and incongruent trials as well as the Simon effect in first and second round of testing are provided in Table 8.3. Simon task performance was analysed with a model including Trial type (congruent or incongruent) and Time (first round or second round) and interaction between Trial type and Time as fixed effects, and Subject and Item as random intercept (adding by-Subject and by-Item random slope for Trial type and Time did not improve the overall fit of the model). The baseline intercept was set to congruent trials and first round of testing. Responses were significantly faster in congruent than incongruent trials (i.e., Simon effect), $E = .06, t = 5.82, p < .001$.

Table 8.3 Descriptive statistics of the Simon task split by Time

	Congruent	Incongruent	Simon effect
First round	531 (144) .91	563 (129) .89	32 (15)
Second round	460 (125) .91	488 (110) .85	28 (15)

Note. Numbers without bracket indicate RT; numbers in brackets indicate SD; percentages below the RT and SD indicate accuracy

There was also a decrease in RTs from first to second round of testing, $E = -.14, t = -12.15, p < .001$. As illustrated in Figure 8.1, RTs on both congruent and incongruent trials became faster over time. However, there was no interaction between Trial type and Time, $E = -.0007, t = -.04, p = .96$. That is, the Simon effect did not change from first to second round of testing.

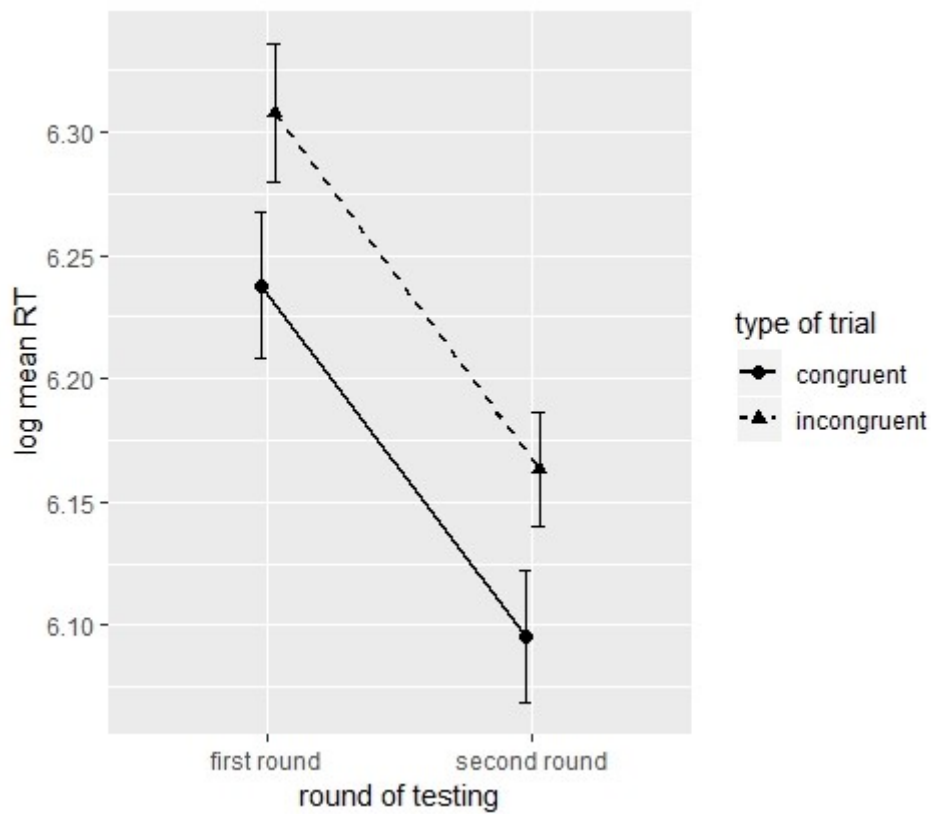


Figure 8.1 Interaction between Trial type and Time on the performance in the Simon task
error bars = standard error

8.3.2 Language-switching task

Mean reaction time, standard deviation, and accuracy for each Trial type (single, repetition, and switch) aggregated by Time (first round or second round) and Language (Japanese or English) are provided in Table 8.4.

Table 8.4 Descriptive statistics of each trial in the language-switching task split by Time and Language

Japanese (L1)					
	Single	Repetition	Switch	Switch cost	Mixing cost
First Round	1026 (537) 91.3	1166 (491) 99.8	1468 (736) 98.1	302 (245)	145 (45)
Second Round	931 (504) 91.3	1028 (414) 99.8	1131 (464) 98.8	103 (49)	96 (89)
English (L2)					
First Round	1186 (662) 97.1	1142 (541) 99.0	1365 (609) 98.8	224 (68)	-44 (122)
Second Round	1149 (657) 98.0	946 (396) 99.6	1096 (454) 99.6	151 (58)	-203(262)

Note. Numbers without bracket indicate RT; numbers in brackets indicate SD; percentages below the RT and SD indicate accuracy

The linear mixed effect model for language-switching included RT as a dependent variable and Language (Japanese or English), Trial type (single, repetition, and switch), and Time (first round or second round) as fixed effects, and Subject and Item as random intercept (adding by-Subject and by-Item random slope for Trial type, Time, and Language did not improve the overall fit of the model). The baseline of the intercept was set to English, repetition, and first round of testing. The estimates of the model are provided in Table 8.5.

Table 8.5 Estimated coefficients of the mixed effect model for language-switching task

Fixed effects	Estimate	Standard error	<i>t</i>	<i>p</i>
Intercept	6.92	.04	149	<.001***
Japanese	.02	.02	1.29	.19
Round 2	-.16	.02	-7.48	<.001***
Mixing cost	.07	.04	1.59	.11
Switch cost	.17	.02	6.42	<.001***
Japanese x Time	.05	.03	1.67	.09
Japanese x Mixing	-.17	.04	-4.10	<.001***
Japanese x Switch	.03	.03	.77	.43
Round2 x Mixing	.13	.02	4.48	<.001***
Round2 x Switch	-.03	.03	-.84	.40
Japanese x Round 2 x Mixing	-.11	.04	-2.75	.005**
Japanese x Round 2 x Switch	-.08	.05	-1.54	.12
Random effects	Variance	SD		
Subject	.01	.13		
Item	.01	.13		

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

Responses became faster from first to second round of testing, $E = -.16$, $t = -7.48$, $p < .001$. There was an interaction between Language and Trial type, $E = -.17$, $t = -4.10$, $p < .001$ (Figure 8.2). Children's naming latencies for Japanese words was significantly faster than for English words in the single blocks. However, in the mixed blocks (both repetition and switch) children were slower at naming items in Japanese than in English.

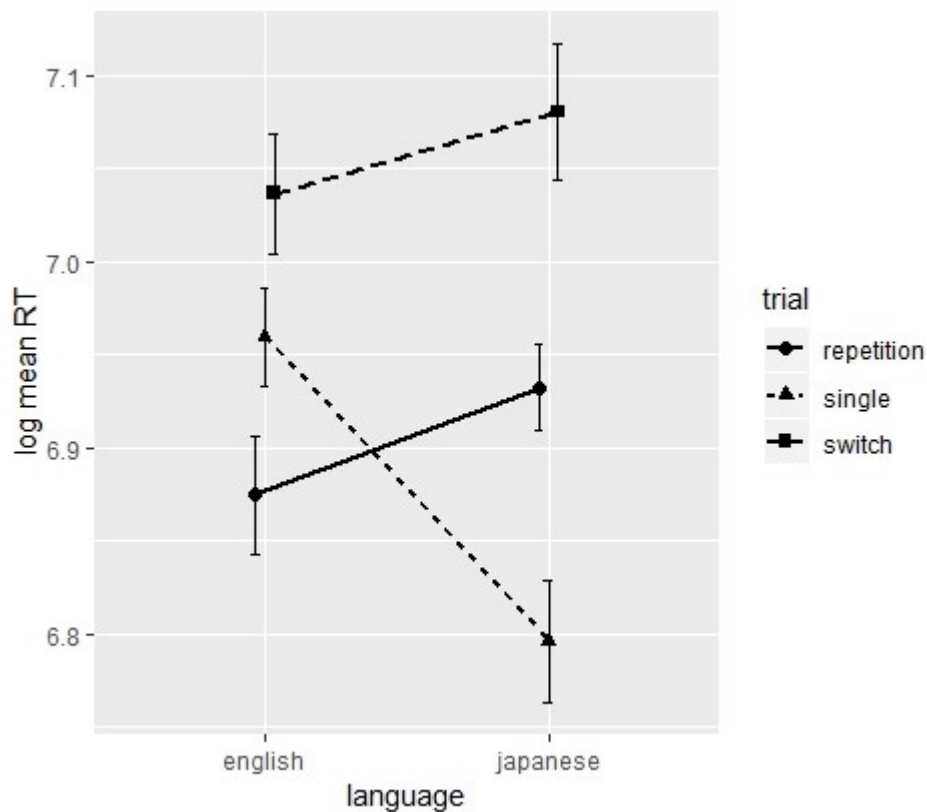


Figure 8.2 Interaction between Language and Trial type on performance in the language-switching task
error bars = standard error

There was a significant interaction between Time and Trial type, $E = .13$, $t = 4.48$, $p < .001$; that is, the magnitude of mixing costs increased from first to second round of testing. However, the significant interaction among Language, Time, and Trial type, $E = -.11$, $t = -2.75$, $p = .005$, suggests that the interaction between Time and Trial type was influenced by Language. Figure 8.3 illustrates the three-way interaction among Language, Time, and Trial type. The English mixing cost increased from first to second round of testing, but this effect was mainly due to the fact that the RTs of single trials in English did not decrease relative to the repetition trials. The mixing cost in Japanese did not change over time. The negative values for mixing cost in English (first round = -44-ms; second round = -203-ms) also showed that single trials were slower than repetition trials for both rounds of testing. This result was unexpected, given that single trials generally elicit faster responses than repetition trials as there is

no need to switch between languages in the single block. In Japanese, however, the mixing cost values were positive (in the expected direction) and decreased over time (first round = 145-ms; second round = 96-ms).

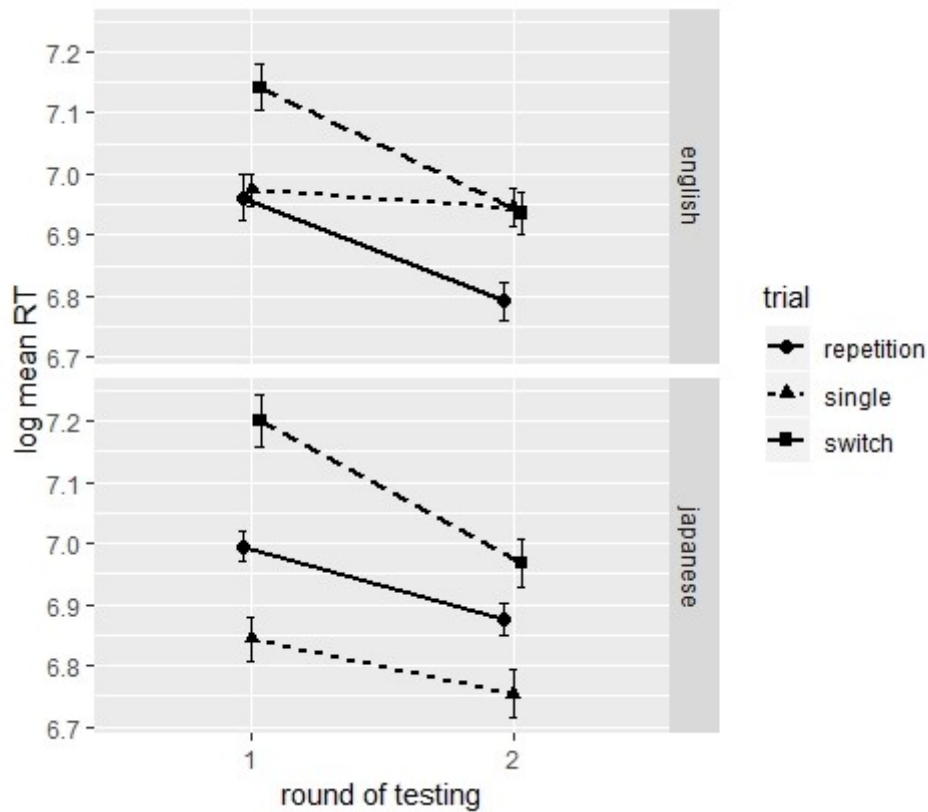


Figure 8.3 Interaction among Language, Time, and Trial type on performance in the language-switching task
error bars = standard error

8.3.3 *Effect of bilingual experience and executive control on development of language control*

As a significant difference from the first to the second round in the language-switching task was only found in the magnitude of English mixing cost, we subsequently explored what factors could account for this difference. As shown in Figure 8.3, the change in English mixing cost appeared to be driven by single trials. The rate of RT decrease for the English single trials was not as steep as in the other trials. For instance,

the RTs of Japanese single trials decreased over time by 95-ms, but English single decreased only by 37-ms.

In order to test the influence of bilingual experience and executive control in the observed changes in language control, we constructed two separate linear mixed effect models, one with English single RT as a dependent variable, and the other with English repetition RT as a dependent variable. We included Time (first round and second round), English exposure, and Simon global RT change as fixed effects and Age at first round of testing as a covariate. Both models included Subject and Item as random intercept (including Time as a random slope for both by-Subject and by-Item intercepts did not improve the overall fit of the model).

We used the English exposure measures at home, school, and extra activities at second round of testing for the English exposure variable. We took the measures from the second round of testing, as we expected that children who had more exposure in English when they were back in their L1 Japanese environment would be able to better enhance their performance on the English picture naming over time.

Simon global RT change was calculated by subtracting the global RT (RTs of both congruent and incongruent trials) of each participant from first to second round of testing. Higher values indicate faster performance on the Simon task over time. We used the global RT difference rather than the difference in Simon effect, as we found that Simon effect did not change over time and thus showed little variability. In contrast, there was a significant change in global RT, and most participants had faster RTs in the second round of testing (with the exception of two participants).

Before running the linear mixed effect model, we ran a Pearson product-moment correlations between the predictors (L2 exposure, Simon global RT change) and the covariate (Age at first round of testing) in order to ensure that there are no issues of multicollinearity. All correlations between these variables had low correlation coefficients but significant p-values: L2 Exposure and Simon global RT change, $r = .10$, $p < .001$; L2 Exposure and Age at first round of testing, $r = -.26$, $p < .001$; Simon global RT change and Age at first round of testing, $r = -.35$, $p < .001$. Moreover, we used variance inflation factor (VIF) to confirm this, and all predictors had VIF values less than 5 (range 1.37 – 3.73), indicating that there is no issue of

collinearity. The low correlation coefficient and VIF values indicate that these variables can be treated independently in further analyses.

We used backward elimination strategy to determine the most optimal model. We first constructed a full model with all predictors and interactions. We then eliminated interactions in a stepwise manner to test whether the new model without the specific interaction is significantly better than the old model with the interaction. We used maximum likelihood ratio test to determine the more optimal model. We used backward elimination for the interactions only and the main effects were consistently kept in the model. We report the results of the optimal model for English single and English repetition trials in Table 8.6.

Table 8.6 Estimated coefficients of the mixed effect model for English single and repetition trials

English single				
Fixed effects	Estimate	Standard error	<i>t</i>	<i>p</i>
Intercept	6.95	.08	86.58	<.001***
Age	-.005	.001	-4.22	<.001***
L2 exposure	-.04	.30	-1.36	.18
Round 2	.15	.04	3.20	.001**
Simon	-.001	.0008	-1.37	.17
L2 exposure x Round2	-.60	.42	-3.74	<.001***
Simon x Round 2	-.001	.0005	-2.14	.03*
Random effects	Variance	SD		
Subject	.02	.14		
Item	.03	.18		
English repetition				
Fixed effects	Estimate	Standard error	<i>t</i>	<i>p</i>
Intercept	6.85	.05	118.91	<.001***
Age	-.007	.001	-4.91	<.001***
L2 exposure	.40	.29	1.00	.32
Simon	-.001	.0005	-1.32	.19
Round 2	-.07	.03	-2.40	.01*
Simon x Round 2	-.003	.0004	-3.05	.002**
Random effects	Variance	SD		
Subject	.03	.17		
Item	.002	.05		

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

The output of the optimal model for English single trials showed that, Round of testing, L2 English exposure, and Simon global RT change predicted English single RT, as we found a significant interaction between L2 exposure and Round 2, $E = -.60$ $t = -3.74$, $p < .001$; as well as Simon and Round 2, $E = -.001$, $t = -2.14$, $p = .03$. The more English exposure the children had when they were back in Japan, the faster they had become at naming pictures in English in the single block (Figure 8.4). Similarly, bilinguals who became faster at responding in the Simon task also became faster at naming English items in the single block (Figure 8.5).

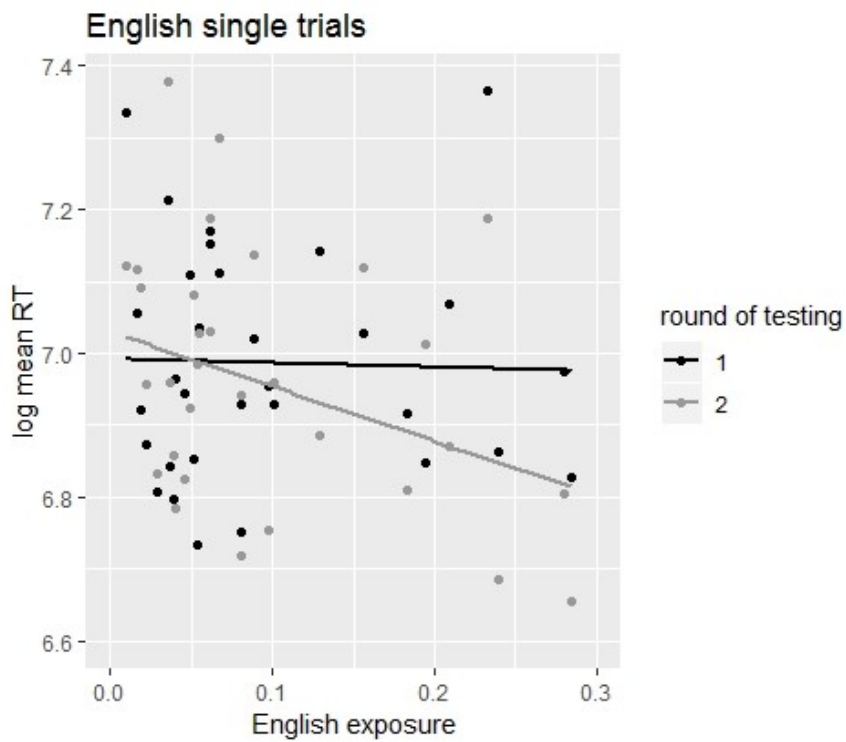


Figure 8.4 Interaction between English exposure and Time on English single trial performance

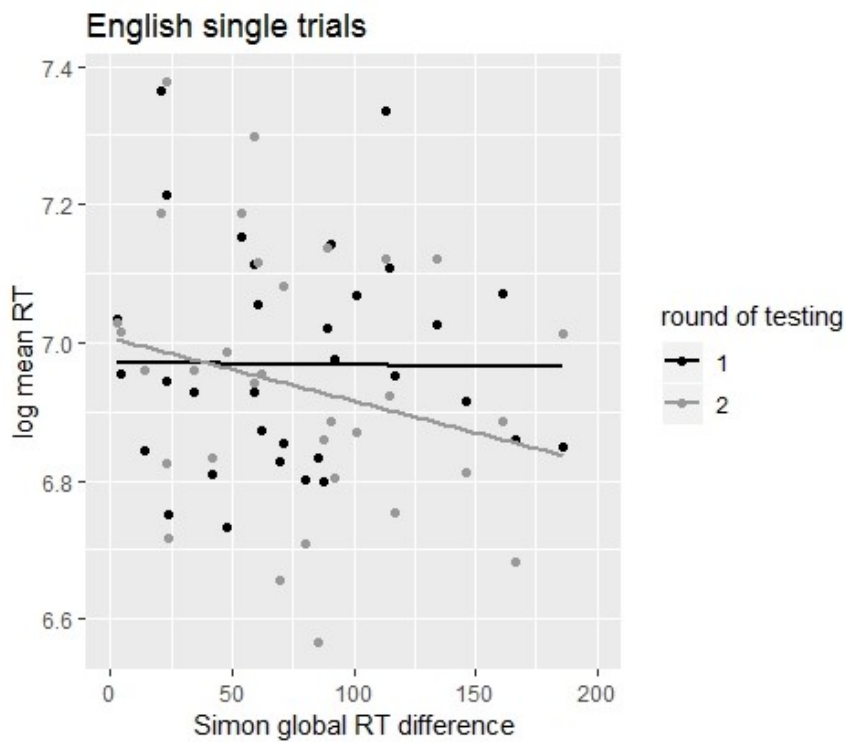


Figure 8.5 Interaction between Simon global RT difference and Time on English single trial performance

For English repetition trials, the only significant interaction was between Simon global RT change and Time, $E = -.003$ $t = -3.05$, $p = .002$ (Figure 8.6), which was mainly due to the slope in the first round of testing. The larger the Simon global RT change was, the slower the RTs were in the first round of testing. In other words, children whose Simon performance increased the most responded faster in the English repetition over time, but this was mainly due to the fact that they started off with slower RTs in the first round of testing.

