Reframing Differences: The Dialect Variations in the Phonological Development of Canadian Bilingual Children who Speak French

By

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Abstract

Introduction: Canada's French-English bilingual population is increasing, including the number of individuals outside of Québec who speak French. These individuals make up Official Language Minority Communities (OLMCs) which refer to Canadians who speak French and live outside of Québec, and Canadians who speak English and live in Québec. Children who are part of OLMCs are often bilingual. Following best practice in speech-language pathology, these children should be assessed for speech and language delays in both French and English. Unfortunately, limited reference data exists for children who speak French in Canada, and even less so for those part of OLMCs across Canada where a broad range of dialects exist. A better understanding of age-related phonological development and differences in OLMC populations is needed to fill the gap in the literature and to provide appropriate services to these children.

Objective: The purpose of this research study is to investigate the variations of French phonological development in typically developing four-year old bilingual children in OLMCs. This project captures the broad range of dialectal variations across the country through various analyses.

Method: Data from 51 children from Edmonton, Winnipeg, Montréal, and Québec City were analyzed. The Évaluation sommaire de la phonologie chez les enfants d'âge préscolaire (ESPP) captured the phonological abilities of those children in French. Independent, relational and statistical analyses were conducted to obtain phonological inventories, Percent Consonant Correct (PCC) by site, position, and shared/unshared French-English sounds, as well as phonological patterns from children in Québec City and Winnipeg.

Results: Children from OLMCs had similar phonological inventories overall and by word position, similar PCC by position, and all had higher shared French-English phonemes as compared to French specific consonants. Québec City had significantly lower global PCC compared to Edmonton and Montréal. The phonological pattern analysis provided insight on possible dialectal variations in Winnipeg and Québec City including aspiration and voicing errors.

Implications: This study provides phonological reference data for children in various provinces for speech-language pathologists (SLPs) to refer to when assessing for language difference or disorder. The results from this study indicate that children from various provinces have common patterns of phonological acquisition. Differences in PCC are present and may depend on several factors, including language exposure and level of transcription. Phonological pattern analysis provided preliminary data on allophonic and dialectical variations present in Québec City and Winnipeg.

Preface

This thesis is an original work by Émilie Lefebvre. The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board 2, Project Name "Islands and Peninsulas: Speech and language skills of 4-year-old children in Language Minority Communities", ID: Pro00104392, October 29, 2020.

Some of the research conducted for this thesis forms part of a national research collaboration, namely the data collection led by Dr. Andrea MacLeod at the University of Alberta and at the University of Montréal. The literature review, data analysis, discussion and conclusion sections of this paper are my original work. A condensed version of this manuscript will be submitted for publication to a journal following the thesis defense.

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Glossary of Terms

1. **Bilingualism**: The mastery and use of more than one language (Lleó, 2016).
2. **Broad transcription** (also known as phonemic transcription): Does not capture many details, but enough to differentiate between the pronunciation of other words in a language.
3. **L1**: First language.
4. **L2**: Second language.
5. **Narrow transcription** (also known as phonetic/allophonic transcription): Captures as many details as possible using diacritics in the pronunciation of words and sounds.
6. **Phonemes**: The smallest unit of a sound to distinguish the meaning of a word from another, e.g., /p/ in "pat".
7. **Phonetics**: The classification of speech sounds according to their physical aspects, including production, transmission, and perceptual characteristics.
8. **Phonetic inventory:** Sounds able to be produced regardless of correctness as compared to target. Motor ability to produce sounds.
9. **Phonology**: The abstract organization of sound patterns in a language into contrastive units to bring meaning to sound.
10. **Phonological inventory**: Correct production of sounds as compared to target productions.
11. **Sequential bilinguals**: The development of a language following the acquisition of a first language.
12. **Simultaneous bilinguals**: The development and acquisition of two or more languages from birth.

Introduction

In addition to the historical French-English communities across Canada, there has been a gradual rise in the bilingual French-English population, including those who speak French outside of Québec (Lachapelle & Lepage, 2006). It is common for individuals from across the country to relocate, for instance due to professional obligations, and settle down in different linguistic environments. Together, these individuals make up Official Language Minority Communities (OLMCs) which refer to Canadians who speak French and live outside of Québec, and Canadians who speak English and live in Québec. Members of OLMCs report higher rates of bilingualism than other Canadians (Turcotte, 2019) as they adjust to their different linguistic environments. Children raised in these communities often learn to speak both French and English in different settings, speaking one language in a particular environment, such as school, and the other language spoken in the home.

Despite the gradual rise of bilingual French-English children within the Canadian population (Lachapelle & Lepage, 2006), there is limited literature reporting on the language acquisition of bilingual children who speak French outside of Québec. The lack of data poses a problem for speech-language pathologists: following best practice, bilingual children should be assessed in both languages to obtain a complete evaluation of their language competences (ASHA, 1985; ASHA, 2004; Fabiano, 2007; Paradis, Emmerzael, & Duncan, 2010; Thordardottir et al., 2006). Unfortunately, bilingual services are limited for children in OLMCs due to a lack of representative data, resources, and bilingual professionals. In addition, the difference in phonology of Canadian French across bilingual contexts and regions further complicates the difficult task of adequately capturing the broad range of dialect variations in the literature. The lack of normative or reference data that takes into account regional variation may lead to a misdiagnosed communication disorder, and subsequently result in a lack of access to speech-language pathology services (MacLeod & McCauley, 2003). This problem highlights the need for more comprehensive research that documents regional variation in French spoken by young bilingual children. Here, we expand on previous research examining the language development of bilingual children and the dialect variations present within the French language across Canada, to explore the phonological development of bilingual Canadian children who speak French.

Bilingual Language and Phonological Development

Research on bilingual language development is important as it may shed light on the capacity of human language acquisition (Hoff, 2014). However, research on bilingualism is relatively new as compared to monolingual research (Bhatia & Ritchie, 1999). The heterogeneity of bilinguals makes studying dual language acquisition difficult. The unique contexts of bilinguals include the difference in the amount of exposure in each language, reading, and the social context in which they hear their languages (Genesee, 2009; MacLeod & Fabiano-Smith, 2015). These complicating factors are compounded further when considering bilinguals in OLMCs.

Early views on bilingualism reflected negative societal opinions regarding bilingual immigrants as they were seen as having a lower IQ (see for review, Hakuta, 1986). Psychologists followed the Limited Capacity Hypothesis which stated that children had a limited capacity for language learning. This hypothesis claimed that if language acquisition was spread between two languages, it would cause delays and negatively influence cognition and language abilities (Hakuta, 1986). The negative connotations of bilingualism persisted for several decades until Peal and Lambert (1962) released a study that changed the perspective surrounding bilingualism.

The authors examined French-English bilingual children in Montréal and found that bilinguals performed significantly better than monolinguals on both verbal and nonverbal intelligence tests, leading to the belief that dual language competencies improved cognitive abilities (Peal & Lambert, 1962). This study was pivotal for the field of bilingualism as it demonstrated the positive consequences of bilingualism on non-linguistic cognitive abilities (Peal & Lambert, 1962). It is now believed that dual language learners have a bilingual advantage as compared to monolinguals as they have a broader linguistic representation, allowing them to distinguish and acquire a large range of phonemes from a young age (Abboub et al., 2015, Bialystok et al., 2003).

Debates about the existence of unity or dual linguistic representations in young bilingual children have persisted for years. The Unitary Systems Hypothesis (Volterra & Taeschner, 1978) asserts that children have a unified lexicon and linguistic representation until 2 to 3 years of age, after which it undergoes separation into a dual system. This view is no longer supported as subsequent evidence has emerged supporting the Dual System Hypothesis. This model claims that children construct separate linguistic representations when presented with dual language input (Genesee et al., 2004). Evidence for the dual model includes the presence of language-specific word order in early word combinations, and language-specific speech perception and word segmentation strategies, which confirm the mutual exclusivity of representation systems (Genesee et al., 2004). The Dual System Hypothesis is largely accepted by researchers today.

Several theories and models have attempted to explain the abstract concept of bilingual language development and bilingual phonological development. Among them is the Universal Hypothesis, proposed by Jakobson (1968). This theory stated that phonological systems were similar across children and languages during development. The Universal Hypothesis did not leave room for individual differences in phonological acquisition within and between languages, and was ultimately contraindicated by the findings of Ferguson and Farwell (1975) that found differences in children's phonologies at identical time points. The authors suggested that children build their own phonologies based on word forms previously acquired (Ferguson and Farwell, 1975). Further evidence for a dual phonological system include language-specific differences found at the phoneme level which can affect the rate of phonological acquisition and the types of phonological errors (Fabiano-Smith & Goldstein, 2010). Additionally, Paradis (2001) found evidence for separate phonological systems in two year old bilingual children using a non-word repetition task in both languages. Results showed that children omitted syllables differently depending on the language, following the syllable structure of the appropriate language and showing similar patterns to their monolingual controls (Paradis, 2001). Research now attempts to examine how the language systems interact.