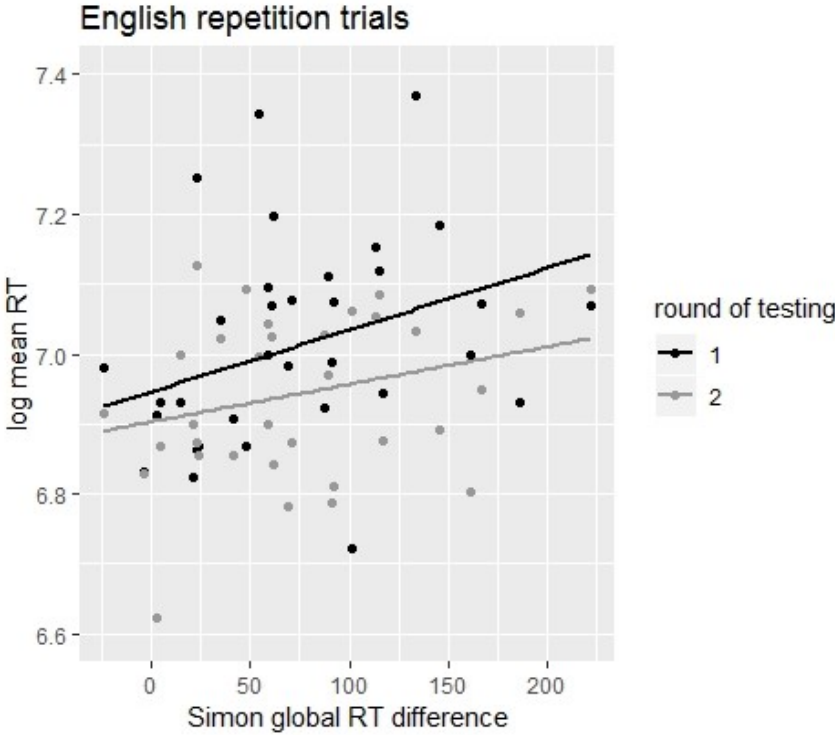


Figure 8.6 Interaction between Simon global RT difference and Time on English repetition trial performance

8.4 Discussion

This study investigated whether bilingual experience and/or executive control predict the development of bilingual returnee children’s language control. The findings show that magnitude of English mixing cost increased over time. By analyzing the English single trials and the English mixed repetition trials separately, we found that both L2

exposure and development in executive control modulated the change in English single trials, whereas development in executive control (but not L2 exposure) predicted the change in English mixed repetition trials.

We will first discuss the results of the Simon task, used to measure executive control. Surprisingly, the magnitude of the Simon effect did not change over time. However, the global RT (RTs of congruent and incongruent trials) significantly decreased from first to second round of testing. The time span of one year between first and second round of testing may have been too short to reveal a significant change in inhibition. Alternatively, inhibitory skills may have already reached adult-like level for the bilinguals in the current study, since they were older children with the mean age of 9;8 (in the first round). Consistently, greatest progress in inhibition (measured through frontal lobe functioning) is usually observed before eight years of age (Best & Miller, 2010; Romine & Reynolds, 2005).

The lack of change for the Simon effect was due to similarly steep decline in RTs for both congruent and incongruent trials over time. Consistently, a prior study reported faster global RT in bilingual than monolingual children, but no difference in Simon effect (Martin-Rhee & Bialystok, 2008). Although measures of inhibition in the Simon task is typically defined as the RT difference between congruent and incongruent trials, global RT may reflect the initial ability to control attention to complex stimuli (Martin-Rhee & Bialystok, 2008). Specifically, bilingual children's advantage in global RT may reflect greater ability to monitor two sets of competing stimuli (Bialystok et al., 2004; Costa et al., 2008; Craik & Bialystok, 2006; Hilchey & Klein, 2011; Poarch & Van Hell, 2012) or greater ability to handle tasks or trials of different types (Costa et al., 2009).

Alternatively, global RT in non-linguistic interference tasks may reflect processing costs, that is, a measure that “reflects the integrity of neural connections and the functional integration of frontal systems, and can be evaluated by the speed, quantity and quality of output” (Anderson, 2002, p.74). Indeed, processing speed may be an underlying construct that is reflected in all dimensions of the executive control (Salthouse, 2005). The global RT advantage found in Bialystok et al. (2004) has been interpreted as an indicator for enhanced processing speed (Diamond, 2013). A ‘neutral’

condition, where there is no need to monitor and control conflicts, could have helped differentiate the cognitive mechanisms behind global RT (Paap & Greenberg, 2013). Unfortunately, the lack of such a neutral condition in our study prevents making definite conclusions as to whether global RT decrease between the two testing sessions reflects improvement in processing cost or monitoring. However, the fact that we found a positive relationship between improvement in global RT and faster response in the English single block—which require no conflict monitoring between two languages—may point towards the interpretation that processing cost is more likely to be manifested in global RT.

The findings from the language-switching task showed a significant interaction between Trial type and Language. In other words, while the bilinguals performed faster in Japanese than in English for the single block, they were slower in the mixed block. L1 global slowing effect was present in both time points, despite no differences in L1 and L2 switch costs across time. Similar L1 global slowing effects have been found in other language-switching studies (Costa & Santesteban, 2004; Costa et al., 2006; Gollan & Ferreira, 2009; Misra et al., 2012). In these studies, bilinguals were slower at L1 naming than L2 naming during language switching (but not when they did not have to switch between languages). L1 global slowing effect may reflect sustained language suppression, as suggested by ERP findings showing that L1 inhibition is applied to not only in the immediate switch to the L2, but also persists in later L2 production (Misra et al., 2012). Our results lend support to the claim that the L1 global slowing effect emerges only when the bilinguals display symmetric switch costs (Costa et al., 2006).

Interestingly, English mixing cost increased over time, and this effect derives from the lower rate of decline in English single trials compared to repetition trials. Specifically, while there was on average -196-ms difference from first to second round of testing for the English repetition, RTs on English single trials decreased only by 37-ms. Recall that in the single block trials, the bilinguals had to name 20 different pictures in each language. This involves language-specific process of matching 20 different concepts to their appropriate forms. Since the efficiency of mapping concept to form is determined by the use of the target language, children who continued to receive English exposure in Japan may be able to maintain the link between concept

and form, and therefore experience less effect of attrition in English naming. In contrast, in the mixed block trials, the bilinguals had to name eight pictures that appeared repeatedly. Furthermore, they could only proceed to the experimental trial if they named all eight pictures correctly in the practice trial (this was not the case for the single block). In other words, we made sure that the link between concept and form was already established in the mixed block. This difference in experimental setup may explain why English exposure/use influenced the degree of change in the English single, but not in the repetition trials. Taken together, our findings suggest that the amount of L2 exposure influenced the performance on a specific task that require greater language-specific processing.

In addition to the role of language exposure, we were interested in how executive control predicts the development of language control. Our results showed that measures of executive control (i.e., difference in global RT on the Simon task) predicted the rate of development in *both* English single and English repetition trials. That is, bilingual children who increased their performance on the Simon task also became faster at English naming for both types of trials over time. Nevertheless, it should be noted that the bilinguals who experienced greater development in the Simon task started off (in first round of testing) with slower RTs in the English repetition trials. Therefore, their greater development in the English repetition trials may be motivated by the fact that they had more ‘room for improvement’, compared to others who were already fast at responding in the first round of testing.

In sum, our study shows that the change in English mixing cost over time can be explained by dual effects of bilingual experience and executive control. Bilingual experience especially influenced the change of mixing cost, and in particular single block trials (but not mixed block) which involved naming many novel pictures, calling for language-specific processes that are mediated by language use. As the returnees experienced a dramatic decrease in their English exposure, this yielded only a moderate decline in RT for the English single trials, in comparison to a steep decline in English repetition trials; resulting in a larger mixing cost over time. However, it would be interesting to see whether this pattern would hold if the mixed blocks included as many novel pictures as the single blocks. In such case, we would expect

language exposure to also influence the performance in the repetition as well as switch trials.

Most importantly, general cognitive development—whether it is monitoring or processing cost—predicted the performance of both English single as well as English repetition trials, suggesting partial overlap between executive control and language control. Unlike previous studies that looked at age-related changes of language control and executive control by comparing different age groups (Calabria et al., 2015; Weissberger et al., 2012), our longitudinal study shows that there is indeed a relationship between the developmental *trajectories* of language control and executive control. Even a short time span of one year was enough to reveal an interaction between the two control mechanisms. This is consistent with prior evidence for a direct correlation between language control and executive control in bilingual children (ages 5-7; Gross & Kaushanskaya, 2018). In that study, overall naming speed in the language-switching task was associated with shifting skills in DCCS; however, this relationship was only apparent in the children’s non-dominant language. In our study, we also found that the mixing costs of the children’s non-dominant language (L2 English) changed over time and were modulated by development in executive control. Stronger relationship between language control and executive control were observed for the non-dominant language, probably because use of the weaker language necessitates inhibiting the dominant language to a greater extent than use of the dominant language inhibiting the non-dominant one.

A hot debate in the current bilingual literature focuses on how language influences general cognition. Our study contributes to the literature by demonstrating that the directionality of the relationship can be also explained the other way around—cognition can modulate language in the course of the children’s development. This sheds light on a fundamental question in bilingualism and cognition: does having two languages yield general cognitive benefits or does having advanced cognitive skills make one a better bilingual? Although our findings speak to the latter, this question remains open and further research is needed to investigate the relationship between these two key skill sets in a longitudinal manner and over a longer period of time.

8.5 Conclusion

In conclusion, although recent research has focused on how language control contributes to executive control, our study shows that this relationship is not unidirectional—in fact, executive control also has predictive power over language control in bilingual development. Our findings highlight the importance of considering different aspects of the bilingual experience when examining the development of language control abilities in children, including language-specific processes and domain-general processes involved in language control. Such an approach is especially promising to further our understanding of how bilingual experiences and executive control shape the children’s abilities to acquire, use, and maintain two languages.

9 Clarifying the influence of bilingualism on executive control development

9.1 Introduction

Executive control (EC) is defined as the goal-directed regulation of thoughts and actions. It is necessary to solve complex and novel problems and to accomplish desired goals (Elliott, 2003) and is usually considered to encompass three partially separable components: inhibition which is the ability suppress irrelevant responses; shifting which is the ability to switch flexibly between mental sets or tasks; and working memory (WM) defined as the ability to temporarily maintain and process information (Miyake et al., 2000). EC emerges in the first years of life and continues to develop throughout childhood and adolescence (Best & Miller, 2010). Among the factors that influence EC development, bilingualism has attracted increasing attention over the last two decades (for a review see Bialystok, 2009; Bialystok et al., 2012); findings that bilingual children outperform monolinguals on a range of EC tasks (often termed ‘bilingual advantage’) can have important implications in terms of education policies. Nevertheless, research on the bilingual advantage have yielded mixed findings, calling for a closer investigation of the specific aspects of bilingualism that may influence EC development (Paap, Johnson, & Sawi, 2014).

EC performance has been found to vary, not only between bilinguals and monolinguals, but even among bilinguals. A few studies have shown bilinguals with *more* bilingual experience (e.g., *higher* L2 proficiency, *younger* age of L2 onset, and *more* L2 exposure) to perform *better* on EC tasks than others with less experience (for a review see Bialystok, 2007). Yet, it is still unclear which specific dimensions of bilingual experience (e.g., proficiency, exposure, age of L2 onset) contribute to individual differences in EC performance. Moreover, much of previous work has looked at adults by examining the relation between bilingual experience and cognitive

performance at one point in time. In fact, very few studies have approached this question from developmental and longitudinal perspectives, looking at how the bilingual experience influences *development* in cognitive performance during childhood. Therefore, the goal of the present study is to longitudinally examine what aspects of the bilingual experience promote changes in EC performance over time.

Our study focused on three prominent aspects of bilingual experience: proficiency, age of L2 onset, and exposure. Specifically, it investigated whether children with *higher* L2 proficiency, *younger* age of L2 onset, and *more* L2 exposure show *greater* EC abilities improvement over time, by tracking EC development in bilingual children over the course of one year. The current study strategically targeted Japanese-English returnee children who had recently returned from second language (L2) English-dominant to first language (L1) Japanese-dominant environment, as this population allowed us to examine how cognitive performance develops in the context of language attrition, when abrupt and drastic changes in the linguistic environment occur. Specifically, these children typically experience a reduction of their *current, daily* contact to L2, although their *cumulative exposure* continues to increase since the children still receive some English input in Japan through attending English maintenance courses. Such environment enables us to better distinguish age-related effects (i.e., enhanced EC due to general development) and bilingualism effects (i.e., enhanced EC due to daily exposure to the L2)—factors that are usually confounded in ‘regular’ bilingual populations.

9.1.1 Effects of bilingualism on executive control

Since both languages of bilinguals are constantly activated in language processing (Dijkstra et al., 1998; Hernandez, Bates, & Avila, 1996; Kaushanskaya & Marian, 2007; Kroll, Bobb, & Wodniecka, 2006; Marian, Spivey, & Hirsch, 2003) bilinguals need to monitor their co-activated languages, shift between their first (L1) and second (L2) languages, and inhibit the activation of the unwanted language. These mental processes involved in bilingual language production are hypothesized to enhance the bilinguals’ EC abilities. However, studies on bilingual advantage in children have

yielded mixed results (Bialystok & Martin, 2004; Bialystok, Martin, et al., 2005; Carlson & Meltzoff, 2008; Kapa & Colombo, 2013; Poarch & Van Hell, 2012).

A bilingual advantage has been rarely found in children for inhibition, often tested by utilizing the Simon or Flanker task. In the Simon task, children press a button that matches the stimuli, which are presented on either the right or left side of the screen. In congruent trials, the stimulus position lines up with that of the correct response button (button = right; stimulus = right), whereas the stimulus is presented on the opposite side in incongruent trials (button = right; stimulus = left). The Simon effect is the difference in reaction time between the congruent and incongruent trials, which reflects the ability to inhibit unwanted responses and resolve interference. Despite no bilingual advantage in the Simon effect *per se* (Bialystok, Martin, et al., 2005; Engel de Abreu et al., 2012; Martin-Rhee & Bialystok, 2008), a clear bilingual advantage with regard to global reaction time (i.e., reaction time for both incongruent and congruent trials) has often been reported (Costa et al., 2009; De Cat et al., 2018; Martin-Rhee & Bialystok, 2008; Poarch & Van Hell, 2012; Xie & Pisano, 2018), suggesting that faster overall response could reflect superior selective attention and control in conflicting situations or alternatively, greater basic processing abilities (i.e., fluency, efficiency, and speed of output) that support all three domains of EC (Anderson, 2002; Diamond, 2013). Similarly, research on WM in bilingual and monolingual children has also produced contradictory findings in middle childhood, with evidence for a bilingual effect on a series of working memory tasks in a cross-sectional study (Morales et al., 2013), while no evidence of such an advantage emerged in a 3-year longitudinal investigation (Engel de Abreu et al., 2012).

In contrast to the mixed findings obtained for inhibition and WM, a childhood bilingual advantage has been commonly found in tasks measuring shifting (Bialystok & Martin, 2004; Carlson & Meltzoff, 2008; Iluz-Cohen & Armon-Lotem, 2013; Tran et al., 2018). These studies all employed the Dimensional Change Card Sorting (DCCS) task, which requires children to sort objects by either shape or color only in single blocks and switch between color- and shape-sorting in mixed blocks. In one study with bilingual and monolingual preschoolers, larger bilingual advantage was found in the DCCS task than in measures of inhibition and other tasks tapping shifting, possibly because the DCCS taps multiple cognitive processes (i.e., not only shifting between

dimensions but also inhibition of the unwanted rule and selective attention to the relevant feature) (Tran et al., 2018).

9.1.2 *Dimensions of bilingual experience*

When discussing the effects commonly subsumed under the ‘bilingual advantage’, it is important to consider which aspects of bilingualism may confer enhanced EC. Various dimensions of bilingualism have been linked to cognitive benefits such as proficiency in both L1 and L2 (Antoniou, Grohmann, Kambanaros, & Katsos, 2016; Bialystok & Feng, 2009; Blom, Boerma, Bosma, Cornips, & Everaert, 2017; Hommel et al., 2011; Rosselli et al., 2016; Thomas-Sunesson, Hakuta, & Bialystok, 2018), age of onset of bilingualism (Carlson & Meltzoff, 2008; Kapa & Colombo, 2013; Pelham & Abrams, 2014; Tao et al., 2011) and language exposure (i.e., current and cumulative language input) and use (both current and cumulative use including frequency of switching between the two languages) (Festman et al., 2010; Prior & Gollan, 2011; Soveri, Rodriguez-Fornells, & Laine, 2011; Verreyt et al., 2016).

Proficiency has so far received the most attention. It should be emphasized here that proficiency in the target language and *relative* proficiency of the two languages do not always go hand in hand; a child who is proficient in the L2, for example, does not always have the same level of proficiency in the L1. Although such discrepancy in operationalization makes it difficult to compare findings across studies, highly proficient bilinguals in the target language (usually L2 or heritage language) and balanced bilinguals generally exhibit the greatest EC skills (Antoniou et al., 2016; Blom et al., 2017; Iluz-Cohen & Armon-Lotem, 2013; Tao, Taft, & Gollan, 2015; Thomas-Sunesson et al., 2018). For instance, a study comparing cognitive performance of bidialectal, multilingual, and monolingual children who all speak Standard Modern Greek as the common language found that bidialectal and multilingual children outperformed the monolinguals; and their proficiency in Greek modulated the degree of cognitive advantage among the bidialectal children. However, the effect of proficiency on EC is not always apparent. For instance, proficiency in the heritage language has been observed to relate to cognitive performance in Spanish-English bilinguals, but not among Mandarin-English bilinguals (Tao et al., 2015).

Age of L2 onset has also been found to moderate cognitive development. Early bilinguals outperformed late bilinguals on tasks measuring attention (Kapa & Colombo, 2013; Tao et al., 2011) and inhibition (Luk et al., 2011; Yow & Li, 2015). For instance, school-age children who started acquiring their L2 English before the age of three responded faster on the Attentional Network Test than children whose age of L2 onset took place past the age of three (Kapa & Colombo, 2013). However, these findings should be interpreted with caution, as age of L2 onset is often confounded with proficiency (i.e., earlier age of L2 onset is usually associated with greater proficiency).

Finally, a few studies looked into the influence of language exposure and use on bilingual cognition. Exposure generally relates to the current and cumulative frequency of input (e.g., number of hours/day a child is exposed to a given language at the time of testing and over time in the past), while language use is defined as the frequency of language output as well as the type of language use, such as switching frequency (i.e., how often a child needs to switch back and forth between the two languages). Studies in children have mainly examined the cognition of L2 learners enrolled in an immersion program (Bialystok & Barac, 2012; Carlson & Meltzoff, 2008; Nicolay & Poncelet, 2013; Poarch & van Hell, 2012; Woumans, Surmont, Struys, & Duyck, 2016). A prominent example is a study by Purić, Vuksanović, and Chondrogianni (2017) that compared cognitive performance among Serbian second graders enrolled in a high exposure immersion program (around 5 hours of daily exposure for one year), low exposure immersion program (around 1.5 hours of daily exposure for one year), and a control monolingual group. The high exposure immersion group performed better than the other two groups on complex WM tasks, but no group differences were found for inhibition and shifting. The authors suggest that WM may be a facet of executive control that may be especially sensitive to early stages of intensive L2 learning. Taken together, the findings show that while daily exposure to the L2 for six months may not be adequate to confer cognitive advantage (Carlson & Meltzoff, 2008), a year (Purić et al., 2017) or even up to three years of exposure (Bialystok & Barac, 2012) may give rise to a sizeable bilingual advantage.

A major issue with the aforementioned studies is that the multiple factors that contribute to bilingual experience are deeply entangled with one another—for example,

age of L2 onset may correlate with proficiency and relative proficiency in each language may be modulated by frequency of language exposure and use, making it difficult to tease apart their respective influence on executive control. Another problem is that there are multiple ways of quantifying and operationalizing specific bilingual dimensions. For example, proficiency can be measured through various methods such as standardized tests (Iluz-Cohen & Armon-Lotem, 2013), self-rated proficiency questionnaire (Singh & Mishra, 2013), picture-naming test (Tao et al., 2015) or verbal fluency task (Xie & Pisano, 2018), which makes it difficult for a clear picture to emerge about the specific aspects of language experience that may or may not affect EC development.

9.1.3 *The present study*

The present study aims to disentangle the respective contribution of three major aspects of bilingual experience on children's development in EC abilities: age of L2 onset, L2 proficiency, and current L2 exposure. Instead of comparing different groups of bilinguals who may differ on factors *other* than bilingualism, we tracked the development of domain-general abilities in the same group of children over time. Longitudinal research *within* bilinguals has the potential to uncover the developmental trajectories of their non-verbal skills, and how exactly this may be affected by different types of linguistic activities. We tested a group of Japanese-English bilingual returnee children over the course of a year—children who came back from a L2 English dominant-environment to a L1 Japanese environment. Since L2 exposure is a variable that is expected to change considerably as children return to their L1 environment, we predicted that returnee children who continues to receive more L2 exposure, over the effects of L2 onset and L2 proficiency, would show greater improvement in the EC tasks over time. Age-related change in EC is expected to be manifested through faster global reaction time, higher accuracy, and smaller performance costs.

9.2 Methodology

9.2.1 Participants

The participants were 36 Japanese-English bilingual children, who acquired English as a second language in a foreign country and had recently returned to Japan. In the first round of testing, 38 children participated but two dropped out in the second round of testing. All of the bilingual children's parents spoke Japanese as their native language and the children were exposed to Japanese from birth. The bilingual children were exposed to minimal English before moving to the L2 environment. Thus, they started acquiring English as an L2 when they moved to the foreign environment. Bilingual children's age at first and second round of testing, age of L2 onset, length of residence in the L2 environment, age of return to L1 environment, length of time from return to L2 environment to first round of testing (incubation period) are summarized in Table 9.1. Eighteen participants had been living in a country where English is the majority language (e.g., USA, UK, Canada), and the other 18 participants attended international schools with English as the medium of instruction in countries where English is not the official language (e.g., Netherland, China, Poland).

Table 9.1 Summary of participant information

	Age at first testing	Age at second testing	Age of L2 acquisition	Length of L2 residence	Age of return to L1	Incubation period
Mean	9.8	10.8	5.0	4.1	9.5	0.3
Min	7.6	8.6	1.2	2.0	7.2	0.1
Max	13.0	14.0	9.7	12.8	12.6	0.5

The participants were recruited from an English maintenance course offered from JOES (Japan Overseas Educational Services). Prior to the study, they were assessed on their English proficiency (listening, speaking, reading, writing) by JOES, in order to group them into appropriate English classes. The participants were categorized by JOES in one of the three proficiency groups within their age range:

basic, intermediate, or advanced. There were 12 participants in the basic group, 12 in the intermediate, and 12 in the advanced.