Paradis and Genesee (1996) proposed that bilingual children acquire two language systems, including their phonologies, by deceleration, acceleration, and transfer. Deceleration describes a slower rate of acquisition when compared to monolingual peers. Evidence for deceleration includes that bilingual children show slower acquisition of some phonological skills at certain points in time (Fabiano-Smith & Barlow, 2010). Acceleration describes a faster rate of acquisition compared to monolingual peers (Paradis & Genesee, 1996). There is evidence showing that bilingual children have both faster and slower rates of phonological acquisition compared to monolingual children at various periods in language development (Fabiano-Smith & Barlow, 2010). The literature now examines how acceleration and deceleration occur simultaneously depending on the language and phoneme. One language may be used to help in the phonological development of the other language, which is known as bootstrapping. While this may accelerate acquisition, accuracy of some phonological skills may decelerate (Fabiano-Smith & Barlow, 2010). The balance between acceleration and deceleration of phonological development is thought to help bilinguals stay relatively congruent with their monolingual peers' language development (Fabiano-Smith and Barlow, 2010). Finally, transfer, also known as the cross-linguistic effect, is the interaction of language systems observed with the presence of sounds of one language in the other language (Fabiano-Smith & Goldstein, 2010). Evidence for transfer supports the notion that language systems are not distinct from one another and can bi-directionally influence morphological, phonological, and stress patterns (Fabiano-Smith & Goldstein, 2010). Serratrice et al. (2009) believe that the potential for cross-linguistic influence is always present in the bilingual mind and that languages are most likely interacting at some level when making grammatical decisions. Nevertheless, crosslinguistic influence should not be viewed as a deviance or disorder but instead should be seen as a permanent feature of bilingual language competence.

In addition to the interaction between a bilingual child's phonological systems, phonological accuracy may also be influenced by the amount of language exposure and by the phoneme environment, or phoneme position within the word. Each will be reviewed in the following paragraphs.

Studies have shown that increased language exposure may allow for more native-like phonological production in bilingual children (Nance, 2020). Bilingual children are often exposed to smaller amounts of language (i.e., hours in a day) in each language as compared to their monolingual peers, which may affect speech production accuracy. Additional factors such as quality and consistency of language input may also influence phonological production accuracy (Nance, 2020). Of note, Thordardottir (2011) found that the linear relationship between exposure and bilingual vocabulary development plateaued around 40-60% of exposure, after which the amount of exposure did not increase performance. It is unknown if this exposure threshold transfers to bilingual phonological development performance as well.

McLeod & Crowe (2018)'s review of the literature found that the phoneme position in the syllable has been infrequently studied with bilingual children as the large majority of phoneme position studies examined monolingual children. Most studies looking at phoneme position examined word initial position, followed by word final position, with the fewest number of studies looking at medial word positions (McLeod & Crowe, 2018). Since limited data is available regarding phonological development with all positions and bilingual children, clinicians may reference inappropriate norms, including norms from different languages or on monolingual data (MacLeod et al., 2011). MacLeod et al. (2011) found that in monolingual children, the phoneme position in the word influences development and affects certain consonant productions. For instance, voiceless stops were produced in the initial word position but not in the final word position at the same time point. Additionally, research on consonant acquisition by position has been broken down into those that are emerging and mastered. MacLeod et al. 's (2011) review of the literature established that emerging consonants were those that 75% of children could produce regardless of the adult target, whereas mastered consonants were those that 90% of children produce correctly. Examining emerging and mastered consonants by position provides a thorough insight into children's phonological development. These patterns of consonant acquisition can help guide clinical practice (MacLeod et al., 2011).

Acquisition of Shared and Unshared Phonemes

As mentioned above, bilingual children can show patterns of phonological development that are comparable to or ahead of their monolingual peers (acceleration), as well as atypical patterns or delayed phonological development (deceleration). A combination of models of non-native speech sound perception and speech sound learning can help further hypothesize how sequential and simultaneous bilingual children develop their consonant inventory and acquire shared and unshared phonemes in their first language (L1) and second language (L2). The Native Language Magnet Model (Kuhl, Tsuzaki, Tohkura, & Meltzoff, 1994) will be discussed as it describes the innate abilities of early bilingual children to acquire shared and unshared phonemes. Flege's Speech Language Model will be examined in order to explain the continuation of speech sound acquisition beyond the critical period. Finally, considering how frequency of use and exposure influences shared and unshared sounds has been proposed to understand bilingual patterns of speech development.

The Native Language Magnet (NLM) Model indicates that language acquisition is acquired and organized during a critical period, i.e., 6 months to 12 months, by perceptual magnets based on speech prototypes (Kuhl, 2000). Speech prototypes represent phonetic categories in which sounds are categorized and act as a magnet, attracting and organizing similar sounds in the native language (Kuhl, 2000). These perceptual magnets create a mental map of sounds, allowing infants to discriminate between acoustic cues, organize them along acoustic dimensions, and associate sound patterns with objects (Kuhl 1993; Kuhl 2000; MacLeod & Meziane 2020). Kuhl et al. (2008) explain that infants between six and eight months of age can better discriminate between speech sounds due to limited interference in neural networks as compared to children older than ten to twelve months of age. Decreased interference therefore allows children to perceive and organize sounds in more than one language. When children are above ten to twelve months of age, language experience takes over perception: refined neural networks assign meaning to sounds that are present most often in the environment (Kuhl, 2000).

The NLM model explains that early linguistic experience allows children to create a complex filter through which language is perceived and categorized (Kuhl, 2000). In bilingual children, the magnetic effect and enhanced perceptual abilities allow children to categorize sounds in both languages (Kuhl, 2000). Compared to adults, children benefit from relatively flexible perceptual representations allowing them to perceive, categorize, and produce speech sounds more accurately. Therefore, a language acquired early in childhood would have highly accurate L2 consonant productions as compared to adult second language learners (MacLeod & Meziane, 2020).

The Speech Language Model (SLM) examines how individuals learn a second language and native-like accuracy without attributing it to age effects, contrary to developmental models such as the NLM model. The SLM postulates that the mechanisms for language learning are present throughout the lifespan and individuals can therefore acquire a second language at any age (Flege, 1995). This model explains that the acquisition of a second language depends on the ability to perceive and organize L1 and L2 sounds into appropriate phonemic categories, as well as the physical motor abilities to produce the sounds. Flege suggests that phonemes in L2 would be merged with similar L1 phonemes, leading to similar phonemes decreasing in production accuracy. On the other hand, different L2 phonemes would need to form their own categories, leading to higher production accuracy. How "similar" and "different" phonemes are from each other, however, are not clearly defined in the model. Additionally, the SLM postulates that the quantity and quality of language input allows for this language learning and that they have a greater impact on native-like second language speech than age of language learning (Flege, 2007). For example, Flege, Yeni-Komshian & Liu (1999) found that education in L2, use of L1 and L2 and length of residence in the new country had significant effects on L2 acquisition, whereas age of acquisition was not significant when compared to the previous factors. The SLM explains the speech production abilities of sequential bilinguals, and how older children and adults learn a new language.

Accuracy of shared and unshared phonemes can further be explained by frequency and the interaction between languages. It is hypothesized that bilingual children perceive and categorize sounds that are similar in both languages into the same phonetic category (Fabiano-Smith & Goldstein, 2010). Sounds from both languages that are categorized in similar categories (i.e., shared) are therefore produced at a higher frequency than those with dissimilar acoustic cues (i.e., unshared) (Fabiano-Smith & Goldstein, 2010). Production frequency is believed to predict accuracy as shared sounds have been found to demonstrate a higher accuracy compared to unshared sounds (Kirk & Demuth, 2003). Higher accuracy of shared sounds may also be attributed to the interaction between languages allowing for quick access between similar sounds (Fabiano-Smith & Goldstein, 2010).

In summary, bilingual speech sound acquisition has not been able to be captured in a single model. Diverse theories and approaches can be combined to explain bilingual phonological acquisition throughout the lifetime, however researchers and clinicians must stay flexible when applying these models in their practice and tailor them to the unique contexts of bilingual individuals. Two key concepts should be considered from innate and acquired perspectives. First, infants likely have a critical period for speech sound acquisition during which their brains are highly plastic, allowing them to perceive and organize sounds efficiently. Second, following this critical period, a combination of theories could explain the abilities of children to acquire additional phonemes. For instance, their relatively plastic brains are still able to perceive and organize speech sounds in an environment that provides a rich quality and high quantity of language input.

Capturing Phonological Inventories

Capturing bilingual children's phonological inventories allows clinicians and researchers to better understand bilingual language development. This can in turn inform practitioners when determining if these children have phonological disorders or phonological differences (Fabiano, 2007). See Table 1 below for the consonant inventories present both in French and English. Best practices to capture phonological inventories for bilingual children includes administering a single word task as well as a connected speech sample in both languages (Fabiano, 2007). Advantages and limitations of single word naming tasks will be explored for the purpose of this study.

A single word naming task allows clinicians and researchers to quickly examine if all sounds are present in the child's inventory. These tasks examine all sounds and various word shapes in a short period of time, and elicit more diverse sounds and word shapes than are typically produced during a connected speech sample (Masterson et al., 2005). Single word naming tasks also have been shown to reflect phonological patterns and similar percent consonant correct (PCC) in connected speech (Masterson et al., 2005). Therefore, administering a single word naming task to examine consonant inventories and patterns can be extrapolated to the child's overall phonological system. On the other hand, limitations of single word naming tasks include having a finite number of production opportunities of sounds and word shapes. Generalizability of a single word naming task may need to be interpreted cautiously, especially with the bilingual population, in view of single word naming tasks often normed on monolingual speakers. Bilingual speakers often have high levels of variability in their speech when compared to monolingual peers and single word naming tasks may not provide them with ample opportunities to capture their phonological abilities (Fabiano-Smith & Hoffman, 2018). Combined, the effectiveness and limitations of single word naming tasks demonstrate that they're effective tests that can be generalized to the child's overall phonological system. However, its interpretation and application to the bilingual population must be done with reservation as it does not capture their abilities in all languages.