9.2.2 Instruments

Language exposure measurement

The Bilingual Language Experience Calculator (BiLEC) was administered to the parents in order to elicit information about quantitative language exposure in each language and history of language use (for further information see Unsworth, 2016b). Data on quantitative exposure to L1 Japanese and L2 English when they lived in a foreign environment and when they were back in Japan were extracted using this questionnaire. In further analyses, we used English exposure measures from the latter, since we predicted that children who continued to receive English exposure when they were back in Japan would better develop their EC over time.

Proficiency test

The English proficiency test was administered by JOES and consisted of three sections: listening and speaking, writing, and grammar. The total score from each section was 120 points, with 30 points from listening and speaking, 40 from writing, and 50 from grammar. Children who scored in the range of 51-70 points were placed in the basic group, those who scored 71-95 points in the intermediate group, and those who scored 96-120 points in the advanced group.

Executive control tasks

The following are the descriptions of the three executive control tasks administered in the current study. All of these tasks were administered on a laptop computer (15-inch screen). The experiment was constructed and administered with E-prime 2 (Psychology Software Tools, Inc., Pittsburgh, PA), which automatically recorded accuracy and response times.

Advanced DCCS

The advanced DCCS task (adapted from Chevalier, Blaye, Dufau, & Lucenet, 2010) was used to measure shifting abilities. Each trial involved choosing the response

picture with either the same color or shape as the target picture as a function of a visual cue (i.e., color cue: a box with different colors; shape cue: a box with different shapes). For example, if a color cue was displayed along with a red-bear stimulus, the participants had to press the key with a red object (and *not* the bear). The mixed condition included both switch (color-shape or shape-color) and repetition (color-color or shape-shape) trials. In addition, one-third of the trials were switch trials and the other two-thirds repetition trials. Response options were a red-bear and a blue-car positioned on the left or right bottom corner (the position was counterbalanced). The participants entered responses by pressing the keys located beneath the response options. The experiment included a total of 84 test trials in three conditions: blocked-color, blocked-shape, and mixed-color and shape. The blocked-color and blocked-shape conditions were counterbalanced, but always preceded the mixed-color and shape condition. Each blocked condition consisted of 20 trials and five practice trials. The mixed condition included 44 trials divided into two blocks with 22 trials each, preceded by 16 practice trials. The switch cost was calculated by subtracting the response time on the repetition trials from the switch trials. The mixing costs was calculated by subtracting the reaction time on the single trials (blocked-color and -shape) from the repetition trials in the mixed condition. Accuracy was scored as 1 for correct response and 0 for incorrect response.

Simon

The Simon task measured the ability to suppress unwanted responses and control interferences. On each trial, participants saw a target picture (either a shoe or a frog) on top of the screen and on the corresponding response key (i.e., either the 'shoe' key or the 'frog' key). To minimize working memory demands, small pictures of a shoe and a frog were displayed at the bottom corners of the screen, each on the same side as the corresponding response key (this side was counterbalanced across participants). On congruent trials, the target was presented on the same side as the matching response, whereas it was presented on the opposite side on incongruent trials. There were 13 practice trials followed by 40 test trials including 27 congruent and 13 incongruent trials in a random order. The stimuli in the test trial disappeared after a certain amount of time, tailored to each participant's mean response time in the practice trials, in order to make the task challenging for each child. The limit was calculated by multiplying

the mean reaction time in practice trials by 1.5. The Simon effect was calculated by subtracting the average reaction time on the congruent trials from the incongruent trials. Accuracy was scored as 1 for correct response and 0 for incorrect response.

N-back

The *N-back* task (adapted from Chevalier, 2018) measured the ability to update information in working memory. In this task, children saw series of pictures presented one at a time, and had to press a response key each time the current picture matched the picture presented *n* trials back. The participants completed three difficulty levels of the *N-back* task. Each level contained a series of 32 pictures. There were four different pictures (smiley face, cat, house, airplane) used in each level. These pictures were presented one at a time for 1,500-ms, preceded by a 500-ms fixation cross. The pictures appeared eight times in each level in random order. Children were instructed to press the space bar if they saw a picture that was the same as the one presented one trial back (1-back), 2 trials back (2-back), or 3 trials back (3-back). The order of the three levels was fixed, in order to first familiarize the children with the easiest level (1-back) and end with the most difficult level (3-back). In each level, there were eight target pictures (matched) and 24 non-target pictures (unmatched). When the participants pressed the space bar at the correct matched picture, a green tick appeared for 1,500-ms as a form of feedback. In contrast, a red cross appeared if the participants incorrectly pressed the space bar at the unmatched picture. Correct scores were given when the participants pressed the space bar on the matched picture (i.e., hit trial), or gave no response to the unmatched picture (i.e., correct rejection). The responses were computed as incorrect when the participants did not press the space bar on the matched picture (i.e., miss trial) or gave a response to the unmatched picture (i.e., false alarm). Upon completion of each trial, the total percentages of correct and incorrect responses were presented on the screen. Each trial was preceded by a practice session and there was a small break in between each trial. Accuracy was scored as 1 for correct response and 0 for incorrect response.

9.2.3 Procedure

The experiment was administered at the participants' home or at JOES classrooms. The order of the three EC tasks was counterbalanced across participants. The EC tasks lasted approximately 30 minutes for each child. A Japanese-English bilingual researcher spoke to the children in their comfortable language (either Japanese or English) when administering the EC tasks. The administration procedure of the language tests and EC tasks were identical for the first and second rounds of testing. Furthermore, the participants took the English proficiency test approximately a month before the first round of testing. As the current study was part of a larger project on language attrition in bilingual returnee children, other language tests not reported here were conducted on the same day as the EC tasks. EC tasks took place in between the language tasks (e.g., Japanese-EC-English or English-EC-Japanese).

9.2.4 Data analysis

We ran a mixed effects model to examine whether there are any differences in the EC performance from first to second round of testing, as well as the effect of individual variables on bilinguals' cognitive performance. We used linear mixed effect modeling for reaction time (RT) and generalized linear mixed effect modeling for accuracy of the three EC tasks. Before running the models with RT as the dependent variable, the RTs of inaccurate trials of all EC tasks were removed. RTs were log-transformed to correct for normality. Observations further than three standard deviations from the mean were also removed. For the N-back task, the RTs of hit trials (trials where children are required to press the button) for the two-back trials were used for further analysis (since two-back trials are expected to be not too easy but challenging enough for older children).

The preliminary analysis revealed no change in accuracy over time for Simon and DCCS (p 's < .32), and a significant but modest improvement in accuracy was found for the N-back ($p = .03$). Given the low variance for accuracy in two of the three tasks, we focused on the RT models to further examine the modulating effect of individual variables on RT improvement. We constructed a model for each EC task

with RT as the dependent variable and Time (first round, second round), Trial (DCCS: single repetition, mixed repetition, mixed switch; Simon: congruent, incongruent), Age at first round, L2 proficiency (advanced, intermediate, beginners), L2 exposure, and age of L2 onset as fixed effects. Age at first round was included as fixed effect as a means of controlling for variances that arise due to differences in age. Subject and Item were entered as random intercepts. The intercept for all models were set to advanced group for Proficiency, first round of testing for Time, and mixed repetition trial for DCCS, congruent trial for Simon. We used backward elimination strategy to determine the most optimal model. We created a full model including the interaction we are interested in (i.e., two way interaction between Time and predictor variables as well as three way interaction between Time, Trial and predictor variables for Simon and DCCS) and variables that did not reach significance were excluded from the model in a stepwise manner. Models were fit in R (R Core Team, 2013) with the package “lme4” (Bates, Mächler, Bolker, & Walker, 2015). The more optimal model was determined using maximum likelihood ratio test (Baayen et al., 2008).

9.3 Results

9.3.1 Exposure measures

A summary of key variables in BiLEC is reported in Table 9.2. Columns labelled ‘Round 1’ refers to the amount of language exposure when the children lived in a foreign environment, and ‘Round 2’ is after the children had returned to Japan.

Table 9.2 Summary of BiLEC variables split by Language
 Round 1 indicates language exposures of when the children lived abroad and Round 2 indicates exposures of when the children returned to Japan (the numbers are in percentages)

English (L2)				
	Round1	Round2	Round 1	Round 2
	Home	Home	Home+	Home+
			School	School
Mean	14.4	3.2	46.8	4.5
Min	0	0	26.5	0
Max	62.6	32.2	82.4	20.5
SD	18.2	7.9	12.1	5.6
Japanese (L1)				
Mean	85.6	96.8	53.2	95.5
Min	43.5	67.7	35.4	58.0
Max	100	100	89.2	100
SD	19.9	12.6	10.8	8.5

As presented in Table 9.2, the participants were exposed mainly to Japanese at home, regardless of whether they lived in a foreign country or in Japan. English exposure at home and school declined from 46.8% to 4.5% when they returned to Japan. In contrast, their Japanese exposure increased from 53.2% to 95.5%.

9.3.2 *The effect of bilingual experience on EC development*

The mean reaction time (RT), standard deviation, and accuracy for each level of trials in the three EC tasks as well as processing costs for DCCS and Simon are summarized in Table 9.3.

Table 9.3 Descriptive statistics of executive control tasks split by Group and Trial type
Mean RT, SD in brackets, Accuracy in decimals

DCCS					
	Single non-switch	Mixed non-switch	Mixed switch	Switch Cost	Mixing Cost
Round 1	562 (217) .97	1371 (529) .93	1440 (531) .84	69	809
Round 2	457 (134) .94	1140 (448) .91	1157 (413) .83	17	683
Simon					
	Incongruent	Congruent	Simon Effect		
Round 1	561 (135) .91	531 (148) .90	30		
Round 2	488 (125) .85	460 (125) .91	28		
N-back					
Group	1-Back	2-Back	3-Back		
Round 1	145 (266) .99	148 (313) .87	114 (264) .72		
Round 2	122 (220) 1.0	142 (286) .88	134 (297) .70		

We first ran Spearman's correlations between the four individual variables: Age at first round, L2 exposure, L2 proficiency (advanced, intermediate, basic), and age of L2 onset, in order to ensure that these variables were not strongly correlated and therefore did not interfere with issues of collinearity. As for the L2 proficiency variable, we re-coded the levels into ranks (advanced=3, intermediate=2, basic=1). We used measures of English exposure (Home and School) from second round of testing for the L2 exposure variable. No strong correlations ($r > .80$) were observed between the individual variables (r 's $< .44$, p 's $> .05$). Low associations between the predictor variables meant that all these factors could be treated independently when running linear mixed effect models. The estimated coefficients of the best-fitted models for DCCS, Simon, and N-back are summarized in Table 9.4.

Table 9.4 Estimated coefficients of each EC model with age, proficiency, and exposure as predictors

DCCS				
Fixed effects	Estimate	Standard error	<i>t</i>	<i>p</i>
Intercept	7.71	.16	47.39	<.001***
Time2	-.02	.02	-7.93	<.001***
Prof:basic	.06	.05	-2.18	.03*
Prof:intermediate	-.08	.05	-1.47	.14
Age	-.006	.001	-5.23	<.001***
Single repetition trial	-.87	.01	-79.71	<.001***
Mixed switch trial	.04	.01	3.18	.001**
Time2:Profbasic	.06	.04	3.96	.009**
Time2:Profinterm	.05	.04	1.89	.07
Simon				
Fixed effects	Estimate	Standard error	<i>t</i>	<i>p</i>
Intercept	7.24	.13	54.51	<.001***
Time2	-.39	.06	-6.03	<.001***
Prof:basic	.05	.04	-1.32	.19
Prof:intermediate	-.11	.04	-2.66	.01*
Age	-.007	.001	-7.31	<.001***
Incongruent trial	.06	.008	7.76	<.001***
Time2:Profbasic	.06	.02	3.20	.001**
Time2:Profinterm	.07	.02	3.50	<.001***
Time2:Age	.001	.0005	3.35	<.001***
N-back				
Fixed effects	Estimate	Standard error	<i>t</i>	<i>p</i>
Intercept	6.74	.17	39.63	<.001***
Time2	.18	.16	2.09	.04*
Age	-.002	.001	-2.12	.04*
Age of L2 onset	-.02	.008	-2.50	.01*
Time2:Profbasic	.04	.05	1.72	.09
Time2:Profinterm	.09	.05	2.36	.03*
Time2:Age	-.002	.001	-2.08	.03*

Note. **p* < .05; ***p* < .01; ****p* < .001

9.3.3 DCCS

The significant effects of Time, $E = -.02$, $t = -7.93$, $p < .001$, and Trial (mixing cost: $E = -.87$, $t = -79.71$, $p < .001$, switch cost: $E = .04$, $t = 3.18$, $p < .001$) but no interaction between them, $\chi(8) = 1.79$, $p = 0.40$, indicated that response times similarly decreased in all types of trials from first to second testing, hence resulting in faster global RT but no change in switch costs or mixing costs over time. The only significant interaction was found between Proficiency and Time, $E = .06$, $t = 3.96$, $p = .009$, meaning L2 proficiency moderated change in global RT (i.e., overall RTs). Specifically, the advanced group showed greater performance improvement than the basic group, as illustrated in Figure 9.1. However, no interaction among Trial, Time, and Proficiency was found, $\chi(13) = 7.95$, $p = 0.63$. That is, changes in switch costs and mixing costs were not moderated by proficiency.

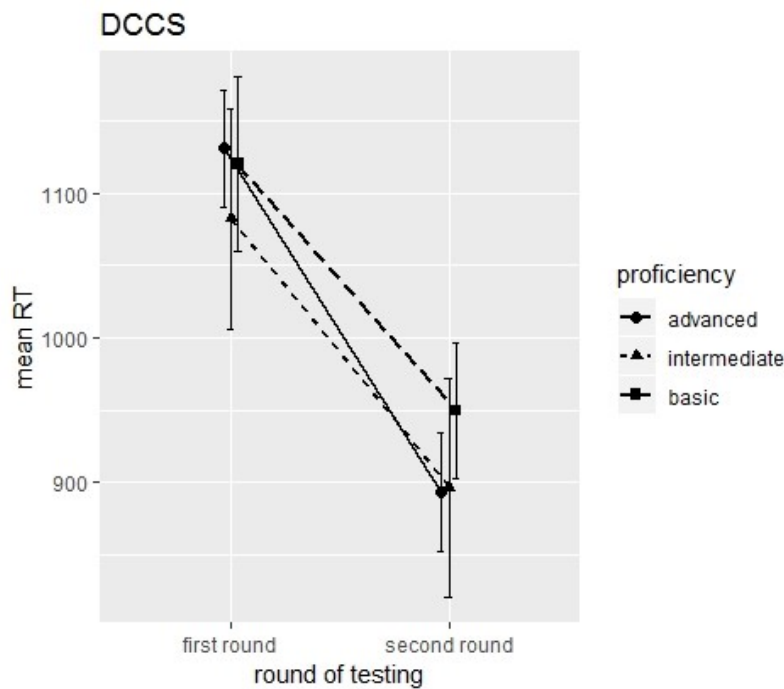


Figure 9.1 Interaction between Time and Proficiency on RT for DCCS
error bars = standard error

9.3.4 Simon

There was a significant effect of Time, $E = -.39$, $t = -6.03$, $p < .001$ and Trial, $E = .06$, $t = 7.76$, $p < .001$. However, there was no interaction between Time and Trial $\chi(6) = .0004$, $p = 0.99$, demonstrating an improvement in overall response time, but not in the Simon effect. There was a significant interaction between Time and Proficiency, $E = .07$, $t = 3.50$, $p < .001$, as well as Time and Age at first round, $E = .001$, $t = 3.35$, $p < .001$. In other words, change in global RT on the Simon task was modulated by both factors: proficiency and age at first round. More proficient bilinguals showed greater reduction in RT over time (Figure 9.2). In addition, the younger the children were, the greater improvement they showed in overall RT on the Simon task. Nevertheless, no significant interactions were found for Trial x Time x Proficiency, $\chi(16) = 8.29$, $p = 0.14$, or Trial x Time x Age at first round, $\chi(14) = 4.09$, $p = 0.25$, suggesting that proficiency and age did not affect changes in the magnitude of the Simon effect.

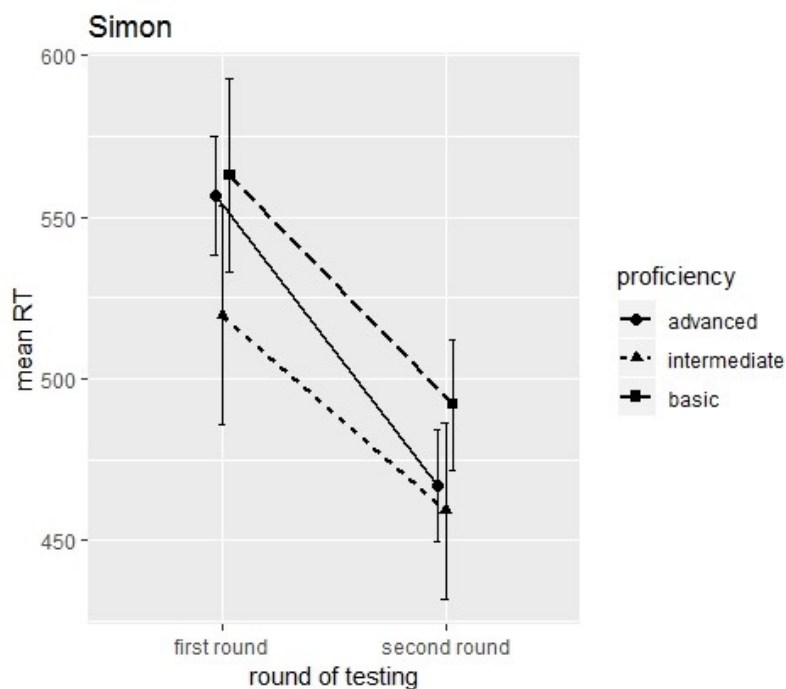


Figure 9.2 Interaction between Time and Proficiency on RT for Simon
error bars = standard error

9.3.5 N-back

There was a significant interaction between Time and Proficiency, $E = .09$, $t = 2.36$, $p = .03$ as well as Time and Age at first round, $E = -.002$, $t = -2.08$, $p = .03$. The rate of decrease in RT for the intermediate group was not as steep as for the advanced group, as illustrated in Figure 9.3. Furthermore, the older the children were at the first round, the faster they became at responding in the N-back task at the second round. This result was surprising, as we expected younger children to show greater improvement than the older children.

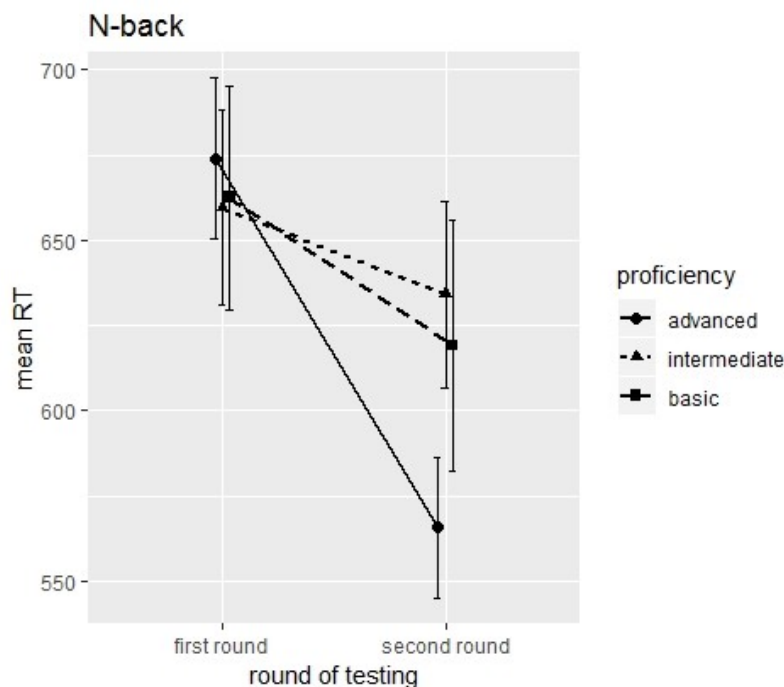


Figure 9.3 Interaction between Time and Proficiency on RT for N-back error bars= standard error

9.4 Discussion

The aim of the current study was to identify the dimensions of bilingual experience that contribute to the development of EC in a specific context, where L2 contact was reduced due to changes in the language environment. Our findings first demonstrated

that children's performance on the three EC tasks—DCCS, Simon, and N-back—improved from first to second testing, but only with respect to global RT. The mixing costs and switch costs on the DCCS task as well as the Simon effect on the Simon task did not change over time. These results were unexpected, given that past studies found improvements in EC using similar tasks (Beveridge et al., 2002; Cepeda et al., 2001; Gathercole et al., 2004; Klenberg, Korkman, & Lahti-Nuuttila, 2001; Kray et al., 2004; Luciana et al., 2005; Ridderinkhof & van der Molen, 1995; Van den Wildenberg & Van Der Molen, 2004).

A possible explanation for the lack of change is that the children in our current study may have already reached adult-like level of performance for inhibition and shifting. It has been suggested that inhibition and shifting abilities undergo rapid development in young childhood, while performance in complex WM tasks follows a more protracted development until young adulthood (Best & Miller, 2010). In our study of children from the ages of 7 to 13, we found that both RT and accuracy on the N-back task improved over time, supporting Best and Miller's account that WM development can still be visibly observed in older children.

Regarding the effect of bilingual experience on children's cognitive development, our findings revealed that L2 proficiency was the strongest predictor for the returnee children's development of EC performance. Across all three EC tasks, the rate of improvement in global RT (or hit RT for the N-back task) was significantly greater in the advanced group, suggesting that the more proficient the children were in their second language, the faster they had become in their overall response time. The prominent role of proficiency as a predictor for greater cognitive improvement has been widely examined in bilingual literature (Hilchey & Klein, 2011). In line with past studies, our finding also shows that proficiency is the key variable that influences the development of cognitive abilities in children. This result goes against our prediction that L2 exposure modulates cognitive development in these returnee children. There is a possibility, however, that proficiency has overridden the effects of age of L2 onset and language exposure, given that higher L2 proficiency is generally found to be a byproduct of earlier age of L2 onset *and* intensive L2 exposure. As Purić et al. (2017) point out, language proficiency may act as a bridge between the amount of language exposure as well as age of L2 onset. In our study, there was a near-significant

correlation between L2 proficiency and L2 exposure, $r = .44$, $p = .05$, suggesting that children who continued to receive more English exposure in Japan were also the ones who had advanced English proficiency at the time of return. This may be due to the fact that families of children with advanced English proficiency are highly motivated in maintaining their children's English abilities, thereby providing them with more opportunities to be exposed to English in Japan. Such an explanation is plausible in a country like Japan, where English education is highly valued and prioritized. Despite the possibility that L2 proficiency may have concealed the contributions of age of L2 onset and language exposure, the strong and sole effect of proficiency exhibited in all three cognitive tasks point towards the notion that L2 proficiency plays a central role in cognitive development, sometimes over and above the effects of other dimensions of bilingual experience.