Capturing consonant inventories is likely influenced by the level of transcription, more specifically broad and narrow transcriptions. The level of transcription for a single word naming task usually depends on the purpose of test administration, time constraints, or the goal of transcription (Stemberger & Bernhardt, 2020). For example, narrow transcriptions have been shown to help differentiate dialectal variations from language difficulties (Pollock & Meredith, 2001). Therefore, when applying evidence-based data in the clinical setting, it is important to keep in mind the differences in administration purposes and how to interpret the differences in findings that may arise.

There are three main speech tasks that examine French phonological development in Canada. The *Test de dépistage francophone de la Phonologie* (TFP) (Rvachew et al., 2013) is for children between kindergarten and grade one, normed on children from Montréal with diverse linguistic backgrounds. *Le test de phonologie en français* (Bérubé et al., 2015) assesses the phonology of children between the ages of 3 and 9, hasn't been standardized, but is based on characteristics of Manitoba French adult speakers. Finally, the *Évaluation sommaire de la phonologie chez les enfants d'âge préscolaire* (ESPP) (MacLeod et al., 2014) examines the French phonology of preschool children. The ESPP was the single word picture naming task used to capture the French phonological abilities of bilingual children in this study. This test consists of 40 target words based on the *Casse-tête d'évaluation de la phonologie* (Auger, 1994) and examines all French consonants in initial, medial and final word positions. This naming task was standardized on 243 French speaking children from Québec aged 20-53 months. The manual and administration materials are open access.

Table 1. Consonant inventories for French and English by place and manner of articulation, and voicing*.

Manner of Articulation			**Place of Articulation**								
			Bilabial	Labio-dental	Dental	Alveolar	Post-alveolar	Palatal	Velar	Uvular	Glottal
	Stops	French	p b			t d			k g		
		English	p b			t d			k g		ʔ
	Nasal	French	m			n		ɲ			
		English	m			n			ŋ		
	Fricative	French		f v		s z	ʃ ʒ			ʁ	
		English		f v	θ ð	s z	ʃ ʒ				h
	Affricate	English					tʃ dʒ				
	Approximant	French	w** ɥ**					j ɥ**	w**		
		English	w**			ɹ		j	w**		
	Lateral Approximant	French				l					
		English				l					

*Voiceless are presented to the left in the pair.
**Double place of articulation.

Acquisition of Dialect Variations

Like all aspects of language, phonology is dynamic and dialectal variations exist across regions and even within cities (Pennington, 2007). Early regional dialects were influenced by origins of immigration and social relations within colonial contexts (Kurath, 1928). In addition, social factors such as gender, ethnicity, and socioeconomic status influence discernible differences in dialect (Pennington, 2007). Dialect change happens gradually and involves perceptual and social factors, with new language norms gaining functional and linguistic meanings (Pennington, 2007). Several perspectives describe how variations in phonology arise, such as the classical phonological and sociolinguistic approaches. Classical phonology is based on efficiency, with variability seen as trivial and without structural implication. Sociolinguistics, on the other hand, pertains to phonological variability and its relationship to social factors (Pennington, 2007). Language variability occurs at several levels including phonemic, lexical, and morphosyntactic. Variability at these levels can be governed by the language system as well as the social context, such as speaker identity and situation (Johnson & White, 2020). Therefore, phonological variability and dialect theories must reflect both internal language and social factors.

When children first begin to speak, their dialect/s typically mirror that of their primary caregivers' (Wagner et al., 2014) as they attempt to match their language production to the input received from adults. As they enter school or daycare, children's social circles tend to expand beyond the family and caretakers. At this time, dialectal differences may be mediated with a shift away from the home dialect and similarities to the dialect of peers and the community may emerge (Wagner et al., 2014). Roberts (1997) found that from a young age, children learn allowable variable rules in their speech, which may change depending on context and listeners. Acquisition of the allophonic rule can explain children's abilities to produce variations of speech depending on different phonetic contexts (MacLeod & Fabiano-Smith, 2015). MacLeod & Fabiano-Smith (2015) explained that with the allophonic rule, the underlying representation of a sound does not change, however a different surface form or sound variant can be used depending on the context of input. In bilingual children, the complexity and variability of allophonic pattern input in two languages influence the production of allophones depending on the language spoken. Bilingual children can also transfer allophonic rules from one language to another in which the rule does not exist. Therefore, when assessing bilingual children's speech production, clinicians should be aware of the allophonic rules present in the languages spoken by the child in order to not mistake language interaction for the diagnosis of a speech sound disorder (MacLeod & Fabiano-Smith, 2015).

French Phonology Across Canada

The present study focuses on bilingual children from OLMCs in Alberta, Manitoba and Québec. An overview of these communities and the phonological features of these varieties of French are important for understanding their development. French settlers first arrived in Canada in the 17th century in what is known today as Nova Scotia, which expanded to Québec City and Montréal (Walker, 2005). Due to the fur trade, exploration and the quest to find new resources, newcomers ventured far into the prairies and the first francophone communities were established across Canada. Today, francophone communities' rich cultures are attributable to their tenacity, overcoming decade long battles fighting to be recognized and represented in the Canadian legislature (Canada, Office of the Commissioner of Official Languages, 2001). Some of the largest concentrations of francophone communities in Canada include Saint-Boniface in Winnipeg and Edmonton in Alberta (Walker, 2005). These OLMCs are part of the target groups examined in this study.

The 2016 Canadian Census revealed that francophones in Alberta are the fastest growing French population in Canada. Over 418,000 Albertans are descendants of France or French Canadians, and French is the mother tongue of 86,705 Albertans (Statistics Canada, 2017). Additionally, the province was ranked 5th in bilingual French English population size in the country, a 19% increase in 10 years (Statistics Canada, 2017). Walker (2005) notes that Alberta French is quite conservative as compared to its France referent. Some distinctions of Alberta French phonology include /œ̃/ being consistently used instead of /ɛ̃/ (e.g., *brun* [bʁœ̃]) (Walker, 2005). Additionally, it releases closed vowels (e.g., /i/, to /ɪ/ such as in *vite* [vɪt]) and nasal vowels in an open final syllable are moved anteriorly (e.g., /ɛ̃/ to /ẽ/ such as in *bain* [bẽ]) (Walker, 2005). Some marked features of Alberta French phonology include long vowels being diphthongized (e.g., /ɛ̃/ to /ɛ̃j/ such as in *crainte* [kʁɛ̃jt]), /t/ produced as /ts/ and /d/ produced as /dz/ before /i/ /y/ /j/ /ɥ/ (e.g., *petit* as [pətsi]) (Walker, 2005). Finally, consonant clusters are simplified such as the final syllable group (e.g., *aveugle* as [avœg]) (Walker, 2005). It is important to note that these norms correspond to adult targets and that no normative reference phonological data for French speaking children in Alberta have been published yet.

In Manitoba, French is included as an official language in the legislature and courts. Manitoba French is spoken by over 47,000 people and most are bilingual with English (Bérubé et al., 2015). Some consonant patterns of Manitoba French phonology include a variation of rhotic consonants, with the alveolar trill /r/ produced by some older individuals and uvular trill /ʀ/ produced by an increasing number of younger Manitobans (Bérubé et al., 2015). Additionally, Manitoba French phonology includes affrication within and across words, pronouncing onset /h/ (e.g., *haut* [hô]), and the elision of consonants in many contexts, such as /l/ and /v/ to simplify syllable shapes (e.g., *balançoire* [baɑ̃ːˈswɑʁ]) (Bérubé et al., 2015). Vowel patterns of Manitoba French include the nasalization of vowels, neutralization of vowel contrasts (e.g., /ɑ̃/ to /ɛ̃/), and the diphthongization of vowels especially in closed stressed syllables (e.g., *lampe* as [ˈlɑ̃ɔ̃p] (Bérubé et al., 2015). Additionally, high vowels are often laxed, and vowel devoicing or elision can occur (Bérubé et al., 2015). It is important to note that these norms correspond to adult targets and that no normative reference phonological data for children that are French speakers in Manitoba have been published as of yet.

Québec has a rich and complicated linguistic history. Its inhabitants fought to maintain their language for centuries and with the Official Language Act of 1974, Québec is the only province in Canada with the sole official language of French with over 6 million French speakers (Statistics Canada, 2011). There are a variety of dialects within the province of Québec, however for the purposes of this study, general phonological trends will be discussed typical of Montréal and Québec City. Some consonant patterns observed in adult speakers include the uvular fricative rhotic /ʁ/, and /t/ and /d/ affricated to /ts/ and /dz/ before high front vowels (e.g., *dinner* as [dzine]) (MacLeod et al., 2011). Vowel patterns commonly observed include tense high vowels becoming lax unless they are open syllables or with voiced fricatives in the coda (e.g., *petite* [pətsɪt] vs. *petit* [pətsi]) (MacLeod et al., 2011). Finally, Québec French allophonic processes includes allophonic diphthongs for front mid-vowels (e.g., *fête* [faɪt]). MacLeod et al. (2011) examined the phonology of children in Québec, finding that consonant acquisition was most productive between 36-53 months, that consonant acquisition was generally linear but varied across word positions and that singletons were acquired before clusters. Consonants mastered in children include /t, m, n, z/ before 36 months, /p, b, d, k, g, ɲ, f, v, ʁ, l, w, ɥ/ in children 36-53 months old, and /s, ʒ, ʃ, j/ with children older than 53 months old (MacLeod et al., 2011). Children approach production accuracy around 48 months of age (MacLeod et al., 2011).

Summary

Much of the research conducted thus far on bilingual phonology across Canada has examined adult phonology (see Table 2). The information gathered from these studies provides adult target forms in terms of phonological differences between Alberta, Manitoba, and Québec.

However, several pieces of information are still missing from the literature, specifically developing bilingual children language norms in OLMCs.

Table 2. An overview of the recognized regional variations to date representing the French phonology across Canada in children and adults.

OLMC Region	Adult French Phonological Consonant Patterns	Children French Phonological Consonant Patterns
Alberta	• Affrication of /t/ → /ts/ and /d/ → /dz/ before /i/ /y/ /j/ /ɥ/ • Simplified consonant groups, including final syllable group *Walker (2005)*	None available
Manitoba	• **Trill alveolar /r/** produced by older individuals and **trill uvular /ʀ/** increasingly produced by younger individuals • **Devoicing uvular fricative /ʁ/** in syllable-final position or between vowels • Affrication within and across words • **Pronouncing onset /h/:** haut [hô]) • Simplifying syllable shapes by elision of consonants /l/ and /v/ *Bérubé et al. (2015)*	None available
Québec and Montréal	• Affrication of /t/ and /d/ to /ts/ and /dz/ before high front vowels • Simplifying syllable shapes *Walker (1984)* *MacLeod et al. (2011)* *Morin (1979)*	• Consonant acquisition generally linear and most productive between 36-53 months • Consonants mastered before 36 months: /t, m, n, z/ • 36-53 months: /p, b, d, k, g, ɲ, f, v, ʁ, l, w, ɥ/ • 53 months and older: /s, ʒ, ʃ, j/ *MacLeod et al. (2011)*

*Bold: the unique phonological patterns specific to each region.

Current Study

The American Speech-Language-Hearing Association (ASHA)'s position on dialects is "that no dialectal variety … is a disorder or a pathological form of speech or language" (ASHA, 2003). An example of literature examining dialectal differences from disorders has been related to General American English (GAE) and African American English (AAE). For instance, Velleman & Pearson (2010) found that when children who enter GAE kindergarten speaking AAE are assessed in grade 5, key phonological features of AAE continue to be produced. Research with AAE and GAE can indicate similar results in communities with different dialects, as well as the diverse cultural and linguistic implications that must be considered when working with unique populations. For instance, Breton (2019) outlined strategies for speech-language pathologists to implement when assessing children that are Indigenous and speak with First Nations English Dialects (FNED). These guidelines may be applied when working with linguistically diverse populations to obtain a thorough understanding of abilities as tests are not typically normed on diverse speakers. Guidelines suggested by Breton (2009) include engaging and establishing relationships with the community, collaborating with community members every step of the assessment and treatment process, and assessing language abilities using a variety of measures.

When assessing children for language disorders, speech-language pathologists refer to standardized assessments normed on monolingual, “standard” speakers. These tests don’t take into consideration the linguistic rules of dialects that children follow (Bland-Stewart, 2005). Therefore, these children are often classified as having a language disorder instead of being language different (Bland-Stewart, 2005). Some standardized assessments take into account language differences such as the Fluharty and the Diagnostic Evaluation of Language Variation (DELV), however these tests are scarce and bilingual children’s profiles are rarely reflected in assessment norms. Bilingual language norms are difficult to capture since every bilingual child’s linguistic context is unique, including their language exposure, language socialization, and majority or minority language environments that influence their language development and production (Genesee, 2009).

The lack of representative data for bilingual children in Canada who speak French poses a problem for speech-language pathologists. There is no true “normative” bilingual child profile for children with dialect differences. Therefore, this study aims to provide reference data outlining the range of common trends identified in certain regions, to guide speech-language pathologists in their assessments, diagnosis, and treatment of children with diverse linguistic backgrounds. The terminology of reference data was chosen instead of normative data due to there not being a normative bilingual child profile in linguistic minority contexts. Instead, a range of observed patterns will be described. It's important that clinicians use their discretion when assessing a bilingual child and include the many sociocultural factors that may affect their language production.

The present study compares the phonological development of children from Alberta, Manitoba, Montréal, and Québec City. Despite the francophone children from Alberta and Manitoba in OLMCs being compared to one another and to the language majority children in Québec, this study does not compare to a "standard" of French. Instead, it views all children as bilingual speakers who speak French in Canada, celebrating differences without being compared to a standard. The question of a "standard" in language is also to be debated but exceeds the scope of this study. The present study will examine and compare the French phonological development of typically developing bilingual four-year-old children across Canada, contributing to a more comprehensive understanding of their speech sound acquisition in various sociocultural contexts.

Based on these observations, we will examine if these children produce a range of allophonic variants, the phonological accuracy globally and by position, and phonological patterns present between regions. We will also examine whether bilingual children across Canada have more accurate PCC in French-English shared or unshared phonemes. The aim of the current study is to investigate the following research questions:

Question 1:

How do children in various OLMC regions compare in the size of their consonant inventories overall and by position?

Hypothesis 1:

If speech sounds are acquired generally linearly despite children acquiring more than one language, we hypothesize that children will show similar consonant inventories overall and by position across regions suggesting a common progression in the acquisition of French speech sounds.

Question 2:

Are there differences in children's PCC based on their site or the position of the phoneme in the syllable?

Hypothesis 2:

If allophones are accepted as being a language difference and not a language disorder, we hypothesize that children will show similar PCC across sites suggesting a common progression in the acquisition of French. We also hypothesize that there will not be a PCC difference based on syllable position since French and English have opposing developmental syllable position acquisition patterns.

Question 3:

Do children from different OLMC regions have lower PCC values on unshared French phonemes compared to phonemes shared in French and English?

Hypothesis 3:

We hypothesize that unshared phonemes will have a lower PCC due to a decrease in use and organization into appropriate phonemic categories, whereas shared phonemes are organized in similar ways, allowing them to be quickly accessed and thus have a higher PCC.

Question 4:

Do children from Québec City and Winnipeg produce more variation in the consonantal phonological markers commonly observed in adult speakers of those dialects?

Hypothesis 4:

We hypothesize high variability in bilingual children from Québec City and Winnipeg compared to monolingual adults due to dual language exposure and input, choosing from two language systems, as well as less overall language exposure in each language (MacLeod & Fabiano-Smith, 2015).

Methods

Data from this analysis comes from a larger study of English-French bilingual children living in OLMCs that focused on their language abilities. The following section describes participant recruitment and tasks that were used. Procedure and analyses are specific to the current analysis.

Participants

Data collected from a total of 51 children were analyzed. The children had a mean age of 53 months (44-65 months) from Edmonton (*n* =12), Winnipeg (*n* =13), Montréal (*n* =9), and Québec City (*n* =17). Participants included in the study were typically developing as per parent reports and demonstrated normal results on clinician-led hearing screenings. Parents completed a questionnaire to calculate exposure to different languages across contexts, parents' first languages, language use in the home and at daycare, and between siblings.

The children recruited for this study were targeted based on their bilingual language exposure, specifically the minority language they acquired from birth. Children had to speak the minority language in the home. They obtained dual language input from significant adults either at home or in daycare. Additionally, they had to have a minimum of 20% exposure time to both the minority and majority languages for a minimum of 12 months prior to the study. Data related to exposure is outlined in the table below but was not included in the analysis as it exceeded the scope of this study. However, as seen in the table below, children from all regions, including French minority communities, had early exposure to French. The children needed to be able to communicate in both languages, which was defined as being able to answer questions in both languages.

Table 3. Site and participant demographics.

Site	Number of participants	Gender (number of girls)	Mean age and range (months)	First exposure to English (mean age and range in months)	First exposure to French (mean age and range in months)	Amount of exposure to English (mean hours per week)	Amount of exposure to French (mean hours per week)
Edmonton	12	8	52 (48-59)	7 (0-36)	1 (0-12)	26	58
Montréal	9	3	53 (49-60)	4 (0-18)	14 (0-48)	43*	39*
Québec City	17	11	57 (48-65)	0 (0-0)	1 (0-24)	33	51
Winnipeg	13	7	50 (44-56)	3 (0-0)	1 (0-12)	19**	61**

*One child was exposed to Spanish as a third language and thus the amount does not add up to 84 hours across English and French
** One child was exposed to Arabic as a third language and thus the amount does not add up to 84 hours across English and French

Data Collection

Data was collected between 2012-2017 as part of a larger national project. Sites in Edmonton, Winnipeg, Québec City, Montréal and Ottawa administered several assessments in both French and English to bilingual children to examine their language development. Both researchers and clinicians administered these assessments and collected data after receiving training to collect data in a valid and reliable manner across the various sites. The data was then sent to the central lab under Dr. Andrea MacLeod in various formats, including pdf files, scans of documents, physical paper documents, and video/audio files. Research assistants entered the data on an encrypted drive. In order to use the data set for this project, ethical approval for this study was obtained from the University of Alberta Research Ethics Board 2, Project Name

"Islands and Peninsulas: Speech and language skills of 4-year-old children in Language Minority Communities", ID: Pro00104392.

For the purposes of this study, data related to the French phonology of the children was examined from Edmonton, Winnipeg, Québec City and Montréal. Data from Ottawa was removed from this study as they did not have enough participants who completed the task to draw reliable conclusions for the goals of this study. Data from the *Évaluation sommaire de la phonologie chez les enfants d'âge préscolaire* (ESPP; MacLeod et al., 2014), a picture naming task that consists of 40 images, captured the children's phonological abilities in French. Words from the ESPP were inputted into Phon (Version 3.0; Hedlund, Gregory & Yvan Rose, 2019) for analysis. In the cases where written transcriptions were not legible, the words were omitted from the corpuses. When video and audio recordings were available, they were corroborated with the available transcriptions.