It is also interesting, yet puzzling, that the intermediate group performed better than the advanced group on DCCS and Simon in the first round of testing. As shown in Figure 9.1 and 9.2, the intermediate group was faster at responding than the other two groups in the first round of testing. Although the advanced group experienced the fastest *rate* of development, it is unclear why the intermediate group started out with faster RT than the advanced group. Despite the difference between advanced and basic group in overall RT improvement (with the advanced group performing better), the advanced group appears to be only 'catching up' to the intermediate group in their development of global RT. The intermediate group, nevertheless, exhibited the largest standard error for all EC tasks, indicating a greater degree of variability. Such variation in the intermediate group's data may play some part in their unexpectedly advanced performance in the first round of testing.

Our results showed that L2 proficiency predicted EC development, manifested by the decrease in global RT. Nevertheless, there is no clear consensus in the literature as to what the cognitive sources of global RT in non-linguistic interference tasks are. The most recent proposal in the bilingual literature is that global RT reflects the conflict-monitoring system. In their systematic review, Hilchey and Klein (2011) found that the bilingual advantage is more robustly observed in global RT than in interference effects (e.g., Simon effect). This global RT advantage was demonstrated across all age groups, but specifically in child populations (Bialystok, Martin, et al.,

2005; De Cat et al., 2018; Martin-Rhee & Bialystok, 2008). Although the role of conflict monitoring in tasks that involve interference suppression (such as Simon, Flanker, and Stroop tasks) is fairly established in the literature, it is still uncertain whether such monitoring is also involved in global RT of task-switching paradigms such as the DCCS.

Alternatively, overall performance may also involve processing speed—that is, the speed with which mental operations are performed (e.g., Anderson, 2002). Indeed, in a review of EC, Diamond (2013) interpreted the global RT advantage in bilinguals as an indication of enhanced processing speed. Moreover, Salthouse (2005) proposed that processing speed represents the underlying factors pertinent to all dimensions of the EC. Several empirical studies have also found that processing speed supports EC performance in both children and adults (Cassidy, White, DeMaso, Newburger, & Bellinger, 2016; Genova, DeLuca, Chiaravalloti, & Wylie, 2013; Luz, Rodrigues, & Cordovil, 2015; Mulder, Pitchford, Hagger, & Marlow, 2009). In fact, some studies have even suggested that EC is difficult to distinguish from processing speed, especially in child populations (Cepeda, Blackwell, & Munakata, 2013; Clark et al., 2014). Following this, a number of developmental studies (Fry & Hale, 1996, 2000; Hertzog, Dixon, Hultsch, & MacDonald, 2003; Kail, 2007; McAuley & White, 2011; Nettelbeck & Burns, 2010; Salthouse, 1991, 1992) have found a close relationship between WM and processing speed. According to the Developmental Cascade Model (Fry & Hale, 1996), age is a strong predictor for both WM and processing speed, and processing speed is a predictor for WM in children’s cognitive development. Uncovering the cognitive mechanisms behind global RT advances our understanding of *why* and *how* bilingual children have been found to exhibit advantages in overall response time, but not in performance costs (Hilchey & Klein, 2011).

Our findings also provide insights into research on L2 attrition, that is, the change in one’s L2 knowledge that occurs due to disengagement from L2-dominant environment. Previous research on L2 attrition has shown that higher L2 proficiency at the point of removal from the L2 environment contributes to better maintenance in the L2 (Bahrick, 1984; Hansen & Chantrill, 1999; Hansen, Umeda, & McKinney, 2002; Reetz-Kurashige, 1999). For instance, a longitudinal study by Reetz-Kurashige (1999) on Japanese returnee children found that English proficiency predicted the rate of

English retention better than other individual factors such as age or length of residence in the L2 environment. Our study demonstrated that L2 proficiency *also* modulated cognitive development in returnee children. Thus, L2 proficiency appears to affect the development of both linguistic and cognitive abilities in a specific context where exposure to L2 becomes limited. If so, then the question is whether there is a relationship between the degree of L2 maintenance/attrition and cognition. Perhaps, children who are better ‘retainers’ of the L2 are also better ‘developers’ in general cognitive terms. Although the directionality of this relationship is unclear—whether better maintenance of the L2 contributes to enhanced cognitive abilities or vice-versa—our findings shed light on the possibility that effects of L2 attrition may be modulated by cognitive factors, in addition to many other individual variables. However, much more work, preferably utilizing longitudinal methods, needs to be done to explain how language and cognition interact developmentally in attrition.

9.5 Conclusion

The aim of the current study was to examine which aspect(s) of the bilingual experience modulate cognitive development in bilingual returnee children. Our finding shows that L2 proficiency was a significant factor in predicting the developmental trajectories of their cognitive performance. Our longitudinal investigation *within* a bilingual population supports previous findings that compared cognitive performance of bilinguals to monolinguals, confirming the critical role of proficiency on the ‘bilingual advantage’. However, further investigation is necessary to clarify whether L2 proficiency enhances changes in processing speed or monitoring over time. Finally, our results point towards the notion that cognition plays a crucial role in the context of L2 attrition in children. We speculate that the success of maintaining an L2 in childhood may be dependent on how well the returnees can develop their cognitive abilities over time.

10 General conclusion

This thesis aimed to identify the linguistic aspects vulnerable to attrition, and to explore the complex interplay among bilingual experience, cognition, and attrition in the development of returnee children. To this end, through a series of four studies, I provided novel evidence about the linguistic sources that cause processing difficulties in bilinguals (Chapter 6), the relative influence of individual variables on attrition (Chapter 7), and the extent to which linguistic and cognitive systems interact in the context of attrition (Chapters 8 and 9).

In this concluding chapter, I review each of these studies by summarising the main findings (Section 10.1), and provide a general discussion of the implications (Section 10.2) and the study's limitations (Section 10.3).

10.1 Summary

Chapter 2 focused on three aspects of bilingualism that are relevant to the four studies: age, language exposure, and linguistic structure. To illustrate, the age of L2 onset modulated the degree of L2 lexical attrition (Chapter 7), the (current) amount of L2 exposure influenced language control development (Chapter 8), and certain linguistic structures (such as genitives, which exhibit conflicting factors) were vulnerable to the effects of attrition (Chapter 6). By examining the role of these three factors on language acquisition and attrition, I highlighted the fact that both bilingual experience and linguistic properties explain the patterns of variability attested in bilingual language.

Chapter 3 reviewed the literature on word production, first outlining the models of monolingual and bilingual language production. I then discussed two different accounts proposed to explain why bilinguals lag behind monolinguals in word

production—namely, the frequency-lag account and the interference account. These two accounts together explain the findings in Chapter 8: the development of bilingual children in L2 single trials was predicted by the frequency (i.e., the exposure) of L2, while development in L2 repetition trials involving interference control was predicted by the rate of improvement in executive control.

Chapter 4 first discussed the various models of executive control, mainly focusing on the unity and diversity approach (Miyake et al., 2000) and outlining three components of executive control (inhibition, shifting, and updating), as well as the tests developed to measure these skills. The development of these three cognitive skills was tested in Chapter 9, where I unexpectedly found no change in performance costs, but a significant improvement in overall response time. Finally, I explored the current debate surrounding the cognitive advantage in bilinguals, and explored various dimensions of the bilingual experience that may (or may not) give rise to such cognitive enhancement. This topic was empirically explored in Chapter 9, where I found the strongest effect of L2 proficiency on bilingual children's cognitive development.

Chapter 5 summarised the main points illustrated in Chapters 2–4, and formulated four general research questions and the predictions for each research question.

Chapter 6 investigated the choice of genitive forms (*s*-genitive: *the woman's book* versus *of*-genitive: *the book of the woman*) in bilingual returnee children. Its aim was to examine whether changes in language dominance influenced the choice of genitive form in bilingual children, and whether the observed behaviour can be explained by cross-linguistic transfer. I first compared the choice of genitive form between bilinguals and monolinguals. I then tracked the change in genitive preference *within* bilingual children—when they had just returned to Japan, and a year after. The findings showed that cross-linguistic transfer alone is not sufficient to explain the difference in genitive evaluation between bilinguals and monolinguals, or the changes over time among the bilinguals. Rather, I suggest that both cross-linguistic transfer and general processing difficulties are at play in the selectivity of changes in genitive preference.

Chapter 7 examined the influence of individual variables such as age, length of residence, language exposure, and proficiency on L2 lexical attrition in returnee children. I used the verbal fluency task to measure their lexical access over time. The results showed that the age of L2 acquisition and/or the length of residence in the L2 environment—but not L2 proficiency or L2 exposure—contributes to the maintenance of L2 lexical access. The findings lend support to the idea that it takes some time for the children’s language knowledge to stabilise in the human brain. The earlier the bilingual returnee children acquire their L2, and the longer they have to go through the ‘stabilisation phase’ in this language, the more resistant they become to attrition effects.

Chapter 8 investigated whether the development in executive control and bilingual experience predicts change in language control in these bilingual children. They were tested longitudinally using the language-switching paradigm and the Simon task. The findings demonstrated that children who had less L2 exposure showed smaller improvement in naming pictures in the English baseline performance (i.e., when English was relevant across all trials). Moreover, development in trials where children had to switch between languages was modulated by development in executive control. In other words, children who increased their performance in the English mixed repetition trials also performed better on the executive control task over time. Thus, development in executive control modulated change in language control among bilingual children, suggesting a positive relationship between language control and executive control in a child’s development.

Chapter 9 looked at how different aspects of the bilingual experience (i.e., proficiency, language exposure, and the age of L2 onset) influence the development of executive control in returnee children. I administered three executive control tasks designed to measure inhibition, shifting, and updating skills. The results showed that children became generally faster at responding in all three executive control tasks, but no changes were observed in inhibition, switch, and mixing costs. Most importantly, L2 proficiency—but not the L2 exposure or the age of L2 onset—predicted the rate of development (measured by global reaction time) in all three executive control tasks. In other words, children who had higher L2 proficiency became faster at responding in executive control tasks over time. These findings point to the specific role of L2 proficiency in predicting children’s change in executive control performance.

10.2 Discussion and implications

Once a speaker starts learning another language, not only does the linguistic knowledge accumulate over time, but qualitative changes are also observed in terms of how the speaker processes the language. This is because both languages are activated in the speaker's mind and the cross-linguistic activation changes the way we process not only the L2, as well as our L1 (discussed in Section 3.1). As discussed in Section 3.2, the level of activation in each language is determined by the recency and frequency of contact (Weaker Links Hypothesis: Gollan & Acenas, 2004; Gollan & Ferreira, 2009; Gollan & Silverberg, 2001; ATH: Paradis, 1993).

Against this background, this thesis has explored what happens when the balance of the activation level between the two languages changes as a consequence of shifts in the linguistic environment. Bilingual returnee children who come back to their native language environment somehow need to control the imbalance of activation levels caused by increased contact with their L1 and reduced contact with their L2. If this control mechanism is governed by domain-general processes—mainly at the level of inhibition—then the children are required to heighten their activation of L2 *and* inhibit their highly activated L1 to a greater extent when speaking in their L2.

Heightening the activation of L2 is a process that takes place *within* a language, whereas inhibition of L1 involves recruiting the domain-general process. The integration of these processes is indeed challenging, and the large cognitive demands imposed on bilinguals may 'spill over' into their linguistic performance, resulting in what is referred to as 'attrition phenomena'. Chapter 6 shows that such 'spill over' is more likely to occur in a structure that requires integration of multiple and conflicted sources of information. Imagine that a cup is almost full of water due to the processing demands caused by changes in the levels of language activation. More water is then poured into the cup by asking these children to process additional semantic information—causing the water to spill over the edge of the cup.

However, no 'spill overs' were observed in Chapter 7, where both English and Japanese performance in the verbal fluency task increased over time. It is important to emphasise here that the returnee children developed their cognitive performance

within this time frame, as indicated by the results in Chapter 9. Perhaps, the development of their executive control (as a function of their increase in age) allows children to more easily inhibit the activation of L1, draining some water in the cup and thus leaving more space for L2 activation to take place. A verbal fluency task has been shown to involve cognitive processing (Shao, Janse, Visser, & Meyer, 2014; also discussed in detail in Section 7.2.2), so it may be the case that the children were able to fall back on their enhanced executive control abilities to execute the task successfully, rather than relying on within-language activation. Thus, it is hypothesised that this fall back strategy may depend on the cognitive demands posed by a specific task. That is, the higher the cognitive demands imposed by a specific linguistic task, the more the children are required to rely on their executive control abilities to compensate for the reduced level of activation in their L2.

The idea that bilinguals may use their enhanced cognitive skills to compensate for their relative disadvantages in verbal abilities or lower SES when compared to monolinguals (thus performing similarly to the monolinguals on certain linguistic tasks) has been proposed by many researchers (Bialystok, 2011; Bialystok & Feng, 2009; Carlson & Meltzoff, 2008). However, such accounts were established based on studies comparing the linguistic and cognitive performances of bilinguals with those of their monolingual counterparts. I argue that such an explanation can also be adapted to language attrition: if bilinguals rely on their advanced executive control to close the language knowledge gap between them and monolinguals, then bilingual children who have better developed their executive control may be better able to make up for the lack of within-language activation in their L2 caused by a change in the linguistic environment.

Such a relationship between within-language activation and domain-general inhibition is illustrated in Chapter 8: children who show smaller improvement in the inhibition task also displayed smaller improvement in L2 naming. This effect was however confounded with L2 exposure, especially in a case where L2 naming was relevant across all trials (i.e., it did not involve switching between languages). In other words, children who received more L2 exposure and/or better enhanced their cognitive performance were the ones who were able to maintain and even increase their L2 naming performance over time. Added to this, the findings in Chapter 7 show that the

time these children had to consolidate their language knowledge was important for the degree of L2 lexical maintenance. In Chapter 7, I speculated that the more time children have to establish a strong link between form and concept of the word, the easier it is to maintain the link even when experiencing interrupted contact with their L2.

Given this context, ways to maintain the language (especially in terms of word production) are: (a) to create stronger links between the form and the semantic content of the word so that L2 is easily activated (Chapter 7) (b) provide more exposure so that the level of L2 activation is heightened (Chapter 8) (c) enhance executive control so that the bilinguals can resort to their executive control abilities to inhibit the unwanted L1 and leave more cognitive resources to be used for the activation of L2 (Chapter 8).

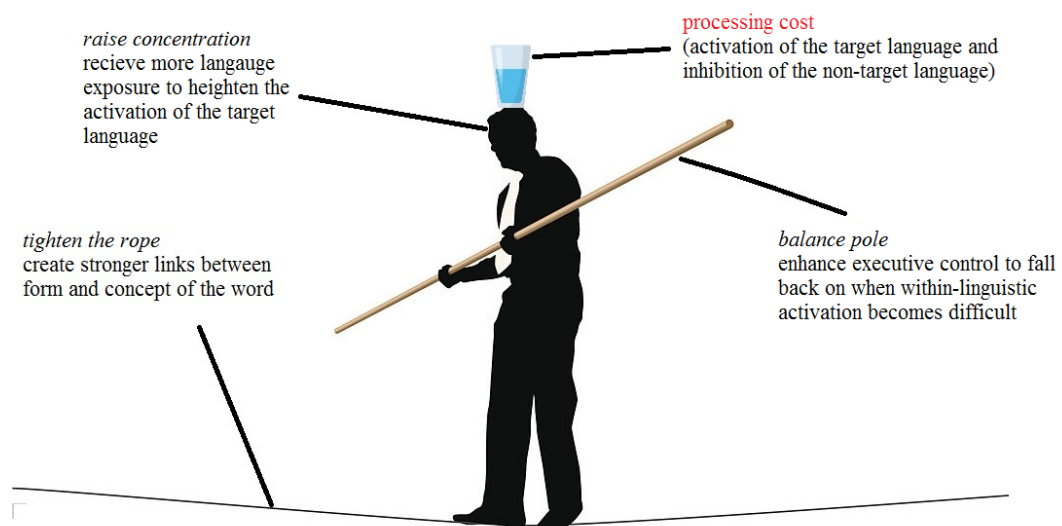


Figure 10.1 The process of attrition using the water analogy

Going back to the water analogy (Figure 10.1), say bilinguals are required to walk on a rope with a cup of water. For the bilinguals to avoid spilling the water in the cup, they may tighten the rope so that it does not become loose (i.e., they might consolidate the link between form and concept of the word so that it is easily activated). Or they may increase their concentration level (i.e., they might heighten the level of

activation by receiving more exposure). They may also prepare an external balance pole to help them keep their balance if the rope becomes loose or they lose concentration (i.e., they may enhance executive control). Bilinguals may need to combine a number of these strategies to find the most productive way of successfully walking across the rope. The combination of these factors may depend on the type of task or the rules associated with the task, such as a time limit.

As illustrated in this analogy, attrition is a context-specific process in which various linguistic features change as a function of several different factors. Schmid (Forthcoming) also proposes that “different kinds of use and exposure feed differently into L1 accessibility and maintenance” (Section 25.5). This thesis demonstrates that attrition, especially in the developing minds of children, is affected by a multitude of factors, including linguistic properties (Chapter 6), the age of L2 onset and/or the length of L2 residence (Chapter 7), and developments in executive control (Chapter 8). Collectively, they show that attrition does not affect all properties of the language, nor does every individual and cognitive factor affect attrition. Perhaps, there needs to be just the “right” combination between the factors that affect attrition and the linguistic properties affected by attrition for an observable effect to emerge. I show in my thesis that considering processing demands as a source of attrition and linking the control of such processing demands to domain-general function may partially explain the selectivity in attrition.

Turning to the implications, the findings of the present thesis underline that the attrition is not necessarily an erosion or a loss of linguistic system. This conclusion is in contrast to the position taken by some researchers in the field. For instance, Meisel (2018) stresses that it is necessary to regard erosion as an essential property for attrition, questioning whether phenomena such as change in the frequency of use can be used as a benchmark for attrition since “nothing is lost, nothing added” (p.736).

Instead, I argue that in the context of L2 attrition the term does not necessarily correspond to erosion, providing the two following conditions are met: (a) transitions in the language environment take place, and (b) a baseline measure is collected before (or shortly after) the transition takes place. As Flores (2018) and Sorace (2004) point out, attrition affects what was within the speaker’s knowledge, and it is therefore

crucial to establish a baseline to pinpoint what has undergone change. This change, however, does not necessarily entail loss, nor is it necessarily permanent.

To illustrate, in Chapter 6, I found that the preference for *s*-genitive choice increased over time for one condition, which in fact is a condition—according to the monolingual standards—that favours the use of the *s*-genitive form. Thus, this change actually brought the bilinguals' evaluation of genitives closer to that of the monolinguals, which under the traditional definition would not be defined as an attrition phenomenon. In fact, in Chapter 6, I argue that this change can be explained in terms of the dual effects of cross-linguistic transfer and processing difficulties, which are brought about by transitions in the language environment. Obtaining the crucial data to show this involves tracking the linguistic changes in the returnee children longitudinally after their return to the L1 environment. Critically, comparing the linguistic performance of bilinguals against the monolinguals only provides us with a fragmented picture of the attrition process, whereas investigations before and after the linguistic transition allow us clearly to identify the linguistic aspects that are subject to change and the extent to which such change occurs.

Longitudinal investigation is also called for in cognitive research. Specifically in the field of bilingualism and cognition, the most common way to test the cognitive advantage of bilinguals is to compare their performance to that of the monolinguals. This approach, however, is only valid if the two populations are matched in every variable *other* than bilingualism. Recent studies carefully matching for potentially confounding variables have overwhelmingly found no cognitive advantage for bilinguals (Antón et al., 2014; de Bruin, Bak, & Della Sala, 2015; Duñabeitia et al., 2014; Paap & Greenberg, 2013).

Following this, what has been missing in the field is examinations of how the *development* of cognition and the *development* of language interact over time within the bilingual population. In Chapter 8, I observed that these two processes interact in a positive manner where the degree of development in the cognitive task predicted the rate of improvement in the language task. Tracking the same group of bilinguals over time eliminates the danger of over-simplifying group data and treating everyone belonging to one group as a homogenous sample. This study is original in that it has

measured both linguistic and cognitive development in children longitudinally, following two recent studies investigating the relationship between development in translation equivalents and executive control over a seven-month period (Crivello et al., 2016), as well as a study investigating the relationship between L2 lexical acquisition and executive control development spanning a three-year period (Nicolay & Poncelet, 2013). Despite the wide acknowledgement among researchers of the need for a longitudinal approach, it is still far from becoming common practice, perhaps due to technical and practical issues in academia, such as limited years of funding and finding participants who are available to be studied longitudinally.

On a final note, the directionality of the relationship between bilingualism and cognition should be further explored. The big question posed by the recent literature has been whether bilingualism influences cognition or vice-versa. The majority of the literature argues for the former: learning another language enhances one's executive control due to the general cognitive training involved in controlling two languages. In Chapter 9, I also demonstrate that L2 proficiency is a significant predictor for cognitive development in bilingual children. The higher their L2 proficiency upon returning to the L1 environment, the better they are at increasing their cognitive performance over time. However, such a relationship can also be explained in the other direction: cognitive abilities may determine a certain profile of language proficiency in bilinguals. Such a quandary is similar to the classic causality dilemma: "Which came first, the chicken or the egg?" It is extremely difficult to resolve, since common statistical analysis used in most studies requires researchers to predetermine the causal direction (such as in regression). The different tools used to measure cognition and bilingualism also render comparisons across studies difficult. On top of this, the cognitive demands posed by a specific task are processed to different ways, and these different types of processes may be modulated by various dimensions of bilingual experience. Taken together, the debate about the interaction between bilingualism and cognition remains open, and perhaps general advances of statistical tools—such as Discriminant Analysis (Schmid & Yılmaz, 2018)—that do not assume linearity in data and can capture the directionality of relationship may offer some solution. My thesis shows that these dynamics need to be studied in the context of attrition. Maintenance/attrition of the language may not only be influenced by bilingual experience, but cognitive factors

also play an important role in determining which speakers are able to maintain a language at a higher level than others.