Design

A challenge in the current data analysis includes the inconsistency in the way the data was transcribed. To ensure reliability in the transcriptions, sites received training and performed interrater reliability checks when gathering data. The discrepancies lie in the transcription detail. Broader transcriptions by speech-language pathologists were available in Edmonton and Montréal with missing audio recordings due to technical problems in data transfer. In contrast, audio recordings were transcribed by the research team for Winnipeg and Québec which allowed for more detailed transcriptions. In order to obtain valid and reliable results based on the level of detail of the transcriptions available across the sites, certain analyses were performed depending on the sites. More specifically, PCC related statistics were calculated for all sites, as these relied on identifying phonemes in error. However, when examining dialectal patterns and allophonic variations, only Winnipeg and Québec sites were used as they used narrow transcriptions to identify the variations in the phonemes produced.

Equipment and Material

A descriptive and statistical analysis was conducted using Phon (Version 3.0; Hedlund, Gregory & Yvan Rose, 2019) to enter transcriptions and analyze the dataset. Phon is a software program that can be used to support research on phonological units and speech analysis.

Statistical Analysis

SPSS (Version 26.0; IBM Corp, 2019) was used to run statistical analysis. Data gathered by sites was entered on Phon and a session file was created for each child taking part in this study. Participants had 40 records in their files corresponding to each word examined in the ESPP task. Records were excluded if scanned transcriptions were unclear and could not be confirmed with videos or audio of participants. Targets used for all sites were the same as the targets provided with the ESPP test in order to replicate the clinical setting across Canada (children assessed with the ESPP which has norms based on French speakers from Québec).

The independent variable is the OLMC (i.e., region) and the dependent variables are the consonant inventories and PCC. A potential confound could be the amount of English spoken by the children at home, which may influence their French production. Data related to the use of dominant language(s) spoken was collected for descriptive statistics but will not be analyzed as it exceeds the scope of the present study.

Independent Analysis - Phonetic inventory

An independent analysis was conducted to determine the size and distribution of each participants' French consonant inventories using Phon. Based on Gildersleeve-Neumann et al. (2008) and the limited production opportunities in the ESPP, if a consonant was produced twice, it was considered to be present in the child's inventory. Consonant place and manner are included in the descriptive analysis. Additionally, the consonant inventory analysis was conducted for each site based on word initial, medial, and final positions. Examining inventories by position are useful tools in assessment to examine general phonological development in children. Sounds in the children's' inventories were further reported to be emerging or mastered. Based on MacLeod et al. (2011), in order for sounds to be deemed as emerging, consonants had to be produced at least once by 75% of the children in each group. Sounds which were produced at least once by 90% of the children were deemed to be mastered.

Relational Analyses - PCC

A relational analysis was run using Phon to determine the participant's Percent Consonant Correct (PCC). Percent Vowel Correct (PVC) was not calculated as sites did not use narrow transcription of vowels and instead focused on consonants due to the nature of the ESPP test. PCC was also examined by syllable onset and coda positions. Additionally, a relational analysis was performed using Phon to determine the accuracy of shared and unshared sounds between languages (English and French). For example, the French /ʁ/ would be an unshared phoneme as it is not present in English, whereas /s/ is shared in both languages. Examining shared and unshared sounds is a useful tool when assessing bilingual children. Since the ESPP phonological test only examines sounds in French, not all English sounds were observed. Only the English sounds shared with French were examined.

Statistical Analyses

Subsequently to obtaining PCC outputs, statistical analyses were run. To determine whether PCC differed by site or by sound position, a two-way between subjects Analysis of Variance (ANOVA) was conducted. SPSS was also used to run another two-way ANOVA to examine if there was a significant effect between shared and unshared PCC. Aside from a violation of equal sample sizes, the ANOVAs were run since the remaining ANOVA assumptions were met, namely the normality, independent samples and sphericity assumptions. For all ANOVAs, a significance level of $p < .05$ was adopted and post-hoc Bonferroni tests were performed to determine whether any variables were significant, as well as to examine possible interaction effects.

Relational Analysis - Phonological Pattern Analysis

A relational analysis was also run to determine the types and frequencies of phonological patterns. The error or variation pattern types were selected based on the frequency of errors observed. If all sites demonstrated this error pattern in several of their participants, it was deemed to be a developmental error pattern typical during the acquisition of the French language. If one or two sites had four or more participants demonstrating a variation, it was considered to be a dialectal variation. The frequency of four was chosen as the cut-off as being an important difference based on the amount of variations present between sites and based on the small number of participants at each site.

Results

Consonant Inventory Analysis

A descriptive analysis was conducted to compare the size and distribution of phonological inventories in different OLMC regions. As noted in the Methods section, a consonant was included in a child's inventory if it was produced two or more times during the single word naming task. Table 4 lists the consonant inventories by site, place and manner of articulation. Diacritics were excluded. The number by each consonant represents the percentage of children in the respective site who produced that consonant two or more times. This table is represented in the Appendix with the count of participants who produced the consonant two or more times.

Table 4. Percentage of children who produced consonants two or more times by site, place and manner of articulation*.

			Place of Articulation						
			Bilabial	Labiodental	Alveolar	Post-alveolar	Palatal	Velar	Uvular
Manner of Articulation	Stops	Edmonton (n=12)	p: 100% b: 100%		t: 100% d: 100%			k: 100% g: 100%	
		Montréal (n=9)	p: 100% b: 100%		t: 100% d: 100%			k: 100% g: 100%	
		Québec City (n=17)	p: 100% b: 100%		t: 100% d: 94%			k: 100% g: 100%	
		Winnipeg (n=13)	p: 100% b: 100%		t: 100% d: 100%			k: 100% g: 100%	
	Nasals	Edmonton (n=12)	m: 100%		n: 100%		ɲ : 50%		
		Montréal (n=9)	m: 100%		n: 100%		ɲ: 56%		
		Québec City (n=17)	m: 100%		n: 100%		ɲ: 59%		
		Winnipeg (n=13)	m: 100%		n: 100%		ɲ: 8%		
	Fricative	Edmonton (n=12)		f: 100% v: 100%	s: 100% z: 100%	ʃ: 83% ʒ: 67%			ʁ: 100%
		Montréal (n=9)		f: 100% v: 100%	s: 100% z: 100%	ʃ: 89% ʒ: 78%			ʁ: 100%
		Québec City (n=17)		f: 100% v: 100%	s: 100% z: 94%	ʃ: 76% ʒ: 65%			ʁ: 82%
		Winnipeg (n=13)		f: 100% v: 100%	s: 100% z: 100%	ʃ: 69% ʒ: 69%			ʁ: 100%
	Approximant	Edmonton (n=12)	w**:100% ɥ**: 92%				j: 100% ɥ**: 92%	w**: 100%	
		Montréal (n=9)	w**: 100% ɥ**: 78%				j: 100% ɥ**: 78%	w**: 100%	

		Québec City (n=17)	w**: 100% ɥ**: 47%				j: 100% ɥ**: 47%	w**: 100%	
		Winnipeg (n=13)	w**: 100% ɥ**: 77%				j: 100% ɥ**: 77%	w**: 100%	
	Lateral Approximant	Edmonton (n=12)			l: 100%				
		Montréal (n=9)			l: 100%				
		Québec City (n=17)			l: 100%				
		Winnipeg (n=13)			l: 100%				

*Accuracy between 75-90% is highlighted in light gray, between 50-74% in mid gray, and below 50% in dark gray.
**Double place of articulation.

As can be seen in Table 4, children from every site had stops in all places of articulation in their consonant inventories. Nasals, specifically the palatal /ɲ/, posed difficulties for children across the sites with a much lower number of children correctly producing the consonant /ɲ/ (i.e., 8-59%). Children from Winnipeg demonstrated the most difficulty with this sound with only one child having the consonant /ɲ/ in their inventory. The remainder of the children transformed it to the velar nasal, /ŋ/, which occurs in English. Fricatives were mostly included in all children's inventories, with the exception of the post-alveolar /ʃ/ and /ʒ/ consonants. Québec City represented the least number of children who had the post-alveolar /ʃ/ and /ʒ/ sounds in their inventories. Children from all sites had every approximant in their inventories, except for Québec City where only 47% of children had the semi-vowel /ɥ/ in their inventories. As seen in the table above, children across various sites demonstrated similar sizes of consonant inventories, suggesting a common progression of sound acquisition in all regions, with few variations that impacted namely /ŋ/, /ʃ/, /ʒ/, and /ɥ/.

The phonetic inventory was further examined by position. The initial consonant production opportunities in the ESPP included /p/, /b/, /t/, /d/, /k/, /g/, /m/, /n/, /f/, /v/, /s/, /z/, /ʃ/, /ʒ/, /ʁ/, /w/, /ɥ/, /j/, and /l/. Medial consonant production included the same opportunities as initial syllable production, excluding /w/ and /ɥ/ but adding /ɲ/. Final consonant production opportunities included /p/, /b/, /t/, /d/, /k/, /g/, /m/, /n/, /ɲ/, /f/, /v/, /s/, /z/, /ʃ/, /ʒ/, /ʁ/, /j/, and /l/. As described in Methods, emerging consonants were those produced at least once by 75% of the children in each group, whereas mastered consonants were produced at least once by 90% of the children. To provide a simple visual overview of the emerging and mastered consonants, Table 5 lists the consonants absent from children's phonological inventories by initial, medial, and final positions.

Table 5. Sounds absent in the French phonological inventories of children by site and position.

	Initial		**Medial**		**Final**	
Production Opportunities	p, b, t, d, k, g, m, n, f, v, s, z, ʃ, ʒ, ʁ, w, ɥ, j, l		p, b, t, d, k, g, m, n, ɲ, f, v, s, z, ʃ, ʒ, ʁ, j, l		p, b, t, d, k, g, m, n, ɲ, f, v, s, z, ʃ, ʒ, ʁ, j, l	
	Emerged*	**Mastered****	**Emerged***	**Mastered****	**Emerged***	**Mastered****
Edmonton	s, ʒ	s, ʒ, ʁ, j	ʃ, ʒ, ɲ	z, ʁ, ʃ, ʒ, ɲ	ʒ	d, ʃ, ʒ
Montréal	s	s, v, ʃ, ʒ, m, ʁ, j, ɥ	ɲ	ɲ, ʃ, ʒ	v, ʃ	d, f, v, z, ʃ, ʒ, ɲ, l
Québec City	ɥ	d, v, s, z, ʃ, ʒ, ʁ, j, ɥ	ʃ	d, ʒ, ɲ, ʁ	d, g, v, ʃ, ʒ	b, d, k, g, v, z, ʃ, ʒ, ʁ
Winnipeg	ʒ	ʃ, ʒ, ɥ	ʃ, ʒ, ɲ	s, z, ʃ, ʒ, ɲ, ʁ	ʃ, ʒ, ɲ	d, g, v, ʃ, ʒ, ɲ

*Emerged consonants: not produced at least once by 75% of the children in each group.
**Mastered consonants: not produced at least once by 90% of the children in each group.

With the majority of sites, children had difficulties with later developing consonants /ʃ/ and /ʒ/ in all word positions. In the initial position, fricatives /s/ and /z/ were often excluded from inventories, both as emerging and mastered. The rhotic /ʁ/ and approximants /j/ and /ɥ/ were not mastered for the majority of participants in the initial position. The consonant /ɲ/ was largely not included in participants' inventories in the medial and final positions of words; however, there were no /ɲ/ production opportunities in the initial position. The rhotic /ʁ/ was not mastered for the majority of participants in the medial position. In the final position, consonants /d/ and /v/ were not consistently emerging nor mastered across sites. In general, early developing consonants such as /n/, /m/, /t/, and /p/ were emerged and mastered across all word positions. The early acquired sound /d/ was included in phonological inventories except in the final position. Fewer sounds were present in the participants' inventories in the final position, followed by medial position sounds. Most sounds were included in the initial position.

PCC by Site and Position

To address the second research question, a two-way between subjects ANOVA was conducted to assess whether PCC differed across sites (Edmonton, Montréal, Ottawa, Québec City), or whether PCC differed by position in the syllable (onset or coda), and if these two factors interacted. There were significant differences in mean PCC between sites $F(3,94) = 6.486$, $p = .001$, but no effect for syllable position $F(1,94) = 3.075$, $p = .083$), and no interaction $F(3,94) =1.864$, $p = .141$). The post-hoc independent samples t-tests showed significant differences between sites: three sites were similar in PCC (Edmonton, Winnipeg, and Montréal) and one site (Québec City) scored lower in PCC. Following the Bonferroni correction, a t-test comparing the sites revealed a significant difference between Québec City and Edmonton ($p = .001$), and Québec City and Montréal ($p = .008$), but no significant differences between Québec City and Winnipeg ($p = .072$). Despite the significant difference in means between sites, their variability as indicated by standard deviations overlapped.

Table 6. A comparison of PCC (combined syllable onset and coda) and by position between OLMC sites.

Site	**PCC***	**PCC Syllable Onset**	**PCC Syllable Coda**
Edmonton	91.85 (*SD* = 6.88)	92.64 (*SD* = 7.59)	91.06 (*SD* = 6.32)
Montréal	91.22 (*SD* = 5.48)	89.30 (*SD* = 5.82)	93.15 (*SD* = 4.65)
Québec City	84.28 (*SD* = 8.93)	80.77 (*SD* = 8.21)	87.79 (*SD* = 8.43)
Winnipeg	89.11 (*SD* = 6.88)	88.60 (*SD* = 6.16)	89.62 (*SD* = 7.76)

Total	88.52 (*SD* = 7.98)	87.07 (*SD* = 8.44)	89.97 (*SD* = 7.29)

*Average of onset and coda PCC.

Shared and Unshared PCC Analysis

The accuracy of shared consonants in French and English was compared to unshared French consonants to examine if children from various OLMC regions have higher PCC values on shared compared to unshared sounds. See the table below for the shared and unshared sounds examined using the ESPP task.

Table 7. Shared and unshared sounds examined in the ESPP.

Shared Sounds (French and English)	**Unshared Sounds (French)**
n, m, t, p, b, d, z, f, k, g, l, s, w, v, ʃ, ʒ, j	ɲ, ɥ, ʁ

A two-way between subjects ANOVA was conducted to assess whether there was a significant difference in shared versus unshared PCC between sites. There was a significant difference of site ($F(3,94) = 3.279$, $p = .024$). Additionally, there was a significant difference between shared and unshared phonemes ($F(1,94) = 46.010$, $p = .001$). However, there was no interaction between site and shared/unshared phonemes ($F(3,94) = 2.035$, $p = .114$), which suggests that across all sites, the effect of shared and unshared phonemes was present. The OLMC site effect was present in the shared/unshared phoneme analysis, and paralleled the findings in the previous global PCC analysis.

Table 8. Means and standard deviations of PCC for accuracy of shared and unshared sounds.

Site	**PCC Shared**	**PCC Unshared**
Edmonton	92.01 (*SD* = 8.65)	81.67 (*SD* = 14.99)
Montréal	94.05 (*SD* = 4.34)	77.42 (*SD* = 19.62)
Québec City	86.47 (*SD* = 8.03)	67.65 (*SD* = 18.71)

Winnipeg	93.74 (*SD* = 6.73)	64.75 (*SD* = 17.31)
Total	90.96 (*SD* = 7.86)	71.93 (*SD* = 18.51)

Phonological Pattern Analysis

A descriptive analysis was used to examine developmental phonological error patterns and variability between OLMC groups indicated by the range in production of consonants. This analysis was conducted descriptively due to limited error patterns found and small sample size. Within this qualitative analysis, differences in production were compared between Québec and Winnipeg to determine if variations were attributable to developmental patterns of acquisition or to the dialect of the region. See Table 8 below for an example of possible ESPP word variations for the OLMC region of Winnipeg.

Developmental error patterns were those that were produced four or more times in both Québec and Winnipeg. These developmental error patterns included final consonant deletion (e.g., "canard" /kanɑʁ/ → [kanɑ]), present in 7% of children's productions. Fronting was seen in 4% of the children's productions across sites (e.g., "jupe" /ʒʏp/ → [zʏp]) with the most common fronting error being /ʃ/ to /s/ (e.g., "douche" /dʊʃ/ → [dʊs]) in those production opportunities. Voicing errors were produced 2% of the time with various sounds in both sites such as "yogourt" /jɔguʁ/ → [jɔguχ] and "framboise" /fʁãbwɑz/ → [fʁãbwɑz̥]. Several error patterns or production variations included the sound /ʁ/, such as gliding of /ʁ/ to /w/ or /l/ (e.g., "train" /tʁẽ/ → [twẽ] and "crayon" /kʁɛjɔ̃/ → [klɛjɔ̃]) in 1.5% of the productions. /ʁ/ was also omitted in 10% of the children's productions ("girafe" /ʒiʁaf/ → [ʒiaf]). Additionally, various cluster reductions were seen across sites, with children most often reducing clusters involving /ʁ/ (e.g., "zèbre" /zɛbʁ/ → [zɛb] and "fourchette" /fʊʁʃɛt/ → [fʊʃɛt]).

Dialectal variations were those produced four or more times in either site. Children from Manitoba aspirated /p/ → pʰ and /t/ → t ↔ tʰ during 14% of available production opportunities. Dentalization patterns were observed during several productions in Manitoba; however, they were attributed to a single child and were therefore not counted as a regional dialectal pattern. There were few variations with early developing nasal sounds, although the palatal consonant /ɲ/ was transformed to the velar nasal /ŋ/ in Manitoba 76% of the time and omitted 12% of the time in Québec. Children from Québec City devoiced or did not release the uvular /ʁ/ to /χ/ 4% of the time. Labiodental sound /v/ was devoiced to /f/ during 10% of production opportunities in Québec City. Additionally, children did not release /t/ 5% of the time. Finally, children from Québec City backed the voiced labio-palatal approximant /ɥ/ during 18% of the time to the voiced labial-velar approximant /w/.

Table 9. Example of select ESPP word variations for OLMC children in Winnipeg and Québec City.

Orthographical Target	**IPA Target**	**Winnipeg Variation**	**Québec City Variation**
Pomme	/pʌm/	[pʰʌm]	
Tasse	/tɑs/	[tʰɑs]	
Beigne	/bɛɲ/	[bɛŋ]	[bɛ]
Fève	/faɪv/		[faɪf]
Huit	/ɥɪt/		[wɪt]

Discussion

The aim of this study was to begin establishing reference data for French phonological development in French-English bilingual children across the country. Four bilingual communities, Edmonton, Montréal, Québec City and Winnipeg, were compared using 2 main measures: (1) consonant inventories, both overall and broken down by position, and (2) consonant accuracy by position and shared/unshared. A second comparison focused on descriptive analysis of phonological patterns in two of the communities, Québec City and Winnipeg. This preliminary data will help guide clinicians in their practice when administering standardized assessments such as the ESPP with bilingual children in Canada. More specifically, the reference data provided will help clinicians distinguish between language differences, or regional variations to be expected, from language difficulties.