10.3 Limitations

Before moving on to the conclusion of this thesis, some limitations of the studies should be mentioned. First, although the studies in this thesis were longitudinal in nature, the time span of one year may have been too short to capture a comprehensive picture of the change in a child's linguistic and cognitive abilities. In fact, many of the families who participated in the study asked for continued investigation over a longer period. Ideally, I would like to have tested the children over a period of five to ten years, up until they reach adulthood. Such extensive investigations, as previously mentioned, may provide extremely valuable sources of information about a child's linguistic and cognitive development, as well as the interaction between language and cognition.

Although a longitudinal approach—even over a relatively short span of time such as a year—comes with many benefits, its methodological complexity should be acknowledged. The beauty of a longitudinal study is that one can operate the exact same procedure on the same group of people over time to see what has changed within the speaker's mind. However, such a design also entails 'practice effects', where marked improvements may simply be due to more practice, thereby masking the targeted effect. Although most of the children in my study mentioned that they did not remember the content of the tests administered a year before, I cannot completely disregard the possibility that their improvements in linguistic and cognitive tasks were influenced by practice effects. Nevertheless, in order to minimise such an effect, I changed the wording of non-target phrases in the grammaticality judgement task for the second round of testing, as stated in the section on Instruments and Procedure (Section 6.2.2).

The limitations regarding the administration of tasks should also be outlined. Although I tested most children shortly after their return to Japan, some had already been back in Japan for some time (for a range of one to five months) before the first

test session took place. Moreover, the children's English proficiency was not tested in the second round, since I used a proficiency measurement from a private organisation that offers English maintenance courses for children who have recently returned to Japan (the test was thus administered only once). Regrettably, the children's Japanese proficiency was also not tested, since including the Japanese proficiency test (in addition to six other linguistic and cognitive tasks) was expected to take too long and thus render the testing process too demanding for the children.

Last but not least, as mentioned in the discussions of Chapters 8 and 9, it would have been ideal to include a cognitive task designed to measure basic processing speed (as well as a test of non-verbal intelligence) to control for these variables and tease apart the cognitive mechanisms involved in the improvements of global reaction time.

10.4 Conclusion

In conclusion, this thesis has shown that processing demands caused by having to activate L2 to a greater extent and simultaneously inhibit a stronger L1 play an important role in how attrition is manifested in the bilingual returnee children's L2. Together, the studies show that both these processes are modulated by the bilingual experience. Within-language activation is influenced by how well the bilingual children can consolidate the link between form and concept and how much contact they have with L2. In turn, the development of executive control that governs the inhibition of L1 is modulated by the level of L2 proficiency. Taken together, exploring the link between bilingual experience and executive control not only provides us with insights into the process of acquiring another language, but also gives us valuable information about why, how, and when changes to an acquired language occur in a child's developmental process.

Appendix A

BiLEC questionnaire (relevant to all studies)

No.	Name	Content	Question [Ask parents/guardians questions in <i>italics</i>]	Location in Excel file	Notes for completing Excel file
General background information (cf. §3.1)					
	Investigator	Name of investigator completing questionnaire	(To be completed by researcher)	B2-C2	Format chosen by researcher.
1	Name	Full name	<i>What is your child's name?</i>	B3-C3	Enter child's name.
	ID	Anonymous identifier code	(To be completed by researcher)	B4-C4	Format chosen by researcher.
2	Gender	Child's gender	<i>What is your child's gender?</i> (Or to be completed by researcher)	B5-C5	Select M or F.
3	Place of birth	Country where child was born	<i>In which country was your child born?</i>	F2	Select code corresponding to country from drop-down menu.
4	Date of birth	Child's date of birth	<i>What is your child's date of birth?</i>	F3	Enter date in following format: 14-Mar-80.
	Date at testing	Date when child was tested	(To be completed by researcher)	F4	Enter date in following format: 14-Mar-80.
5	Date of arrival	(Approximate) date when child arrived in country of residence	<i>When did your child arrive in (country)?</i>	F7	Enter date in following format: 14-Mar-80 . Enter D.O.B. for simultaneous bilingual children.
<i>Does your child have any sisters or brothers? If yes à question 6. If no, question 7.</i>					
6	Siblings	Sibling 1's name and current age (in years)	<i>What are their names and how old are they?</i>	B14-C14	Enter first name; this will be copied automatically to serve as a reminder in later questions. Enter age in years.
		Same for sibling 2		B15-C15	As for sibling 1.
		Same for sibling 3		B16-C16	As for sibling 1.
		Same for sibling 4		B17-C17	As for sibling 1.
7	Parents	Mother/guardian 1's occupation and level of education	<i>What is your current occupation?</i> <i>What is the highest level of education you have completed?</i>	F14-G14	Occupation: if adopting ISCO-08, enter relevant code; otherwise, format chosen by researcher. Education: select number from drop-down menu as it relates to options given in 'Lists' worksheet .
		Same for father/guardian 2	<i>What is your partner's current occupation?</i> <i>What is the highest level of education s/he has completed?</i>	F15-G15	As for mother/guardian 1.

Child's exposure to and use of target language and other language(s) (cf. §3.2)					
8	TL	Name of target language	(To be completed by researcher)	B20	Enter 3-letter code from drop-down menu.
	Type fE	Type of first exposure to TL	<i>How did your child first come into contact with TL?</i>	B21-D23	Select up to 3 options from drop-down menu.
	Date fE	Date of first exposure to TL	<i>When did you child start receiving consistent and significant exposure to TL?</i>	B24	Enter date in following format: 14-Mar-01. This may or may not be same as date of arrival
	Speaking TL	Estimate of child's ability to speak TL	<i>How well does your child speak TL?</i>	B27	Select value from drop-down menu.
	Understanding TL	Estimate of child's ability to understand TL	<i>How well does your child understand TL?</i>	B28	Select value from drop-down menu.
9	OL1	Name of (first) other language	<i>Which other language or languages does your child have contact with?</i> (Or completed by researcher)	G20	As for TL.
	Type fE	Type of first exposure to OL1	As for TL	G21-I23	
	Date fE	Date of first exposure to OL1		G24	
	OL1 speaking	Estimate of child's ability to speak OL1		G27	
	OL1 understanding	Estimate of child's ability to understand OL1		G28	
10	OL2	Name of second other language		<i>Is there any other language your child has contact with?</i>	L20
	Type fE	Type of first exposure to OL2	As for TL	L21-N23	
	Date fE	Date of first exposure to OL2		L24	
	OL1 speaking	Estimate of child's ability to speak OL2		L27	
	OL1 understanding	Estimate of child's ability to understand OL2		L28	

Languages spoken by people in (regular) contact with child at home (cf. 3.3)					
11	%TL	Estimate of how much each person speaks TL to child	<i>Think about the people who have regular contact with your child at home. (Using this scale,) how often do each of these people speak TL to your child?</i>	B36-J36; H34-I34	Specify relationship of any other adults who regularly spend time with the child at home in H34 and I34 from drop-down menu. Enter value between 0 and 1.
	Speaking TL	Estimate of each person's ability to speak TL	<i>(Using this scale,) how well do each of these people speak TL?</i>	B37-J37	Select value from drop-down menu.
	Understanding TL	Estimate of each person's ability to understand TL	<i>(Using this scale), how well do each of these people understand TL?</i>	B38-J38	Select value from drop-down menu.
	AfE TL	(Approximate) age of first exposure to TL for each person	<i>Roughly how old was each person when they first came into contact with TL?</i>	B39-J39	Enter numerical value, using 0 for birth.
12	%OL1	Estimate of how much each person speaks OL1 to child	<i>How often do each of these people speak OL1 to your child?</i>	B41-J41	Completed automatically unless OL2 exists; if OL2 exists, enter value for OL1 between 0 and 1.
	Speaking OL1	Estimate of each person's ability to speak OL1	As for TL	B42-J42	As for TL
	Understanding OL1	Estimate of each person's ability to understand OL1		B43-J43	
	AfE OL1	(Approximate) age of first exposure to OL1 for each person		B44-J44	
13	Speaking OL2	Estimate of each person's ability to speak OL2		B47-J47	
	Understanding OL2	Estimate of each person's ability to understand OL2		B48-J48	
	AfE OL2	(Approximate) age of first exposure to OL2 for each person		B49-J49	
Languages spoken by child to other people at home (cf. §3.4)					
14	TL	%TL spoken by child to other people at home	<i>How often does your child speak TL to you, his/her father, sister, etc. etc.? Or Does your child speak TL to you at the same rate as you speak TL to him/her, etc.?</i>	B55-J55	Enter value between 0 and 1 for each person included in response to questions 11 through 13.
15	OL1	%OL1 spoken by child to other people at home	<i>How often does your child speak OL1 to each of the people?</i>	B56-J56	As for question 12.

Languages spoken outside home (cf. §3.5)					
<i>Does your child attend daycare/school? (depending on child's age)? If daycare <input type="checkbox"/> go to question 16. If school <input type="checkbox"/> go to question 17. If none <input type="checkbox"/> go to question 19.</i>					
16	%TL daycare: instruction	%TL spoken by current teacher(s) at daycare	<i>What is the language of instruction used by the current teacher?</i>	B63	Enter value between 0 and 1.
	%TL daycare: children	%TL spoken by child to other children at daycare	<i>In general, which language(s) do the children use with each other there?</i>	C63	Enter value between 0 and 1.
	TL speaking daycare: instruction	Estimate of ability of present teacher(s) at daycare to speak TL	<i>How well does your child's teacher(s) speak TL?</i>	B64	Select value from drop-down menu.
	TL understanding daycare: instruction	Estimate of ability of present teacher(s) at daycare to understand TL	<i>How well does your child's teacher(s) understand TL?</i>	B65	Select value from drop-down menu.
	TL speaking daycare: children	Estimate of ability of other children at daycare to speak TL	<i>How well (on average) do the other children at the daycare speak TL?</i>	C64	Select value from drop-down menu.
	TL understanding daycare: children	Estimate of ability of other children at daycare to understand TL	<i>How well (on average) do the other children at daycare understand TL?</i>	C65	Select value from drop-down menu.
	OL1 daycare	As for TL	As for TL	B69-C70	As for TL, %OL1 completed automatically unless OL2 exists – see question 12.
	OL2 daycare			B74-C75	As for TL.
17	TL/OL1/OL2 school	As for daycare	As for daycare	D63-E65; D69-E70; D74-E75	As for daycare.
<i>Does your child attend out-of-school care? If yes <input type="checkbox"/> question 18. If no <input type="checkbox"/> question 19.</i>					
18	TL/OL1/OL2 out-of school care	As for daycare	As for daycare	F63-G65; F69-G70; F74-G75	As for daycare.

Holidays (cf. §3.6)					
19	No. of weeks/year	Average no. of weeks of holiday per year	<i>(How many weeks per year is your child on holiday from daycare?)</i>	L61	Completed beforehand where possible.
	Average %TL	%TL heard by child during holidays	<i>Think about when your child is on holiday from daycare/school. How much contact does your child have with the TL during the holidays?</i> [See guidelines for more information on how best to elicit the required information.]	K65	Enter value from 0 to 1.
	Average quality TL	Estimate of overall quality of TL exposure during holidays	<i>How much of your child's contact with TL during the holidays is from native speakers?</i>	L65	Select value from drop-down menu.
	Average % OL1 and OL2	%OL1 and OL2 heard by child during holidays	As for TL	K66-K67	Completed automatically unless OL2 – see question 12.
	Average quality OL1 and OL2	Estimate of overall quality of OL1 and OL2 exposure during holidays	As for TL	L66-L67	Select value from drop-down menu.

Who spends time with child on average day during week and at weekend (cf. §3.7)					
20	Average day during week	Timetable indicating for an average day during the week when child is at home and daycare/school/ out-of-school care and when at home, who spends time with child	<i>Think about an average day in the week. I'm going to ask you about who spends time with your child at home and when they do this, and about when your child goes to daycare/school.</i> [See guidelines for more information on how best to elicit the required information.]	B82-M117	Change 0 to 1 in every cell where the person in question spends time with the child, or where the child is at daycare, school or out-of-school care.
21	Average day at weekend	Timetable indicating for an average day during the weekend when child is at home and daycare/school/ out-of-school care and when at home, who spends time with child	<i>Now think about an average day at the weekend. Who spends time with the child at home then?</i>	B122-M139	As for average day in during the week.

Other sources of language exposure (cf. §3.8)					
<i>So far, I have mostly been asking you about your child's language exposure from family members and daycare or school. Now, I'm going to ask you about other possible sources of language input, such as TV or friends.</i>					
22	Sports/clubs	Hours/wk spent on given activity	<i>How many hours per week on average does your child spend on extra-curricular activities such as sports and clubs?</i>	B146	Enter number (max. 1 decimal place).
		% TL	<i>In general, which language(s) does your child use during such activities?</i>	B147	Enter value between 0 and 1.
		Average quality TL	<i>How well do the other people taking part in this activity speak TL?</i>	B148	Select value from drop-down menu.
23	Friends	As for sports/clubs	<i>How many hours per week on average does your child spend with friends outside school (excluding extra curricular activities such as sports and clubs)?</i> And as for sports/clubs	C146- C148	As for sports/clubs.
24	Watching TV		<i>How many hours per week on average does your child spend watching TV (including watching DVDs and films)?</i> And as for sports/clubs	D146- D148	
25	Reading / being read to		<i>How many hours per week on average does your child spend reading books for leisure (if your child is old enough to read) and/or being read to?</i> And as for sports/clubs	E146- E148	
26	Using computer		<i>How many hours per week on average does your child spend playing computer games (which use language), chatting, surfing the internet?</i> And as for sports/clubs	F146- F148	
27	Other		<i>Does your child participate in any other language-related activities (e.g., listening to audio books, etc.) which you think might be relevant?</i> And as for sports/clubs	G146- G148	

Amount of language exposure in the past (cf. §3.9)					
<i>I'm now going to ask you some questions about (your child's language exposure in) the past.</i>					
<i>Did your child have any kind of preschool care before the age of 4? If yes <input type="checkbox"/> question 28. If no <input type="checkbox"/> question 29.</i>					
28	Days/wk at daycare	Approx. no. of days per week child spent at daycare in given time period	<i>For about how many days per week?</i>	B171- B176	Enter number (max. 1 decimal place) for each 1- year period where child attended daycare, up to and including present moment if applicable.
	Daycare	% TL spoken at daycare in given time period	<i>In general, which language or languages were used there?</i>	C171 - C176	Enter value between 0 and 1 for each 1-year period in child's life when child attended daycare, up to and including present moment if applicable.
29	School	% TL spoken at school in given time period	<i>Think about your child's schooling. Has your child always attended the same school? In general, how much TL was spoken there?</i>	D174- D188	Enter value between 0 and 1 for each 1-year period in child's life up to and including the present moment if applicable.
<i>Whilst at school, did you child ever regularly attend any out-of-school care? If yes <input type="checkbox"/> question 30. If no <input type="checkbox"/> question 31.</i>					
30	Hrs/wk at out-of-school	Approx. no. of hours per week child spent at out-of-school care in given time period	<i>For about how many hours per week?</i>	E174- E188	Enter number (max. 1 decimal place) for each 1- year period where child attended out-of-school care, up to and including present moment if applicable.
	Out-of-school care	% TL spoken at out-of-school care in given time period	<i>In general, which language or languages were used there?</i>	F174- F188	Enter value between 0 and 1 for each 1-year period in child's life when child attended out-of- school care, up to and including present moment if applicable.
31	Mother / guardian 1	% TL spoken by mother / guardian 1 in given time period	<i>Now think about your own language use with your child in the past. About how often did you speak TL to your children from birth to age 2, age 2 to age 4, etc.?</i>	G171- G188	Enter value between 0 and 1 for each 1-year period in child's life up to and including the present moment.
	Father / guardian 2	% TL spoken by father / guardian 2 in given time period	As for mother/guardian 1	H171- H188	As for mother/guardian 1.
	Other adult 1 and 2	% TL spoken by other adults in given time period	<i>Have any other adults lived at home? If so, what is there relationship to your child?</i> As for mother/guardian 1	I170-J170; I171-I188; J171-J188	Select option from drop-down menu. As for mother/guardian 1.
	Siblings 1 to 4	% TL spoken by siblings in given time period	As for mother/guardian 1	K171 - N188	As for mother/guardian 1; remember time periods refer to child's age and not to sibling's age.

32	Holidays	% TL exposure during holidays in given time period	<i>During this period, how much contact did your child have with the TL during the holidays?</i>	P171- P188	As for mother/guardian 1
----	----------	--	--	---------------	--------------------------

Appendix B

Experimental conditions (Genitives) and filler conditions (word order) items used in Chapter 6

Genitive items

Conditions			
[+animate] [+topical]			[-animate] [-topical]
[+proto]	[-proto]	[+proto]	[-proto]
strong s-genitive	weak s-genitive	weak of-genitive	strong of-genitive
A bee stung a boy. <u>The boy's nose/the nose of the boy</u> was swollen for many days.	A new teacher came to our school. But nobody knew <u>the teacher's name/the name of the teacher</u> .	I banged my toe on <u>a table's leg/the leg of a table</u> and it hurts a lot.	It's annoying when people start laughing before <u>a joke's end/ the end of a joke</u> .
A man was feeding his pet bird. Suddenly, <u>the man's bird/the bird of the man</u> flew away.	A teacher made a joke about a boy. <u>The teacher's joke/the joke of the teacher</u> was very mean.	A girl is entering through <u>a building's door/the door of a building</u> .	<u>A room's darkness/the darkness of a room</u> makes people very anxious.
A little boy was looking at a baby because he wanted <u>the baby's toy/the toy of a baby</u> .	A woman was shouting on a train. <u>The woman's voice/the voice of the woman</u> was very loud.	I saw a toy I wanted in <u>a shop's window/the window of a shop</u> .	<u>A story's beginning/ the beginning of a story</u> is the most exciting part.
A girl was freezing outside. <u>The girl's hand/the hand of the girl</u> was very cold.	A man was drowning in a pool. A life guard saved <u>the man's life/the life of the man</u> .	My father fell down <u>a house's chimney/the chimney of a house</u> .	<u>A leaf's colour/ the colour of a leaf</u> changes as the season changes.

Word order items

Conditions			
SOV	OSV	SIODOV	SVDOIO
My dad newspapers everyday reads/ My dad reads newspapers every day.	I don't like apples but oranges I'll eat/ I don't like apples, but I'll eat oranges.	My uncle me a bag last week bought/ My uncle bought me a bag last week.	Our teacher taught the alphabet us today/Our teacher taught us the alphabet today.
My father those chocolates loves/ My father loves those chocolates.	He's very rude, but her I would like to be friends with/ He's very rude, but I would like to be friends with her.	The customer the banker lots of money paid/ The customer paid the banker lots of money.	The mother bought some crayons his son/The mother bought his son some crayons.
The audience the concert very much enjoyed/ The audience enjoyed the concert very much.	My brother lies to me all the time. Him I never believe/ My brother lies to me all the time. I never believe him.	My best friend me a letter sent/ My best friend sent me a letter	My friend told a scary story me last night/ My friend told me a scary story last night.
The student an essay wrote/the student wrote an essay.	I don't know the woman but her husband I know/ I don't know the woman but I know her husband.	She has never her sister a secret told/ She has never told her sister a secret	Our teacher taught math us yesterday/ Our teacher taught us math yesterday.

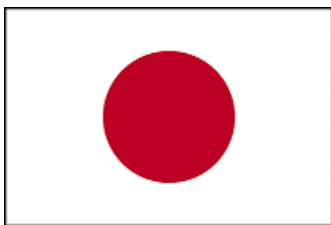
Appendix C

Pictures used for language-switching task in Chapter 8

<Language Cues>



English



Japanese

<Single block>



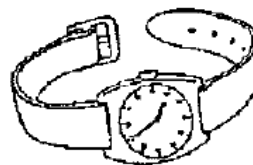
Snail
Katatumuri



Whistle
Fue



Scissors
Hasami



Watch
Udedokei



Bird
Tori



Balloon
Fuusen



Lip
Kuchibiru



Octopus
Tako



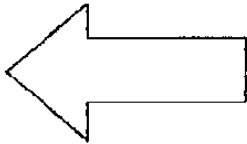
Umbrella
Kasa



Rabbit
Usagi



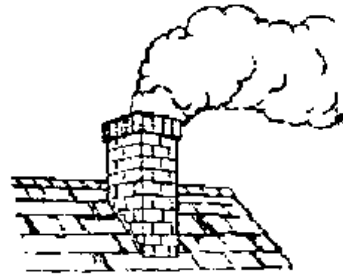
Moon
Tsuki



Arrow
Yajirushi



Star
Hoshi



Chimney
Entotsu



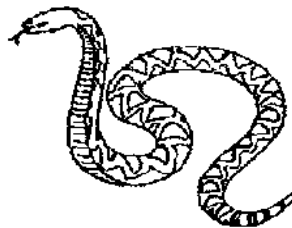
Spider
Kumo



Socks
Kutsushita



Onion
Tamanegi



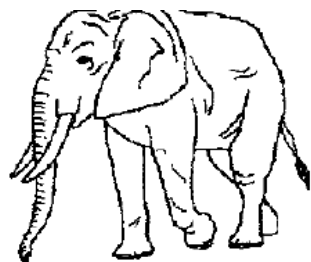
Snake
Hebi



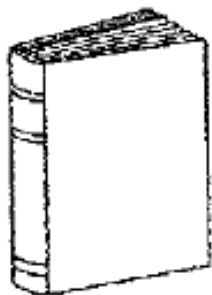
Mountain
Yama



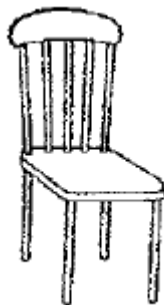
Owl
Fukuro



Elephant
Zou



Book
Honn



Chair
Isu



Monkey
Saru



Pencil
Enpitsu



Nose
Hana



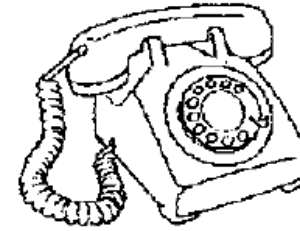
Butterfly
Choucho



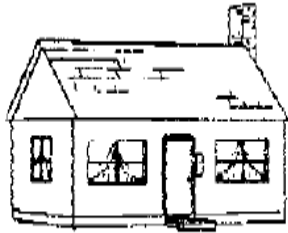
Bread
Pann



Ring
Yubiwa



Telepone
Denwa



House
Ie



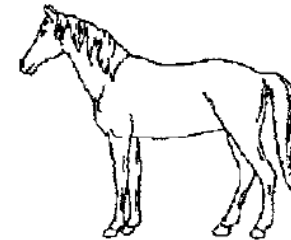
Cat
Neko



Apple
Ringo



Zebra
Shimauma



Horse
Uma



Frog
Kaeru



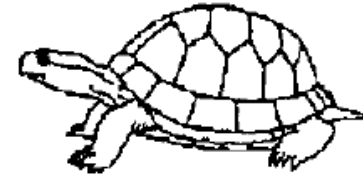
Giraffe
Kirin



Shoe
Kutsu

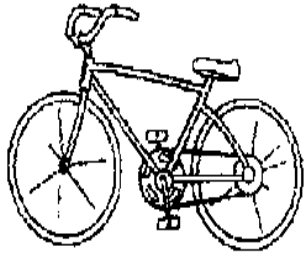


Toothbrush
Habruashi

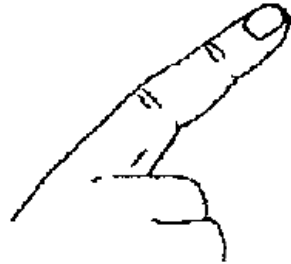


Turtle
Kame

<Mixed block>



Bicycle
Jitensha



Finger
Yubi



Ear
Mimi



Fish
Sakana



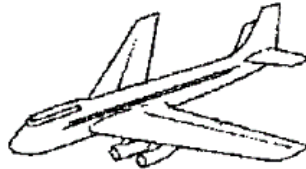
Flower
Hana



Pig
Buta



Dog
Inu



Air plane
Hikoki

References

- Abrahamsson, N., & Hyltenstam, K. (2009). Age of onset and nativelikeness in a second language: Listener perception versus linguistic scrutiny. *Language Learning, 59*(2), 249–306.
- Anderson, P. (2002). Assessment and development of executive function (EF) during childhood. *Child Neuropsychology, 8*(2), 71–82.
- Anschutz, A. (1997). How to choose a possessive noun phrase construction in four easy steps. *Studies in Language. International Journal Sponsored by the Foundation "Foundations of Language," 21*(1), 1–35.
- Antón, E., Duñabeitia, J. A., Estévez, A., Hernández, J. A., Castillo, A., Fuentes, L. J., ... Carreiras, M. (2014). Is there a bilingual advantage in the ANT task? Evidence from children. *Frontiers in Psychology, 5*, 398.
- Antoniou, K., Grohmann, K. K., Kambanaros, M., & Katsos, N. (2016). The effect of childhood bilingualism and multilingualism on executive control. *Cognition, 149*, 18–30. <https://doi.org/10.1016/j.cognition.2015.12.002>
- Argyri, E., & Sorace, A. (2007). Crosslinguistic influence and language dominance in older bilingual children. *Bilingualism: Language and Cognition, 10*(1), 79–99.
- Baayen, R. H., Davidson, D. J., & Bates, D. M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language, 59*(4), 390–412. <https://doi.org/10.1016/j.jml.2007.12.005>
- Bahrack, H. P. (1984). Fifty years of second language attrition: Implications for programmatic research. *The Modern Language Journal, 68*(2), 105–118.
- Bannard, C., & Matthews, D. (2008). Stored word sequences in language learning: The effect of familiarity on children's repetition of four-word combinations. *Psychological Science, 19*(3), 241–248.
- Barac, R., Bialystok, E., Castro, D. C., & Sanchez, M. (2014). The cognitive development of young dual language learners: A critical review. *Early Childhood Research Quarterly, 29*(4), 699–714.
- Barton, K. (2018). *Package 'MuMIn'. R package version 1.40. 4.*
- Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting Linear Mixed-Effects Models Using lme4. *Journal of Statistical Software, 67*(1), 1–48.
- Best, J. R., & Miller, P. H. (2010). A developmental perspective on executive function. *Child Development, 81*(6), 1641–1660. <https://doi.org/10.1111/j.1467-8624.2010.01499.x>
- Beveridge, M., Jarrold, C., & Pettit, E. (2002). An experimental approach to executive fingerprinting in young children. *Infant and Child Development: An International Journal of Research and Practice, 11*(2), 107–123. <https://doi.org/10.1002/icd.300>
- Bialystok, E. (2006). Effect of bilingualism and computer video game experience on the Simon task. *Canadian Journal of Experimental Psychology/Revue Canadienne de Psychologie Expérimentale, 60*(1), 68.
- Bialystok, E. (2007). Cognitive effects of bilingualism: How linguistic experience leads to cognitive change. *International Journal of Bilingual Education and Bilingualism, 10*(3), 210–223. <https://doi.org/10.2167/beb441.0>

- Bialystok, E. (2009). Bilingualism: The good, the bad, and the indifferent. *Bilingualism: Language and Cognition*, 12(1), 3–11. <https://doi.org/10.1017/S1366728908003477>
- Bialystok, E. (2011). Reshaping the mind: the benefits of bilingualism. *Canadian Journal of Experimental Psychology/Revue Canadienne de Psychologie Expérimentale*, 65(4), 229.
- Bialystok, E., & Barac, R. (2012). Emerging bilingualism: Dissociating advantages for metalinguistic awareness and executive control. *Cognition*, 122(1), 67–73. <https://doi.org/10.1016/j.cognition.2011.08.003>
- Bialystok, E., Craik, F. I., Grady, C., Chau, W., Ishii, R., Gunji, A., & Pantev, C. (2005). Effect of bilingualism on cognitive control in the Simon task: Evidence from MEG. *NeuroImage*, 24(1), 40–49.
- Bialystok, E., Craik, F. I., Klein, R., & Viswanathan, M. (2004). Bilingualism, aging, and cognitive control: evidence from the Simon task. *Psychology and Aging*, 19(2), 290.
- Bialystok, E., Craik, F. I., & Luk, G. (2012). Bilingualism: consequences for mind and brain. *Trends in Cognitive Sciences*, 16(4), 240–250. <https://doi.org/10.1016/j.tics.2012.03.001>
- Bialystok, E., & Feng, X. (2009). Language proficiency and executive control in proactive interference: Evidence from monolingual and bilingual children and adults. *Brain and Language*, 109(2–3), 93–100. <https://doi.org/10.1016/j.bandl.2008.09.001>
- Bialystok, E., & Martin, M. M. (2004). Attention and inhibition in bilingual children: Evidence from the dimensional change card sort task. *Developmental Science*, 7(3), 325–339. <https://doi.org/10.1111/j.1467-7687.2004.00351.x>
- Bialystok, E., Martin, M. M., & Viswanathan, M. (2005). Bilingualism across the lifespan: The rise and fall of inhibitory control. *International Journal of Bilingualism*, 9(1), 103–119. <https://doi.org/10.1177/13670069050090010701>
Article information
- Blom, E., Boerma, T., Bosma, E., Cornips, L., & Everaert, E. (2017). Cognitive advantages of bilingual children in different sociolinguistic contexts. *Frontiers in Psychology*, 8, 552. <https://doi.org/10.3389/fpsyg.2017.00552>
- Blom, E., Paradis, J., & Duncan, T. S. (2012). Effects of input properties, vocabulary size, and L1 on the development of third person singular–s in child L2 English. *Language Learning*, 62(3), 965–994.
- Bobb, S. C., & Wodniecka, Z. (2013). Language switching in picture naming: What asymmetric switch costs (do not) tell us about inhibition in bilingual speech planning. *Journal of Cognitive Psychology*, 25(5), 568–585.
- Branzi, F. M., Calabria, M., Boscarino, M. L., & Costa, A. (2016). On the overlap between bilingual language control and domain-general executive control. *Acta Psychologica*, 166, 21–30.
- Braver, T. S. (2012). The variable nature of cognitive control: a dual mechanisms framework. *Trends in Cognitive Sciences*, 16(2), 106–113.
- Braver, T. S., Gray, J. R., & Burgess, G. C. (2007). Explaining the many varieties of working memory variation: Dual mechanisms of cognitive control. *Variation in Working Memory*, 76–106.

- Braver, T. S., Paxton, J. L., Locke, H. S., & Barch, D. M. (2009). Flexible neural mechanisms of cognitive control within human prefrontal cortex. *Proceedings of the National Academy of Sciences*, pnas-0808187106.
- Brenders, P., van Hell, J. G., & Dijkstra, T. (2011). Word recognition in child second language learners: Evidence from cognates and false friends. *Journal of Experimental Child Psychology*, 109(4), 383–396.
- Brulard, I., & Carr, P. (2003). French-English bilingual acquisition of phonology: One production system or two? *International Journal of Bilingualism*, 7(2), 177–202.
- Bultena, S., Dijkstra, T., & Van Hell, J. G. (2015). Language switch costs in sentence comprehension depend on language dominance: Evidence from self-paced reading. *Bilingualism: Language and Cognition*, 18(3), 453–469.
- Bylund, E. (2009a). Effects of age of L2 acquisition on L1 event conceptualization patterns. *Bilingualism: Language and Cognition*, 12(3), 305–322.
- Bylund, E. (2009b). Maturational constraints and first language attrition. *Language Learning*, 59(3), 687–715.
- Bylund, E., Abrahamsson, N., & Hyltenstam, K. (2009). The role of language aptitude in first language attrition: The case of pre-pubescent attriters. *Applied Linguistics*, 31(3), 443–464.
- Bylund, E., Abrahamsson, N., & Hyltenstam, K. (2012). Does first language maintenance hamper nativelikeness in a second language?: a study of ultimate attainment in early bilinguals. *Studies in Second Language Acquisition*, 34(2), 215–241.
- Calabria, M., Branzi, F. M., Marne, P., Hernández, M., & Costa, A. (2015). Age-related effects over bilingual language control and executive control. *Bilingualism: Language and Cognition*, 18(1), 65–78.
- Calabria, M., Hernández, M., Branzi, F. M., & Costa, A. (2012). Qualitative differences between bilingual language control and executive control: Evidence from task-switching. *Frontiers in Psychology*, 2, 399.
- Cambridge University Press. (2018). bilingual. *Cambridge Dictionary*. Retrieved from <https://dictionary.cambridge.org/dictionary/english/bilingual>
- Carlson, S. M., & Meltzoff, A. N. (2008). Bilingual experience and executive functioning in young children. *Developmental Science*, 11(2), 282–298. <https://doi.org/10.1111/j.1467-7687.2008.00675.x>
- Cassidy, A. R., White, M. T., DeMaso, D. R., Newburger, J. W., & Bellinger, D. C. (2016). Processing speed, executive function, and academic achievement in children with dextro-transposition of the great arteries: Testing a longitudinal developmental cascade model. *Neuropsychology*, 30(7), 874. <http://dx.doi.org/10.1037/neu0000289>
- Cattani, A., Abbot-Smith, K., Farag, R., Krott, A., Arreckx, F., Dennis, I., & Floccia, C. (2014). How much exposure to English is necessary for a bilingual toddler to perform like a monolingual peer in language tests? *International Journal of Language & Communication Disorders*, 49(6), 649–671.
- Cepeda, N. J., Blackwell, K. A., & Munakata, Y. (2013). Speed isn't everything: Complex processing speed measures mask individual differences and developmental changes in executive control. *Developmental Science*, 16(2), 269–286. <https://doi.org/10.1111/desc.12024>

- Cepeda, N. J., Kramer, A. F., & Gonzalez de Sather, J. (2001). Changes in executive control across the life span: examination of task-switching performance. *Developmental Psychology, 37*(5), 715.
- Chamorro, G., Sturt, P., & Sorace, A. (2016). Selectivity in L1 attrition: Differential Object Marking in Spanish near-native speakers of English. *Journal of Psycholinguistic Research, 45*(3), 697–715.
- Cherciov, M. (2013). Investigating the impact of attitude on first language attrition and second language acquisition from a Dynamic Systems Theory perspective. *International Journal of Bilingualism, 17*(6), 716–733.
- Chevalier, N. (2018). Willing to think hard? The subjective value of cognitive effort in children. *Child Development, 89*(4), 1283–1295. <https://doi.org/10.1111/cdev.12805>
- Chevalier, N., & Blaye, A. (2008). Cognitive flexibility in preschoolers: The role of representation activation and maintenance. *Developmental Science, 11*(3), 339–353.
- Chevalier, N., Blaye, A., Dufau, S., & Lucenet, J. (2010). What visual information do children and adults consider while switching between tasks? Eye-tracking investigation of cognitive flexibility development. *Developmental Psychology, 46*(4), 955. <https://doi.org/10.1037/a0019674>
- Chevalier, N., James, T. D., Wiebe, S. A., Nelson, J. M., & Espy, K. A. (2014). Contribution of reactive and proactive control to children’s working memory performance: Insight from item recall durations in response sequence planning. *Developmental Psychology, 50*(7), 1999.
- Chondrogianni, V., & Marinis, T. (2011). Differential effects of internal and external factors on the development of vocabulary, tense morphology and morpho-syntax in successive bilingual children. *Linguistic Approaches to Bilingualism, 1*(3), 318–345. <https://doi.org/10.1075/lab.1.3.05cho>
- Clancy, P. M. (1985). The acquisition of Japanese. *The Cross-Linguistic Study of Language Acquisition, 1*, 373–524.
- Clark, C. A. C., Nelson, J. M., Garza, J., Sheffield, T. D., Wiebe, S. A., & Espy, K. A. (2014). Gaining control: changing relations between executive control and processing speed and their relevance for mathematics achievement over course of the preschool period. *Frontiers in Psychology, 5*, 107. <https://doi.org/10.3389/fpsyg.2014.00107>
- Costa, A., Caramazza, A., & Sebastian-Galles, N. (2000). The cognate facilitation effect: implications for models of lexical access. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 26*(5), 1283.
- Costa, A., Hernández, M., Costa-Faidella, J., & Sebastián-Gallés, N. (2009). On the bilingual advantage in conflict processing: Now you see it, now you don’t. *Cognition, 113*(2), 135–149. <https://doi.org/10.1016/j.cognition.2009.08.001>
- Costa, A., Hernández, M., & Sebastián-Gallés, N. (2008). Bilingualism aids conflict resolution: Evidence from the ANT task. *Cognition, 106*(1), 59–86.
- Costa, A., Miozzo, M., & Caramazza, A. (1999). Lexical selection in bilinguals: Do words in the bilingual’s two lexicons compete for selection? *Journal of Memory and Language, 41*(3), 365–397.
- Costa, A., & Santesteban, M. (2004). Lexical access in bilingual speech production: Evidence from language switching in highly proficient bilinguals and L2 learners. *Journal of Memory and Language, 50*(4), 491–511.

- Costa, A., Santesteban, M., & Ivanova, I. (2006). How do highly proficient bilinguals control their lexicalization process? Inhibitory and language-specific selection mechanisms are both functional. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *32*(5), 1057.
- Craik, F. I., & Bialystok, E. (2006). Cognition through the lifespan: mechanisms of change. *Trends in Cognitive Sciences*, *10*(3), 131–138.
- Crivello, C., Kuzyk, O., Rodrigues, M., Friend, M., Zesiger, P., & Poulin-Dubois, D. (2016). The effects of bilingual growth on toddlers' executive function. *Journal of Experimental Child Psychology*, *141*, 121–132.
- Cuza, A. (2013). Crosslinguistic influence at the syntax proper: Interrogative subject–verb inversion in heritage Spanish. *International Journal of Bilingualism*, *17*(1), 71–96. <https://doi.org/10.1177/1367006911432619>
- Cuza, A., & Pérez-Tattam, R. (2016). Grammatical gender selection and phrasal word order in child heritage Spanish: A feature re-assembly approach. *Bilingualism: Language and Cognition*, *19*(1), 50–68.
- Cycowicz, Y. M., Friedman, D., Rothstein, M., & Snodgrass, J. G. (1997). Picture naming by young children: Norms for name agreement, familiarity, and visual complexity. *Journal of Experimental Child Psychology*, *65*(2), 171–237.
- David, A., & Wei, L. (2008). Individual differences in the lexical development of French–English bilingual children. *International Journal of Bilingual Education and Bilingualism*, *11*(5), 598–618.
- de Bruin, A., Bak, T. H., & Della Sala, S. (2015). Examining the effects of active versus inactive bilingualism on executive control in a carefully matched non-immigrant sample. *Journal of Memory and Language*, *85*, 15–26.
- de Bruin, A., Roelofs, A., Dijkstra, T., & FitzPatrick, I. (2014). Domain-general inhibition areas of the brain are involved in language switching: fMRI evidence from trilingual speakers. *NeuroImage*, *90*, 348–359.
- De Cat, C., Gusnanto, A., & Serratrice, L. (2018). Identifying a threshold for the executive function advantage in bilingual children. *Studies in Second Language Acquisition*, *40*(1), 119–151. <https://doi.org/10.1017/S0272263116000486>
- De Houwer, A. (2009). *Bilingual first language acquisition*. Multilingual Matters.
- Declerck, M., Grainger, J., Koch, I., & Philipp, A. M. (2017). Is language control just a form of executive control? Evidence for overlapping processes in language switching and task switching. *Journal of Memory and Language*, *95*, 138–145.
- Declerck, M., & Philipp, A. M. (2015). A review of control processes and their locus in language switching. *Psychonomic Bulletin & Review*, *22*(6), 1630–1645.
- DeKeyser, R. M. (2000). The robustness of critical period effects in second language acquisition. *Studies in Second Language Acquisition*, *22*(4), 499–533.
- Diamond, A. (2002). Normal development of prefrontal cortex from birth to young adulthood: Cognitive functions, anatomy, and biochemistry. *Principles of Frontal Lobe Function*, 466–503.
- Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, *64*, 135–168. <https://doi.org/10.1146/annurev-psych-113011-143750>
- Dijkstra, T. (2005). Bilingual visual word recognition and lexical access. *Handbook of Bilingualism: Psycholinguistic Approaches*, 179–201.

- Dijkstra, T., Timmermans, M., & Schriefers, H. (2000). On being blinded by your other language: Effects of task demands on interlingual homograph recognition. *Journal of Memory and Language*, *42*(4), 445–464.
- Dijkstra, T., Van Jaarsveld, H., & Ten Brinke, S. (1998). Interlingual homograph recognition: Effects of task demands and language intermixing. *Bilingualism: Language and Cognition*, *1*(1), 51–66. <https://doi.org/10.1017/S1366728998000121>
- Doebel, S., Barker, J. E., Chevalier, N., Michaelson, L. E., Fisher, A. V., & Munakata, Y. (2017). Getting ready to use control: Advances in the measurement of young children's use of proactive control. *PloS One*, *12*(4), e0175072.
- Döpke, S. (1998). Competing language structures: The acquisition of verb placement by bilingual German-English children. *Journal of Child Language*, *25*(3), 555–584.
- Duñabeitia, J. A., Hernández, J. A., Antón, E., Macizo, P., Estévez, A., Fuentes, L. J., & Carreiras, M. (2014). The inhibitory advantage in bilingual children revisited. *Experimental Psychology*.
- Duyck, W., Van Assche, E., Drieghe, D., & Hartsuiker, R. J. (2007). Visual word recognition by bilinguals in a sentence context: evidence for nonselective lexical access. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *33*(4), 663.
- Ecke, P. (2004). Words on the tip of the tongue: A study of lexical retrieval failures in Spanish-English bilinguals. *Southwest Journal of Linguistics*, *23*(2), 33–63.
- Ellefson, M. R., Shapiro, L. R., & Chater, N. (2006). Asymmetrical switch costs in children. *Cognitive Development*, *21*(2), 108–130.
- Elliott, R. (2003). Executive functions and their disorders: Imaging in clinical neuroscience. *British Medical Bulletin*, *65*(1), 49–59. <https://doi.org/10.1093/bmb/65.1.49>
- Emmorey, K., Luk, G., Pyers, J. E., & Bialystok, E. (2008). The source of enhanced cognitive control in bilinguals: Evidence from bimodal bilinguals. *Psychological Science*, *19*(12), 1201–1206.
- Engel de Abreu, P. M., Cruz-Santos, A., Tourinho, C. J., Martin, R., & Bialystok, E. (2012). Bilingualism enriches the poor: Enhanced cognitive control in low-income minority children. *Psychological Science*, *23*(11), 1364–1371. <https://doi.org/10.1177/0956797612443836>
- Fernández Fuertes, R., & Licerias, J. M. (2010). Copula omission in the English developing grammar of English/Spanish bilingual children. *International Journal of Bilingual Education and Bilingualism*, *13*(5), 525–551.
- Festman, J., Rodríguez-Fornells, A., & Münte, T. F. (2010). Individual differences in control of language interference in late bilinguals are mainly related to general executive abilities. *Behavioral and Brain Functions*, *6*(1), 5. <https://doi.org/10.1186/1744-9081-6-5>
- Flores, C. (2010). The effect of age on language attrition: Evidence from bilingual returnees. *Bilingualism: Language and Cognition*, *13*(4), 533–546.
- Flores, C. (2012). Differential effects of language attrition in the domains of verb placement and object expression. *Bilingualism: Language and Cognition*, *15*(3), 550–567.
- Flores, C. (2015). Losing a language in childhood: a longitudinal case study on language attrition. *Journal of Child Language*, *42*(3), 562–590.