Consonant Inventory Analysis

Children's consonant inventories were analysed to explore whether sound inventory sizes were similar across OLMC regions. We predicted that children from different OLMCs would show similar consonant inventories overall and by position, suggesting a common progression in the acquisition of speech sounds, no matter the region. The consonant inventory analysis supported our hypothesis and demonstrated that children from all sites generally followed the same patterns of speech sound acquisition overall and in various positions. More consonants were emerging in the initial position, or produced at least 75% of the time, as compared to other word positions. Interestingly, more sounds were mastered in the medial position, followed by initial, then final positions. Consonants that were not emerging or mastered across sites in the initial position largely included fricatives and approximants /ɥ/ and /j/, which are all later developing sounds. In the medial position, children had more sounds deemed as emerged and mastered as compared to initial and final word positions. Consonants that were acquired last in the medial word position included fricatives and the palatal nasal, notably /ʃ/, /ʒ/, and /ɲ/. The final word position had the fewest consonants emerged and mastered. Consonants that were last to be acquired followed similar patterns to other word positions, such as fricatives and palatal nasal consonants. In the final position, children did not master additional consonants such as stops /d/, /g/, and /k/. This follows trends seen in the literature where these were the stops that were mastered last (MacLeod et al., 2011). The results also demonstrated that certain consonants' accuracy varied by their position in the word. An example of word position influence was illustrated with the uvular fricative /ʁ/, which was mastered in the final word position but not in initial or medial positions.

Consonants that were not present in inventories were consistent with developmental patterns based on children's age across all sites, suggesting a common progression of speech sound acquisition in French, no matter the location. For example, children in this study from Edmonton, Winnipeg, Québec City and Montréal did not consistently use the post-alveolar fricatives /ʃ/ and /ʒ/ in their inventories, and these sounds have been shown to be acquired late in francophone children's development (MacLeod et al., 2011). Additionally, children in this study did not consistently use the approximant /ɥ/ in their inventories, also a phoneme that develops late in francophone children (MacLeod et al., 2011). Consonants /p/, /b/, /t/, /d/, /k/, /g/, /m/, and /n/ were consistently produced twice or more by children in all OLMC regions, as expected with francophone children around the ages of 53 months (MacLeod et al., 2011).

In contrast to patterns that are observed in previous research, lower accuracy was observed for the consonant /ɲ/; an average of 43% of four year old children across sites accurately produced the consonant /ɲ/ twice or more, with children from Winnipeg producing the sound accurately only 24% of the time. This is inconsistent with previous research which reported that 75% of francophone children correctly produced this consonant between the ages of 30-48 months (MacLeod et al., 2011). Cross-linguistic influence may explain the lower accuracy in the present study as children were found to often substitute the palatal /ɲ/ with the velar /ŋ/, which occurs in English. This substitution suggests that children may have a less specific representation of /ɲ/ in their phonological system in which both /ŋ/ and /ɲ/ are acceptable and understood in French and English contexts.

Taken together, the consonant inventory analysis demonstrated that children from all sites generally followed similar patterns of sound acquisition and reflected those observed in previous research on francophone children. Specifically, these children from OLMCs showed similar patterns of consonant acquisition by manner of articulation, which suggests that manner of articulation may help predict the consonants that are included in children's consonant inventories in various word positions.

PCC by Site and Position

Children's consonant accuracy was analysed to explore whether there were differences in children's PCC based on the OLMCs. We predicted that all children would show similar PCC across sites. A significant difference in global PCC was demonstrated between sites, and post-hoc analysis showed that Edmonton and Montréal had significantly higher accuracy scores than Québec City, with Winnipeg higher but not significantly. The presence of some statistical differences goes counter to our second hypothesis. Francophone monolingual children around 4 years of age are typically expected to have a PCC of 90%. Children from Edmonton, Montréal, and Winnipeg were close to this score, but Québec City was considerably lower than the expected benchmark at 84.28%. The lower PCC could suggest a language exposure effect such that bilingual children are exposed to less input in French than their monolingual peers. This smaller input may result in lower sound organization opportunities and decreased production accuracy (Nance, 2020). This explanation, however, does not hold much weight as children were exposed to French quite frequently across all sites, and the sites with the highest PCC was Edmonton, where French is a minority language, and Montréal where it is a majority language.

We also explored the transcriptions themselves and believe that the differences in PCC may be explained in part by the level of transcription at each site. Clinicians collected data from Edmonton and Montréal and were responsible for inputting the data. They tended to use a broader transcription and these sites had a PCC of 91.85% and 91.22%, respectively. On the other hand, researchers collected data from Québec City and Winnipeg and inputted the data using a more narrow transcription. These sites had a PCC of 84.28% and 89.11%, respectively. This study suggests that broad transcription may result in higher PCC, subjectively interpreting certain speech production variations as acceptable, whereas narrow transcription may result in lower PCC, capturing more detailed variations in speech production. Again, the relative similarity between Winnipeg and Montréal in terms of PCC suggests that the narrowness of the transcription is not the sole explanation. However, narrow transcriptions have been shown to help differentiate between regional sound variations from language difficulties (Pollock & Meredith, 2001). Another reason why Québec might have been significantly lower in PCC could be due to it having the largest sample size out of all groups, and perhaps capturing more variability in productions. In this study, narrow transcriptions allowed for observation of dialectal variations and phonological patterns in Québec City and Winnipeg, which will be described further below. Future research could look at researchers compared to clinician collected data in order for findings to be consistent and applicable across both realms.

Consonant accuracy was further analysed to explore whether children produced differences in PCC based on the position of the phoneme in the syllable. We predicted that children would not show a significant difference in PCC in the syllable onset as compared to the coda position. The analysis supported our hypothesis as there was no difference for PCC based on syllable position. These results suggest that consonants occurring in syllable onset and coda positions were not significantly different in their accuracy. Some evidence suggests that due to the stress patterns in English often occurring on the syllable, English speakers are less likely to omit the salient onset (MacLeod et al., 2011). However, French speakers may omit the initial syllable more frequently as French rarely has stress on the first syllable (MacLeod et al., 2011). French-English participants in this study may have shown similar PCC in onset and coda syllable positions due to their opposing language systems interacting, demonstrating the acceleration principle of bilingualism as proposed by Paradis and Genesee (1996). Alternatively, we may have missed the developmental window to observe positional effects in French due to the age of the children.

Shared and Unshared PCC Analysis

Children's consonant accuracy was analysed to explore whether shared or unshared sounds had higher PCC. We predicted that children would have a higher PCC with shared French-English sounds as compared to unshared French sounds. The analysis demonstrated a significant difference of shared and unshared phonemes which supported our hypothesis. As described by Fabiano-Smith & Goldstein (2010), the higher accuracy of shared sounds could be attributed to production frequency and exposition of shared sounds when children are speaking both their languages, showing an interaction between languages. This could allow for quick access to shared sounds and increased production accuracy. Unshared sounds, in this case /ɥ, ɲ, ʁ/, had a larger standard deviation than shared sounds across sites, indicating more variation in the production of unshared sounds. The smaller standard deviation observed with shared sounds demonstrates that there is less variability in the ways children produce sounds present in both French in English.

Winnipeg had the lowest unshared PCC out of all sites which could be explained by its use of the English /ŋ/ instead of the French /ɲ/ 76% of the time. This sound variation could be suspected to be a regional difference of /ɲ/ in Manitoba. These similar sounds could be categorized within the normal accepted range in both languages, supporting Flege's Speech Language Model. This model claimed that similar sounds in both languages which are not different enough to be categorized into discrete categories would result in decreased accuracy. Additionally, there was no site difference with the shared and unshared sounds which suggested that all sites had the shared and unshared effect. Bilingual children from all sites demonstrated a higher accuracy with shared sounds as compared to unshared sounds. Examining shared and unshared sound accuracy provides evidence for clinicians when choosing meaningful treatment goals. More specifically, choosing sounds that are shared in both languages may increase treatment efficiency as target sounds can generalize to both languages (Fabiano, 2007).

Phonological Pattern Analysis

Children's phonological pattern analysis was analysed to explore whether children produce consonantal phonological markers commonly observed in adult speakers of those dialects. We predicted that there would be higher production variability in bilingual children compared to monolingual adults. Building phonological patterns reference data in this study was an important step towards establishing a protocol and an increasingly systematic process to evaluate bilingual children. The analysis examined available literature on French phonological development and regional variations to distinguish between potential dialectal variations and developmental processes. Opportunities to produce regional variants found in adult literature and available children's literature were compared to the children's production. Data from Winnipeg and Québec City provided sufficient detail for this analysis using narrow transcription. Children from these sites had error patterns that were aligned with MacLeod et al.'s (2011) findings, such as more error patterns and difficulties with later developing sounds. For instance, errors with later developing /ʃ/, /ʒ/ and /ɲ/ sounds were seen throughout productions in both Québec City and Winnipeg, such as fronting and final consonant deletion. Additionally, voicing errors were produced with several sounds which is a common phonological pattern in language development (MacLeod et al. 2011). Voicing errors are suspected to be more prevalent in bilingual children as different languages such as French and English have differing voicing contrasts (Macleod & Stoel-Gammon, 2009). Voicing errors were especially prevalent with fricatives in children from Québec City and Winnipeg. These errors could be explained by the voicing differences across English and French, and less by these consonants' manner of articulation (i.e., fricatives). Affrication, which is commonly observed in French-speaking adults across Canada, was not observed in children from Québec and Winnipeg. However, this trend is typically observed in front of high vowels and there were no production opportunities in the ESPP with this word structure.