- Flores, C. (2018). Problematizing the scope of language attrition from the perspective of bilingual returnees. *Linguistic Approaches to Bilingualism*, 7(6), 691–695.
- Friedman, N. P., Miyake, A., Young, S. E., DeFries, J. C., Corley, R. P., & Hewitt, J. K. (2008). Individual differences in executive functions are almost entirely genetic in origin. *Journal of Experimental Psychology: General*, 137(2), 201.
- Fry, A. F., & Hale, S. (1996). Processing speed, working memory, and fluid intelligence: Evidence for a developmental cascade. *Psychological Science*, 7(4), 237–241. <https://doi.org/10.1111/j.1467-9280.1996.tb00366.x>
- Fry, A. F., & Hale, S. (2000). Relationships among processing speed, working memory, and fluid intelligence in children. *Biological Psychology*, 54(1–3), 1–34. [https://doi.org/10.1016/S0301-0511\(00\)00051-X](https://doi.org/10.1016/S0301-0511(00)00051-X)
- Garbin, G., Costa, A., Sanjuan, A., Forn, C., Rodriguez-Pujadas, A., Ventura, N. et al, ... Avila, C. (2011). Neural bases of language switching in high and early proficient bilinguals. *Brain and Language*, 119(3), 129–135.
- Gathercole, S. E., Pickering, S. J., Ambridge, B., & Wearing, H. (2004). The structure of working memory from 4 to 15 years of age. *Developmental Psychology*, 40(2), 177. <https://doi.org/10.1037/0012-1649.40.2.177>
- Gathercole, V. C. M., & Thomas, E. M. (2009). Bilingual first-language development: Dominant language takeover, threatened minority language take-up. *Bilingualism: Language and Cognition*, 12(2), 213–237.
- Genova, H. M., DeLuca, J., Chiaravalloti, N., & Wylie, G. (2013). The relationship between executive functioning, processing speed, and white matter integrity in multiple sclerosis. *Journal of Clinical and Experimental Neuropsychology*, 35(6), 631–641. <https://doi.org/10.1080/13803395.2013.806649>
- Gollan, T. H., & Acenas, L.-A. R. (2004). What is a TOT? Cognate and translation effects on tip-of-the-tongue states in Spanish-English and tagalog-English bilinguals. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 30(1), 246.
- Gollan, T. H., & Brown, A. S. (2006). From tip-of-the-tongue (TOT) data to theoretical implications in two steps: When more TOTs means better retrieval. *Journal of Experimental Psychology: General*, 135(3), 462.
- Gollan, T. H., & Ferreira, V. S. (2009). Should I stay or should I switch? A cost–benefit analysis of voluntary language switching in young and aging bilinguals. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 35(3), 640.
- Gollan, T. H., Montoya, R. I., & Bonanni, M. P. (2005). Proper names get stuck on bilingual and monolingual speakers’ tip of the tongue equally often. *Neuropsychology*, 19(3), 278.
- Gollan, T. H., Montoya, R. I., Cera, C., & Sandoval, T. C. (2008). More use almost always means a smaller frequency effect: Aging, bilingualism, and the weaker links hypothesis. *Journal of Memory and Language*, 58(3), 787–814.
- Gollan, T. H., Montoya, R. I., Fennema-Notestine, C., & Morris, S. K. (2005). Bilingualism affects picture naming but not picture classification. *Memory & Cognition*, 33(7), 1220–1234.
- Gollan, T. H., Montoya, R. I., & Werner, G. A. (2002). Semantic and letter fluency in Spanish-English bilinguals. *Neuropsychology*, 16(4), 562.
- Gollan, T. H., & Silverberg, N. B. (2001). Tip-of-the-tongue states in Hebrew–English bilinguals. *Bilingualism: Language and Cognition*, 4(1), 63–83.

- Gollan, T. H., Slattery, T. J., Goldenberg, D., Van Assche, E., Duyck, W., & Rayner, K. (2011). Frequency drives lexical access in reading but not in speaking: The frequency-lag hypothesis. *Journal of Experimental Psychology: General*, *140*(2), 186.
- Goral, M., Libben, G., Obler, L. K., Jarema, G., & Ohayon, K. (2008). Lexical attrition in younger and older bilingual adults. *Clinical Linguistics & Phonetics*, *22*(7), 509–522.
- Green, D. W. (1998). Mental control of the bilingual lexico-semantic system. *Bilingualism: Language and Cognition*, *1*(2), 67–81.
- Green, D. W., & Abutalebi, J. (2013). Language control in bilinguals: The adaptive control hypothesis. *Journal of Cognitive Psychology*, *25*(5), 515–530.
- Gries, S. T. (2002). Evidence in Linguistics YYYY No org found YYY: Three Approaches to Genitives in English. In *Lacus Forum Xxviii: What Constitutes Evidence in Linguistics?* (pp. 17–31). LACUS.
- Grosjean, F. (1989). Neurolinguists, beware! The bilingual is not two monolinguals in one person. *Brain and Language*, *36*(1), 3–15.
- Gross, M., & Kaushanskaya, M. (2018). Contributions of nonlinguistic task-shifting to language control in bilingual children. *Bilingualism: Language and Cognition*, *21*(1), 181–194.
- Gürel, A. (2004). Selectivity in L2-induced L1 attrition: a psycholinguistic account. *Journal of Neurolinguistics*, *17*(1), 53–78.
- Hakuta, K. (1976). A case study of a Japanese child learning English as a second language. *Language Learning*, *26*(2), 321–351.
- Hakuta, K., & d'Andrea, D. (1992). Some properties of bilingual maintenance and loss in Mexican background high-school students. *Applied Linguistics*, *13*(1), 72–99.
- Hansen, L. (1999). Not a total loss: The Attrition of Japanese Negation over Three Decades. In L. Hansen (Ed.), *Second language attrition in Japanese contexts* (pp. 142–153). Oxford: Oxford University Press.
- Hansen, L., & Chantrill, C. (1999). Literacy as a second language anchor: Evidence from L2 Japanese and L2 Chinese. In *Representation and process: Proceedings of the 3rd Pacific Second Language Research Forum* (Vol. 1, pp. 279–286). Tokyo: Aoyama Gakuin University.
- Hansen, Lynne, Umeda, Y., & McKinney, M. (2002). Savings in the relearning of second language vocabulary: The effects of time and proficiency. *Language Learning*, *52*(4), 653–678. <https://doi.org/10.1111/1467-9922.00200>
- Hansen-Strain, L. (1990). The attrition of Japanese by English-speaking children: An interim report. *Language Sciences*, *12*(4), 367–377.
- Hermans, D. (2004). Between-language identity effects in picture-word interference tasks: A challenge for language-nonspecific or language-specific models of lexical access? *International Journal of Bilingualism*, *8*(2), 115–125.
- Hermans, D., Bongaerts, T., De Bot, K., & Schreuder, R. (1998). Producing words in a foreign language: Can speakers prevent interference from their first language? *Bilingualism: Language and Cognition*, *1*(3), 213–229.
- Hernandez, A. E., Bates, E. A., & Avila, L. X. (1996). Processing across the language boundary: A cross-modal priming study of Spanish-English bilinguals. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *22*(4), 846.

- Hertzog, C., Dixon, R. A., Hulstsch, D. F., & MacDonald, S. W. (2003). Latent change models of adult cognition: Are changes in processing speed and working memory associated with changes in episodic memory? *Psychology and Aging, 18*(4), 755. <https://doi.org/10.1037/0882-7974.18.4.755>
- Hervé, C., & Serratrice, L. (2018). The development of determiners in the context of French–English bilingualism: a study of cross-linguistic influence. *Journal of Child Language, 45*(3), 767–787.
- Hilchey, M. D., & Klein, R. M. (2011). Are there bilingual advantages on nonlinguistic interference tasks? Implications for the plasticity of executive control processes. *Psychonomic Bulletin & Review, 18*(4), 625–658. <https://doi.org/10.3758/s13423-011-0116-7>
- Hinrichs, L., & Szmrecsanyi, B. (2007). Recent changes in the function and frequency of Standard English genitive constructions: A multivariate analysis of tagged corpora. *English Language & Linguistics, 11*(3), 437–474.
- Hoff, E., Core, C., Place, S., Rumiche, R., Señor, M., & Parra, M. (2012). Dual language exposure and early bilingual development. *Journal of Child Language, 39*(1), 1–27.
- Hommel, B., Colzato, L. S., Fischer, R., & Christoffels, I. (2011). Bilingualism and creativity: Benefits in convergent thinking come with losses in divergent thinking. *Frontiers in Psychology, 2*, 273. <https://doi.org/10.3389/fpsyg.2011.00273>
- Hopp, H., & Schmid, M. S. (2013). Perceived foreign accent in first language attrition and second language acquisition: The impact of age of acquisition and bilingualism. *Applied Psycholinguistics, 34*(2), 361–394.
- Hoshino, N., & Kroll, J. F. (2008). Cognate effects in picture naming: Does cross-language activation survive a change of script? *Cognition, 106*(1), 501–511.
- Humphrey, A. D., & Valian, V. V. (2012). Multilingualism and cognitive control: Simon and flanker task performance in monolingual and multilingual young adults. In *53rd Annual meeting of the psychonomic society*.
- Hyltenstam, K. (1992). Non-native features of near-native speakers: On the ultimate attainment of childhood L2 learners. In *Advances in psychology* (Vol. 83, pp. 351–368). Elsevier.
- Hyltenstam, K., Bylund, E., Abrahamsson, N., & Park, H.-S. (2009). Dominant-language replacement: The case of international adoptees. *Bilingualism: Language and Cognition, 12*(2), 121–140.
- Iluz-Cohen, P., & Armon-Lotem, S. (2013). Language proficiency and executive control in bilingual children. *Bilingualism: Language and Cognition, 16*(4), 884–899. <https://doi.org/10.1017/S1366728912000788>
- Ivanov, I. P. (2012). L2 acquisition of Bulgarian clitic doubling: A test case for the Interface Hypothesis. *Second Language Research, 28*(3), 345–368.
- Ivanova, I., & Costa, A. (2008). Does bilingualism hamper lexical access in speech production? *Acta Psychologica, 127*(2), 277–288.
- Jia, G., Kohnert, K., Collado, J., & Aquino-Garcia, F. (2006). Action naming in Spanish and English by sequential bilingual children and adolescents. *Journal of Speech, Language, and Hearing Research, 49*(3), 588–602.
- Jia, R., & Paradis, J. (2015). The use of referring expressions in narratives by Mandarin heritage language children and the role of language environment factors in

- predicting individual differences. *Bilingualism: Language and Cognition*, 18(4), 737–752.
- Johnson, J. S., & Newport, E. L. (1989). Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology*, 21(1), 60–99.
- Jucker, A. (1993). The genitive versus the of-construction in newspaper language. *The Noun Phrase in English. Its Structure and Variability*, 121–136.
- Jylkkä, J., Lehtonen, M., Kuusakoski, A., Lindholm, F., Hut, S. C., & Laine, M. (2018). The role of general executive functions in receptive language switching and monitoring. *Bilingualism: Language and Cognition*, 21(4), 839–855.
- Kail, R. V. (2007). Longitudinal evidence that increases in processing speed and working memory enhance children's reasoning. *Psychological Science*, 18(4), 312.
- Kaltsa, M., Tsimpli, I. M., & Rothman, J. (2015). Exploring the source of differences and similarities in L1 attrition and heritage speaker competence: Evidence from pronominal resolution. *Lingua*, 164, 266–288.
- Kapa, L. L., & Colombo, J. (2013). Attentional control in early and later bilingual children. *Cognitive Development*, 28(3), 233–246. <https://doi.org/10.1016/j.cogdev.2013.01.011>
- Kaushanskaya, M., & Marian, V. (2007). Bilingual language processing and interference in bilinguals: Evidence from eye tracking and picture naming. *Language Learning*, 57(1), 119–163. <https://doi.org/10.1111/j.1467-9922.2007.00401.x>
- Kim, S. H. O., & Starks, D. (2008). The role of emotions in L1 attrition: The case of Korean-English late bilinguals in New Zealand. *International Journal of Bilingualism*, 12(4), 303–319.
- Klecha, A. (2013). Language and task switching in Polish-English bilinguals. *Psychology of Language and Communication*, 17(1), 17–36.
- Klenberg, L., Korkman, M., & Lahti-Nuuttila, P. (2001). Differential development of attention and executive functions in 3-to 12-year-old Finnish children. *Developmental Neuropsychology*, 20(1), 407–428. https://doi.org/10.1207/S15326942DN2001_6
- Kohnert, K. J., & Bates, E. (2002). Balancing bilinguals II: Lexical comprehension and cognitive processing in children learning Spanish and English. *Journal of Speech, Language, and Hearing Research*, 45(2), 347–359.
- Kohnert, K. J., Bates, E., & Hernandez, A. E. (1999). Balancing bilinguals: Lexical-semantic production and cognitive processing in children learning Spanish and English. *Journal of Speech, Language, and Hearing Research*, 42(6), 1400–1413.
- Köpke, B. (2002). Activation thresholds and non-pathological first language attrition. *Advances in the Neurolinguistics of Bilingualism*, 119–142.
- Köpke, B., & Schmid, M. S. (2004). First language attrition: The next phase. In M. S. Keijzer, S. Monika, B. Köpke, & L. Weilemar (Eds.), *First language attrition. Interdisciplinary perspectives on methodological issues* (pp. 1–43). Amsterdam: Benjamins.
- Kray, J., Eber, J., & Lindenberger, U. (2004). Age differences in executive functioning across the lifespan: The role of verbalization in task preparation. *Acta*

- Psychologica*, 115(2–3), 143–165.
<https://doi.org/10.1016/j.actpsy.2003.12.001>
- Kroll, J. F., Bobb, S. C., & Wodniecka, Z. (2006). Language selectivity is the exception, not the rule: Arguments against a fixed locus of language selection in bilingual speech. *Bilingualism: Language and Cognition*, 9(2), 119–135. <https://doi.org/10.1017/S1366728906002483>
- Kroll, J. F., Dijkstra, A., Janssen, N., & Schriefers, H. (2000). Selecting the language in which to speak: Experiments on lexical access in bilingual production. In *41st annual meeting of the Psychonomic Society, New Orleans, LA*.
- Kroll, J. F., & Gollan, T. H. (2014). Speech planning in two languages: What bilinguals tell us about language production. *The Oxford Handbook of Language Production*, 165–181.
- Kroll, J. F., Gullifer, J. W., & Rossi, E. (2013). The multilingual lexicon: The cognitive and neural basis of lexical comprehension and production in two or more languages. *Annual Review of Applied Linguistics*, 33, 102–127.
- Kroll, J. F., & Stewart, E. (1994). Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language*, 33(2), 149–174.
- Kupisch, T. (2007). Determiners in bilingual German–Italian children: What they tell us about the relation between language influence and language dominance. *Bilingualism: Language and Cognition*, 10(1), 57–78.
- Kushalnagar, P., Hannay, H. J., & Hernandez, A. E. (2010). Bilingualism and attention: A study of balanced and unbalanced bilingual deaf users of American Sign Language and English. *Journal of Deaf Studies and Deaf Education*, 15(3), 263–273.
- Lagrou, E., Hartsuiker, R. J., & Duyck, W. (2011). Knowledge of a second language influences auditory word recognition in the native language. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 37(4), 952.
- Leech, G., Francis, B., & Xu, X. (1994). The use of computer corpora in the textual demonstrability of gradience in linguistic categories. *Continuity in Linguistic Semantics*, 19, 57–76.
- Lenneberg, E. H. (1967). The biological foundations of language. *Hospital Practice*, 2(12), 59–67.
- Levelt, W. J. (1989). *Speaking: From intention to articulation* (Vol. 1). Cambridge: MIT press.
- Levelt, W. J. (1999). Models of word production. *Trends in Cognitive Sciences*, 3(6), 223–232.
- Levelt, W. J., Roelofs, A., & Meyer, A. S. (1999). A theory of lexical access in speech production. *Behavioral and Brain Sciences*, 22(1), 1–38.
- Linck, J. A., Kroll, J. F., & Sunderman, G. (2009). Losing access to the native language while immersed in a second language: Evidence for the role of inhibition in second-language learning. *Psychological Science*, 20(12), 1507–1515.
- Linck, J. A., Schwieter, J. W., & Sunderman, G. (2012). Inhibitory control predicts language switching performance in trilingual speech production. *Bilingualism: Language and Cognition*, 15(3), 651–662.
- Liu, H., Fan, N., Rossi, S., Yao, P., & Chen, B. (2016). The effect of cognitive flexibility on task switching and language switching. *International Journal of Bilingualism*, 20(5), 563–579.

- Liu, H., Rossi, S., Zhou, H., & Chen, B. (2014). Electrophysiological evidence for domain-general inhibitory control during bilingual language switching. *PloS One*, *9*(10), e110887.
- Lucenet, J., & Blaye, A. (2014). Age-related changes in the temporal dynamics of executive control: a study in 5-and 6-year-old children. *Frontiers in Psychology*, *5*, 831.
- Luciana, M., Conklin, H. M., Hooper, C. J., & Yarger, R. S. (2005). The development of nonverbal working memory and executive control processes in adolescents. *Child Development*, *76*(3), 697–712. <https://doi.org/10.1111/j.1467-8624.2005.00872.x>
- Luk, G., De Sa, E., & Bialystok, E. (2011). Is there a relation between onset age of bilingualism and enhancement of cognitive control? *Bilingualism: Language and Cognition*, *14*(4), 588–595. <https://doi.org/10.1017/S1366728911000010>
- Luk, Z. P., & Shirai, Y. (2009). Is the acquisition order of grammatical morphemes impervious to L1 knowledge? Evidence from the acquisition of plural-s, articles, and possessive's. *Language Learning*, *59*(4), 721–754.
- Luz, C., Rodrigues, L. P., & Cordovil, R. (2015). The relationship between motor coordination and executive functions in 4th grade children. *European Journal of Developmental Psychology*, *12*(2), 129–141. <https://doi.org/10.1080/17405629.2014.966073>
- Macizo, P., Bajo, T., & Paolieri, D. (2012). Language switching and language competition. *Second Language Research*, *28*(2), 131–149.
- Mahone, E. M., Koth, C. W., Cutting, L., Singer, H. S., & Denckla, M. B. (2001). Executive function in fluency and recall measures among children with Tourette syndrome or ADHD. *Journal of the International Neuropsychological Society*, *7*(1), 102–111.
- Marian, V., Spivey, M., & Hirsch, J. (2003). Shared and separate systems in bilingual language processing: Converging evidence from eyetracking and brain imaging. *Brain and Language*, *86*(1), 70–82. [https://doi.org/10.1016/S0093-934X\(02\)00535-7](https://doi.org/10.1016/S0093-934X(02)00535-7)
- Martin-Rhee, M. M., & Bialystok, E. (2008). The development of two types of inhibitory control in monolingual and bilingual children. *Bilingualism: Language and Cognition*, *11*(1), 81–93. <https://doi.org/10.1017/S1366728907003227>
- McAuley, T., & White, D. A. (2011). A latent variables examination of processing speed, response inhibition, and working memory during typical development. *Journal of Experimental Child Psychology*, *108*(3), 453–468. <https://doi.org/10.1016/j.jecp.2010.08.009>
- Meisel, J. M. (2018). On first language attrition in second language learners. *Linguistic Approaches to Bilingualism*, *7*(6), 734–738.
- Meuter, R. F., & Allport, A. (1999). Bilingual language switching in naming: Asymmetrical costs of language selection. *Journal of Memory and Language*, *40*(1), 25–40.
- Michael, E. B., & Gollan, T. H. (2005). Being and becoming bilingual. *Handbook of Bilingualism: Psycholinguistic Approaches*, 389–407.
- Misra, M., Guo, T., Bobb, S. C., & Kroll, J. F. (2012). When bilinguals choose a single word to speak: Electrophysiological evidence for inhibition of the native language. *Journal of Memory and Language*, *67*(1), 224–237.

- Miyake, A., & Friedman, N. P. (2012). The nature and organization of individual differences in executive functions: Four general conclusions. *Current Directions in Psychological Science*, 21(1), 8–14.
- Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex “frontal lobe” tasks: A latent variable analysis. *Cognitive Psychology*, 41(1), 49–100. <https://doi.org/10.1006/cogp.1999.0734>
- Montrul, S. (2004). Subject and object expression in Spanish heritage speakers: A case of morphosyntactic convergence. *Bilingualism: Language and Cognition*, 7(2), 125–142.
- Montrul, S. (2008). *Incomplete acquisition in bilingualism: Re-examining the age factor* (Vol. 39). John Benjamins Publishing.
- Montrul, S., Davidson, J., De La Fuente, I., & Foote, R. (2014). Early language experience facilitates the processing of gender agreement in Spanish heritage speakers. *Bilingualism: Language and Cognition*, 17(1), 118–138.
- Montrul, S., & Louro, C. R. (2006). Beyond the syntax of the null subject parameter. In V. Torrens & L. Escobar, *The acquisition of syntax in Romance languages : a look at the discourse-pragmatic distribution of null and overt subjects by L2 learners of Spanish* (pp. 401–418).
- Morales, J., Calvo, A., & Bialystok, E. (2013). Working memory development in monolingual and bilingual children. *Journal of Experimental Child Psychology*, 114(2), 187–202. <https://doi.org/10.1016/j.jecp.2012.09.002>
- Mosca, M., & Clahsen, H. (2016). Examining language switching in bilinguals: The role of preparation time. *Bilingualism: Language and Cognition*, 19(2), 415–424.
- Mulder, H., Pitchford, N. J., Hagger, M. S., & Marlow, N. (2009). Development of executive function and attention in preterm children: a systematic review. *Developmental Neuropsychology*, 34(4), 393–421. <https://doi.org/10.1080/87565640902964524>
- Müller, N., & Hulk, A. (2001). Crosslinguistic influence in bilingual language acquisition: Italian and French as recipient languages. *Bilingualism: Language and Cognition*, 4(1), 1–21.
- Nagasawa, S. (1999). Learning and losing Japanese as a second language: A multiple case study of American university students. In L. Hansen (Ed.), *Second language attrition in Japanese contexts* (pp. 169–200). Oxford: Oxford University Press.
- Nettelbeck, T., & Burns, N. R. (2010). Processing speed, working memory and reasoning ability from childhood to old age. *Personality and Individual Differences*, 48(4), 379–384. <https://doi.org/10.1016/j.paid.2009.10.032>
- Nicoladis, E. (1999). “Where is my brush-teeth?” Acquisition of compound nouns in a French–English bilingual child. *Bilingualism: Language and Cognition*, 2(3), 245–256.
- Nicoladis, E. (2002). What’s the difference between ‘toilet paper’ and ‘paper toilet’? French-English bilingual children’s crosslinguistic transfer in compound nouns. *Journal of Child Language*, 29(4), 843–863.
- Nicoladis, E. (2003). Cross-linguistic transfer in deverbal compounds of preschool bilingual children. *Bilingualism: Language and Cognition*, 6(1), 17–31.

- Nicoladis, E. (2012). Cross-linguistic influence in French–English bilingual children’s possessive constructions. *Bilingualism: Language and Cognition*, 15(2), 320–328.
- Nicoladis, E. (2015). Measuring language dominance in bilingual children: Implications for crosslinguistic influence. In C. Silva-Corvalán & J. Treffers-Daller (Eds.), *Language dominance in bilinguals: Issues of measurement and operationalization* (pp. 219–234). Cambridge: Cambridge University Press.
- Nicoladis, E., Palmer, A., & Marentette, P. (2007). The role of type and token frequency in using past tense morphemes correctly. *Developmental Science*, 10(2), 237–254.
- Nicolay, A.-C., & Poncelet, M. (2013). Cognitive abilities underlying second-language vocabulary acquisition in an early second-language immersion education context: A longitudinal study. *Journal of Experimental Child Psychology*, 115(4), 655–671.
- Nuibe, Y. (1986). A report on the development of the grammatical morphemes in Japanese junior high school students learning English as a foreign language. *Kyoiku Kagaku [Educational Science]*, 28(2), 371–381.
- Oller, D. K., Pearson, B. Z., & Cobo-Lewis, A. B. (2007). Profile effects in early bilingual language and literacy. *Applied Psycholinguistics*, 28(2), 191–230.
- Orfanidou, E., & Sumner, P. (2005). Language switching and the effects of orthographic specificity and response repetition. *Memory & Cognition*, 33(2), 355–369.
- Oyama, S. (1976). A sensitive period for the acquisition of a nonnative phonological system. *Journal of Psycholinguistic Research*, 5(3), 261–283.
- Paap, K. R., & Greenberg, Z. I. (2013). There is no coherent evidence for a bilingual advantage in executive processing. *Cognitive Psychology*, 66(2), 232–258.
- Paap, K. R., Johnson, H. A., & Sawi, O. (2014). Are bilingual advantages dependent upon specific tasks or specific bilingual experiences? *Journal of Cognitive Psychology*, 26(6), 615–639. <https://doi.org/10.1080/20445911.2014.944914>
- Paap, K. R., Johnson, H. A., & Sawi, O. (2015). Bilingual advantages in executive functioning either do not exist or are restricted to very specific and undetermined circumstances. *Cortex*, 69, 265–278.
- Pallier, C., Dehaene, S., Poline, J.-B., LeBihan, D., Argenti, A.-M., Dupoux, E., & Mehler, J. (2003). Brain imaging of language plasticity in adopted adults: Can a second language replace the first? *Cerebral Cortex*, 13(2), 155–161.
- Paradis, J. (2001). Do bilingual two-year-olds have separate phonological systems? *International Journal of Bilingualism*, 5(1), 19–38.
- Paradis, J., & Navarro, S. (2003). Subject realization and crosslinguistic interference in the bilingual acquisition of Spanish and English: What is the role of the input? *Journal of Child Language*, 30(2), 371–393.
- Paradis, J., Nicoladis, E., Crago, M., & Genesee, F. (2011). Bilingual children’s acquisition of the past tense: A usage-based approach. *Journal of Child Language*, 38(3), 554–578.
- Paradis, M. (1993). Linguistic, psycholinguistic, and neurolinguistic aspects of "interference" in bilingual speakers: The activation threshold hypothesis. *International Journal of Psycholinguistics*.
- Park, H.-S. (2015). Korean adoptees in Sweden: Have they lost their first language completely? *Applied Psycholinguistics*, 36(4), 773–797.

- Pavlenko, A. (2009). *The bilingual mental lexicon: Interdisciplinary approaches* (Vol. 70). Multilingual Matters.
- Pelc, L. A. (2001). *L1 lexical, morphological and morphosyntactic attrition in Greek-English bilinguals*. City University of New York.
- Pelham, S. D., & Abrams, L. (2014). Cognitive advantages and disadvantages in early and late bilinguals. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *40*(2), 313. <http://dx.doi.org/10.1037/a0035224>
- Philipp, A. M., Gade, M., & Koch, I. (2007). Inhibitory processes in language switching: Evidence from switching language-defined response sets. *European Journal of Cognitive Psychology*, *19*(3), 395–416.
- Poarch, G. J., & Van Hell, J. G. (2012). Cross-language activation in children's speech production: Evidence from second language learners, bilinguals, and trilinguals. *Journal of Experimental Child Psychology*, *111*(3), 419–438.
- Poarch, G. J., & van Hell, J. G. (2012). Executive functions and inhibitory control in multilingual children: Evidence from second-language learners, bilinguals, and trilinguals. *Journal of Experimental Child Psychology*, *113*(4), 535–551. <https://doi.org/10.1016/j.jecp.2012.06.013>
- Polinsky, M. (2008). Gender under incomplete acquisition: Heritage speakers' knowledge of noun categorization. *Heritage Language Journal*, *6*(1), 40–71.
- Poullisse, N., & Bongaerts, T. (1994). First language use in second language production. *Applied Linguistics*, *15*(1), 36–57.
- Prior, A., & Gollan, T. H. (2011). Good language-switchers are good task-switchers: Evidence from Spanish–English and Mandarin–English bilinguals. *Journal of the International Neuropsychological Society*, *17*(4), 682–691. <https://doi.org/10.1017/S1355617711000580>
- Prior, A., & MacWhinney, B. (2010). A bilingual advantage in task switching. *Bilingualism: Language and Cognition*, *13*(2), 253–262.
- Protopapas, A. (2007). Check Vocal: A program to facilitate checking the accuracy and response time of vocal responses from DMDX. *Behavior Research Methods*, *39*(4), 859–862.
- Psychology Software Tools. (2016). *E-Prime 3.0*. Pennsylvania, USA. Retrieved from <http://www.pstnet.com>
- Purić, D., Vuksanović, J., & Chondrogianni, V. (2017). Cognitive advantages of immersion education after 1 year: Effects of amount of exposure. *Journal of Experimental Child Psychology*, *159*, 296–309. <https://doi.org/10.1016/j.jecp.2017.02.011>
- Pyers, J. E., Gollan, T. H., & Emmorey, K. (2009). Bimodal bilinguals reveal the source of tip-of-the-tongue states. *Cognition*, *112*(2), 323–329.
- R Core Team. (2013). *R: A language and environment for statistical computing* [R]. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from <http://www.R-project.org/>
- Reetz-Kurashige, A. (1999). Japanese returnees' retention of English-speaking skills: Changes in verb usage over time. In L. Hansen (Ed.), *Second language attrition in Japanese contexts* (pp. 21–58). Oxford: Oxford University Press.
- Ridderinkhof, K. R., & van der Molen, M. W. (1995). A psychophysiological analysis of developmental differences in the ability to resist interference. *Child Development*, *66*(4), 1040–1056. <https://doi.org/10.1111/j.1467-8624.1995.tb00921.x>

- Romine, C. B., & Reynolds, C. R. (2005). A model of the development of frontal lobe functioning: Findings from a meta-analysis. *Applied Neuropsychology*, 12(4), 190–201.
- Rosenbach, A. (2001). The English s-genitive: Animacy, topicality, and possessive relationship in a diachronic perspective. *Amsterdam Studies in the Theory and History of Linguistic Science Series 4*, 277–292.
- Rosenbach, A. (2003). Aspects of iconicity and economy in the choice between the s-genitive and the of-genitive in English. *Determinants of Grammatical Variation in English*, 379412.
- Rosenbach, A. (2005). Animacy versus weight as determinants of grammatical variation in English. *Language*, 613–644.
- Rosenbach, A. (2012). *Genitive variation in English: Conceptual factors in synchronic and diachronic studies* (Vol. 42). Walter de Gruyter.
- Rosenbach, A. (2014). English genitive variation—the state of the art. *English Language & Linguistics*, 18(2), 215–262.
- Rosselli, M., Ardila, A., Lalwani, L. N., & Vélez-Urbe, I. (2016). The effect of language proficiency on executive functions in balanced and unbalanced Spanish–English bilinguals. *Bilingualism: Language and Cognition*, 19(3), 489–503. <https://doi.org/10.1017/S1366728915000309>
- Rothman, J. (2009). Pragmatic deficits with syntactic consequences?: L2 pronominal subjects and the syntax–pragmatics interface. *Journal of Pragmatics*, 41(5), 951–973.
- Salthouse, T. A. (1991). Mediation of adult age differences in cognition by reductions in working memory and speed of processing. *Psychological Science*, 2(3), 179–183. <https://doi.org/10.1111/j.1467-9280.1991.tb00127.x>
- Salthouse, T. A. (1992). Influence of processing speed on adult age differences in working memory. *Acta Psychologica*, 79(2), 155–170.
- Salthouse, T. A. (2005). Relations between cognitive abilities and measures of executive functioning. *Neuropsychology*, 19(4), 532. <http://dx.doi.org/10.1037/0894-4105.19.4.532>
- Sandoval, T. C., Gollan, T. H., Ferreira, V. S., & Salmon, D. P. (2010). What causes the bilingual disadvantage in verbal fluency? The dual-task analogy. *Bilingualism: Language and Cognition*, 13(2), 231–252.
- Sauzón, H., Raboutet, C., Rodrigues, J., Langevin, S., Schelstraete, M.-A., Feyereisen, P., ... N'Kaoua, B. (2011). Verbal knowledge as a compensation determinant of adult age differences in verbal fluency tasks over time. *Journal of Adult Development*, 18(3), 144–154.
- Schmid, M. S. (Forthcoming). Frequency and recency – the impact of amount of use and length of residence on L1 attrition. In B. Köpke & M. S. Schmid (Eds.), *The Oxford handbook of language attrition*. Oxford: Oxford University Press.
- Schmid, M. S. (2002). *First-Language Attrition, Use, and Maintenance*. Amsterdam: John Benjamins.
- Schmid, M. S., & Dusseldorp, E. (2010). Quantitative analyses in a multivariate study of language attrition: The impact of extralinguistic factors. *Second Language Research*, 26(1), 125–160.
- Schmid, M. S., & Jarvis, S. (2014). Lexical access and lexical diversity in first language attrition. *Bilingualism: Language and Cognition*, 17(4), 729–748.

- Schmid, M. S., & Keijzer, M. (2009). First language attrition and reversion among older migrants. *International Journal of the Sociology of Language*, 2009(200), 83–101.
- Schmid, M. S., & Köpke, B. (2017). The relevance of first language attrition to theories of bilingual development. *Linguistic Approaches to Bilingualism*, (7), 637–667.
- Schmid, M. S., & Mehotcheva, T. (2012). Foreign language attrition. *Dutch Journal of Applied Linguistics*, 1(1), 102–124.
- Schmid, M. S., & Yilmaz, G. (2018). Predictors of language dominance: an integrated analysis of first language attrition and second language acquisition in late bilinguals. *Frontiers in Psychology*, 9.
- Schmitt, E. (2010). When boundaries are crossed: Evaluating language attrition data from two perspectives. *Bilingualism: Language and Cognition*, 13(1), 63–72.
- Schwartz, A. I., Kroll, J. F., & Diaz, M. (2007). Reading words in Spanish and English: Mapping orthography to phonology in two languages. *Language and Cognitive Processes*, 22(1), 106–129.
- Schwietzer, J. W., & Sunderman, G. (2008). Language switching in bilingual speech production: In search of the language-specific selection mechanism. *The Mental Lexicon*, 3(2), 214–238.
- Serratrice, L. (2007). Cross-linguistic influence in the interpretation of anaphoric and cataphoric pronouns in English–Italian bilingual children. *Bilingualism: Language and Cognition*, 10(3), 225–238.
- Serratrice, L., Sorace, A., Filiaci, F., & Baldo, M. (2009). Bilingual children’s sensitivity to specificity and genericity: Evidence from metalinguistic awareness. *Bilingualism: Language and Cognition*, 12(2), 239–257.
- Serratrice, L., Sorace, A., Filiaci, F., & Baldo, M. (2012). Pronominal objects in English–Italian and Spanish–Italian bilingual children. *Applied Psycholinguistics*, 33(4), 725–751.
- Serratrice, L., Sorace, A., & Paoli, S. (2004). Crosslinguistic influence at the syntax–pragmatics interface: Subjects and objects in English–Italian bilingual and monolingual acquisition. *Bilingualism: Language and Cognition*, 7(3), 183–205.
- Shao, Z., Janse, E., Visser, K., & Meyer, A. S. (2014). What do verbal fluency tasks measure? Predictors of verbal fluency performance in older adults. *Frontiers in Psychology*, 5, 772.
- Shirahata, T. (1988). The learning order of English grammatical morphemes by Japanese high school students. *JACET Bulletin*, (19), 83–102.
- Silva-Corvalán, C. (1994). The gradual loss of mood distinctions in Los Angeles Spanish. *Language Variation and Change*, 6(3), 255–272.
- Singh, N., & Mishra, R. K. (2013). Second language proficiency modulates conflict-monitoring in an oculomotor Stroop task: evidence from Hindi-English bilinguals. *Frontiers in Psychology*, 4, 322. <https://doi.org/10.3389/fpsyg.2013.00322>
- Skarabela, B., & Serratrice, L. (2009). The doctor’s mother’or ‘the mother of the doctor’?: Syntactic priming of possessive noun phrases in English preschoolers. In *Online Supplement of the Proceedings of the Boston University Conference on Language Development*.
- Slabakova, R. (2006). Is there a critical period for semantics? *Second Language Research*, 22(3), 302–338.

- Sorace, A. (2004). Native language attrition and developmental instability at the syntax-discourse interface: Data, interpretations and methods. *Bilingualism: Language and Cognition*, 7(2), 143–145.
- Sorace, A. (2011). Pinning down the concept of “interface” in bilingualism. *Linguistic Approaches to Bilingualism*, 1(1), 1–33.
- Sorace, A., & Filiaci, F. (2006). Anaphora resolution in near-native speakers of Italian. *Second Language Research*, 22(3), 339–368.
- Sorace, A., & Serratrice, L. (2009). Internal and external interfaces in bilingual language development: Beyond structural overlap. *International Journal of Bilingualism*, 13(2), 195–210.
- Sorace, A., Serratrice, L., Filiaci, F., & Baldo, M. (2009). Discourse conditions on subject pronoun realization: Testing the linguistic intuitions of older bilingual children. *Lingua*, 119(3), 460–477.
- Soveri, A., Rodriguez-Fornells, A., & Laine, M. (2011). Is there a relationship between language switching and executive functions in bilingualism? Introducing a within group analysis approach. *Frontiers in Psychology*, 2, 183. <https://doi.org/10.3389/fpsyg.2011.00183>
- Stefanowitsch, A. (2003). Constructional semantics as a limit to grammatical alternation: The two genitives of English. *Topics in English Linguistics*, 43, 413–444.
- Tao, L., Marzecová, A., Taft, M., Asanowicz, D., & Wodniecka, Z. (2011). The efficiency of attentional networks in early and late bilinguals: the role of age of acquisition. *Frontiers in Psychology*, 2, 123. <https://doi.org/10.3389/fpsyg.2011.00123>
- Tao, L., Taft, M., & Gollan, T. H. (2015). The bilingual switching advantage: Sometimes related to bilingual proficiency, sometimes not. *Journal of the International Neuropsychological Society*, 21(7), 531–544. <https://doi.org/10.1017/S1355617715000521>
- Teramura, H. (1991). *Syntax and semantics in Japanese*. Tokyo: Kurocio Publishers.
- Thomas, M. S., & Allport, A. (2000). Language switching costs in bilingual visual word recognition. *Journal of Memory and Language*, 43(1), 44–66.
- Thomas-Sunesson, D., Hakuta, K., & Bialystok, E. (2018). Degree of bilingualism modifies executive control in Hispanic children in the USA. *International Journal of Bilingual Education and Bilingualism*, 21(2), 197–206. <https://doi.org/10.1080/13670050.2016.1148114>
- Thordardottir, E. (2011). The relationship between bilingual exposure and vocabulary development. *International Journal of Bilingualism*, 15(4), 426–445.
- Tomiyama, M. (1999). The first stage of second language attrition: A case study of a Japanese returnee. In L. Hansen (Ed.), *Second language attrition in Japanese contexts* (pp. 59–79). Oxford: Oxford University Press.
- Tomiyama, M. (2000). Child second language attrition: A longitudinal case study. *Applied Linguistics*, 21(3), 304–332.
- Tomiyama, M. (2008). Age and proficiency in L2 attrition: Data from two siblings. *Applied Linguistics*, 30(2), 253–275.
- Tran, C. D., Arrendono, M. M., & Yoshida, H. (2018). Early executive function: The influence of culture and bilingualism. *Bilingualism: Language and Cognition*, 1–19. <https://doi.org/10.1017/S1366728918000160>

- Treffers-Daller, J., & Silva-Corvalán, C. (2015). *Language dominance in bilinguals: Issues of measurement and operationalization*. Cambridge University Press.
- Tsimpli, I., Sorace, A., Heycock, C., & Filiaci, F. (2004). First language attrition and syntactic subjects: A study of Greek and Italian near-native speakers of English. *International Journal of Bilingualism*, 8(3), 257–277.
- Unsworth, S. (2014). Comparing the role of input in bilingual acquisition across domains. *Input and Experience in Bilingual Development*, 181–201.
- Unsworth, S. (2016a). Early child L2 acquisition: Age or input effects? Neither, or both? *Journal of Child Language*, 43(3), 608–634.
- Unsworth, S. (2016b). Quantity and quality of language input in bilingual language development. In E. Nicoladis & S. Montanari (Eds.), *Bilingualism across the lifespan: Factors moderating language proficiency* (pp. 103–122). Berlin: Mouton de Gruyter.
- Van den Wildenberg, W. P., & Van Der Molen, M. W. (2004). Developmental trends in simple and selective inhibition of compatible and incompatible responses. *Journal of Experimental Child Psychology*, 87(3), 201–220.
- Van Heuven, W. J., Dijkstra, T., & Grainger, J. (1998). Orthographic neighborhood effects in bilingual word recognition. *Journal of Memory and Language*, 39(3), 458–483.
- Vega, C., & Fernandez, M. (2010). Errors on the WCST correlate with language proficiency scores in Spanish-English bilingual children. *Archives of Clinical Neuropsychology*, 26(2), 158–164.
- Vega-Mendoza, M., West, H., Sorace, A., & Bak, T. H. (2015). The impact of late, non-balanced bilingualism on cognitive performance. *Cognition*, 137, 40–46.
- Ventureyra, V. A., Pallier, C., & Yoo, H.-Y. (2004). The loss of first language phonetic perception in adopted Koreans. *Journal of Neurolinguistics*, 17(1), 79–91.
- Verhoef, K., Roelofs, A., & Chwilla, D. J. (2009). Role of inhibition in language switching: Evidence from event-related brain potentials in overt picture naming. *Cognition*, 110(1), 84–99.
- Verreyt, N., Woumans, E. V. Y., Vandelandotte, D., Szmalec, A., & Duyck, W. (2016). The influence of language-switching experience on the bilingual executive control advantage. *Bilingualism: Language and Cognition*, 19(1), 181–190. <https://doi.org/10.1017/S1366728914000352>
- Weissberger, G. H., Gollan, T. H., Bondi, M. W., Clark, L. R., & Wierenga, C. E. (2015). Language and task switching in the bilingual brain: Bilinguals are staying, not switching, experts. *Neuropsychologia*, 66, 193–203.
- Weissberger, G. H., Wierenga, C. E., Bondi, M. W., & Gollan, T. H. (2012). Partially overlapping mechanisms of language and task control in young and older bilinguals. *Psychology and Aging*, 27(4), 959.
- Wilson, F., Sorace, A., & Keller, F. (2009). Antecedent preferences for anaphoric demonstratives in L2 German. In *Proceedings of the 33rd Annual Boston University Conference on Language Development* (pp. 634–645). Somerville, MA: Cascadilla Press.
- Wolk, C., Bresnan, J., Rosenbach, A., & Szmrecsanyi, B. (2013). Dative and genitive variability in Late Modern English: Exploring cross-constructural variation and change. *Diachronica*, 30(3), 382–419.

- Woumans, E., Surmont, J., Struys, E., & Duyck, W. (2016). The longitudinal effect of bilingual immersion schooling on cognitive control and intelligence. *Language Learning*, 66(S2), 76–91. <https://doi.org/10.1111/lang.12171>
- Xie, Z., & Pisano, T. S. (2018). Second language (L2) proficiency, socioeconomic status (SES), and intelligence (IQ) are significant predictors of cognitive control differences among young adult unbalanced Chinese–English bilinguals. *Bilingualism: Language and Cognition*, 1–17. <https://doi.org/10.1017/S1366728918000822>
- Yan, S., & Nicoladis, E. (2009). Finding le mot juste: Differences between bilingual and monolingual children’s lexical access in comprehension and production. *Bilingualism: Language and Cognition*, 12(3), 323–335.
- Yeni-Komshian, G. H., Flege, J. E., & Liu, S. (2000). Pronunciation proficiency in the first and second languages of Korean–English bilinguals. *Bilingualism: Language and Cognition*, 3(2), 131–149.
- Yilmaz, G., & Schmid, M. S. (2012). L1 accessibility among Turkish-Dutch bilinguals. *The Mental Lexicon*, 7(3), 249–274.
- Yim, O., & Bialystok, E. (2012). Degree of conversational code-switching enhances verbal task switching in Cantonese–English bilinguals. *Bilingualism: Language and Cognition*, 15(4), 873–883.
- Yip, V., & Matthews, S. (2000). Syntactic transfer in a Cantonese–English bilingual child. *Bilingualism: Language and Cognition*, 3(3), 193–208.
- Yoshitomi, A. (1999). On the loss of English as a second language by Japanese returnee children. In L. Hansen (Ed.), *Second language attrition in Japanese contexts* (pp. 80–111). Oxford: Oxford University Press.
- Yow, W. Q., & Li, X. (2015). Balanced bilingualism and early age of second language acquisition as the underlying mechanisms of a bilingual executive control advantage: why variations in bilingual experiences matter. *Frontiers in Psychology*, 6, 164. <https://doi.org/10.3389/fpsyg.2015.00164>