Children from Winnipeg were found to produce onset aspirations on sounds including /p/ and /t/, reflecting patterns observed in the literature (Bérubé et al., 2015). A new possible dialectal pattern observed in Winnipeg was backing of /ɲ/ to /ŋ/ which has not yet been described in the literature. Children from Winnipeg were observed to devoice the voiced uvular /ʁ/ between vowels and in final syllable position ("train" /tʁɛ̃/ → [tʁ̥ɛ̃]), following adult patterns in Winnipeg (Bérubé et al., 2015). Interestingly, children in this study were not observed to produce the apical trill /r/ reported in previous studies (i.e., Bérubé et al., 2015). Instead, they used the uvular /ʁ/ (both voiced and unvoiced), or glided it to /l/ or /j/ as is occasionally seen in young francophone children (Brosseau-Lapré et al., 2018).

Children from Québec City produced several voicing differences. Voicing poses an added difficulty with the laryngeal-oral coordination required, reflecting developmental patterns observed in children in the literature (MacLeod et al. 2011). Syllable simplification was not notably seen in the Québec City children, which did not reflect adult patterns observed. This could be explained by the limitations of a single word naming task as compared to a connected speech sample. How single word naming tasks and connected speech samples elicit different syllable shapes could be further explored in future research.

Clinical Implications

When assessing phonological development in bilingual children, speech-language pathologists (SLPs) should consider examining sounds by position to examine general consonantal development, as well as a unique analysis of shared and unshared consonant inventories for bilingual children. More specifically, to assess bilingual children in OLMCs, SLPs can base themselves off typical consonant development in monolinguals in both the children's languages, assess phonemes of the other languages, and accept potential variability due to dialect. To do so, SLPs may consider the adult targets the child is being exposed to, including the dialect variations present in the child's linguistic environment. Finally, SLPs could consider using narrow transcription more often during assessment. Broad transcription has the advantage of efficiency and captures phonemes in a more dichotomic way (correct/incorrect), however, broad transcription may omit key information that has been shown to differentiate between language difference and disorder. To develop a treatment plan for disordered speech, the plan is only as good as the transcription. Assessing bilingual children using these guidelines will help SLPs gain a better understanding of the child's consonant development, as well as identify appropriate and effective treatment targets.

Significance

Findings from this study increased our understanding of phonological abilities of Canadian francophone children who are bilingual. This study provided preliminary data for speech-language pathologists to refer to when assessing school-aged children in a wide range of francophone communities in Canada. This research builds towards improving the accurate identification of delayed and disordered speech for children speaking French with a variety of dialects. Additionally, this study considers variations in Canadian French as differences to be accepted and celebrated. It joins the social justice movement of assessing dialect variations in French without being compared to a standard.

Limitations and Future Directions

A limitation of this exploratory study was the relatively small sample size per site for statistical analysis. Small sample sizes reduce power and increase the risk of Type 2 errors. A significant limitation from this study was in the consistency of data collection which was gathered by sites themselves. The numerous administrative sites and teams resulted in differences in levels of transcription, which limited reliable statistical analysis for certain sites. Further, since clinicians and researchers administered the tests in the regions they lived in, the lens of the administrators could have been impacted by what is acceptable within their normal phonological variation. Additionally, there was no information gathered regarding parent/caregiver origins which could affect the dialect and the general language input the children received. Obtaining a better understanding of the origins could help derive better conclusions regarding young children's phonological variations influenced by the input received in the community and from the parents/caregivers. Finally, this study used a single word naming task to draw conclusions without a connected speech sample. The nature of the ESPP task limited the ability to conclude site specific phonological patterns with few opportunities to produce sounds in a variety of word positions.

This pilot study provided several directions for future studies. These include examining older bilingual children and bilingual adults in OLMCs to see if the variations observed are maintained or change over time, as well as to provide more evidence to differentiate dialectal variations from developmental patterns in OLMCs. Future research could also administer the ESPP and transcribe using narrow transcriptions with various OLMCs across Canada to continue building reference data of bilingual children. Exploring vowel accuracy (PVC) would further increase the reference data available for phonological development of bilingual children across the country. Additionally, further investigation could examine both French and English phonological data and the interaction between the languages to determine if the variation seen in the children's French phonological patterns is also present in English. An examination of PCC or phonological patterns by age could be included in future research. Finally, future studies may wish to examine the amount of exposure to French as part of the statistical analysis to determine how the quantity of exposure could influence the language development and accuracy in bilingual children.

Conclusion

This study provided phonological development reference data for SLPs to refer to when assessing children from various provinces. This pilot data may improve the ability of clinicians to accurately discriminate between language difference or disorder. The results from this study indicated that children from various provinces demonstrate common patterns of language acquisition in their consonant inventories, both globally and by position. Surprisingly, differences in PCC were present, as Québec City scored significantly lower than Edmonton and

Montréal. This significant difference could have been multifactorial, including language exposure and level of transcription. Phonological pattern analysis provided preliminary data on allophonic and dialectal variations present in children from Québec City and Winnipeg. For example, children from Québec City produced several voicing variations, whereas children Winnipeg aspirated /p/ and /t/ and used the English velar /ŋ/ instead of the French palatal /ɲ/. Future studies may want to obtain narrow transcriptions of children from other OLMCs across Canada including Edmonton and Montréal. These findings will increase the data set available to SLPs to accurately assess the phonological development of bilingual children across the country.

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Appendix A - Consonant inventories by place and manner

Table 10. Number of children who produced consonants two or more times by site, place and manner of articulation.

			Place of Articulation						
			Bilabial	Labiodental	Alveolar	Post-alveolar	Palatal	Velar	Uvular
Manner of Articulation	Stops	Edmonton (n=12)	p: 12 b: 12		t: 12 d: 12			k: 12 g: 12	
		Montréal (n=9)	p: 9 b: 9		t: 9 d: 9			k: 9 g: 9	
		Québec City (n=17)	p: 17 b: 17		t: 17 d: 16			k: 17 g: 17	
		Winnipeg (n=13)	p: 13 b: 13		t: 13 d: 13			k: 13 g: 13	
	Nasals	Edmonton (n=12)	m: 12		n: 12		ɲ : 6		
		Montréal (n=9)	m: 9		n: 9		ɲ: 5		
		Québec City (n=17)	m: 17		n: 17		ɲ: 10		
		Winnipeg (n=13)	m: 13		n: 13		ɲ: 1		
	Fricative	Edmonton (n=12)		f: 12 v: 12	s: 12 z: 12	ʃ: 10 ʒ: 8			ʁ: 12
		Montréal (n=9)		f: 9 v: 9	s: 9 z: 9	ʃ: 8 ʒ: 7			ʁ: 9
		Québec City (n=17)		f: 17 v: 17	s: 17 z: 16	ʃ: 13 ʒ: 11			ʁ: 14
		Winnipeg (n=13)		f: 13 v: 13	s: 13 z: 13	ʃ: 9 ʒ: 9			ʁ: 13
	Approximant	Edmonton (n=12)	w*: 12 ɥ*: 11				j: 12 ɥ*: 11	w* 12	

		Montréal (n=9)	w*: 9 ɥ*: 7				j: 9 ɥ*: 7	w*: 9	
		Québec City (n=17)	w*: 17 ɥ*: 8				j: 17 ɥ*: 8	w*: 17	
		Winnipeg (n=13)	w*: 13 ɥ*: 10				j: 13 ɥ*: 10	w*: 13	
	Lateral Approximant	Edmonton (n=12)			l: 12				
		Montréal (n=9)			l: 9				
		Québec City (n=17)			l: 17				
		Winnipeg (n=13)			l: 13				

*Double place of articulation.

Appendix B - Emerging and mastered sounds in all positions

Table 11. Emerging and mastered sounds in initial, medial, and final positions.

	Initial		**Medial**		**Final**	
Site	Emerged*	Mastered**	Emerged*	Mastered**	Emerged*	Mastered**
Edmonton	p, b, t, d, k, g, m, n, f, v, z, ʃ, ʁ, w, j, ɥ, l	p, b, t, d, k, g, m, n, f, v, z, ʃ, w, ɥ, l	p, b, t, d, k, g, m, n, f, v, s, z, ʁ, w, j, l	p, b, t, d, k, g, m, n, f, v, s, j, l	p, b, t, d, k, g, m, n, ɲ, f, v, s, z, ʃ, ʁ, j, l	p, b, t, k, g, m, n, ɲ, f, v, s, z, ʁ, j, l
Montréal	p, b, t, d, k, g, m, n, f, v, z, ʃ, ʒ ʁ, w, j, ɥ, l	p, b, t, d, k, g, n, f, z, w, j, ɥ, l	p, b, t, d, k, g, m, n, f, v, s, z, ʃ, ʒ, ʁ, j, l	p, b, t, d, k, g, m, n, f, v, s, z, ʁ, j, l	p, b, t, d, k, g, m, n, ɲ, f, s, z, ʒ, ʁ, j, l	p, b, t, k, g, m, n, s, ʁ, j
Québec City	p, b, t, d, k, g, m, n, f, v, s, z, ʃ, ʒ, ʁ, w, j, l	p, b, t, k, g, m, n, f, w, l	p, b, t, d, k, g, m, n, ɲ, f, v, s, z, ʒ, ʁ, j, l	p, b, t, k, g, m, n, f, v, s, z, j, l	p, b, t, k, m, n, ɲ, f, s, z, ʁ, j, l	p, t, m, n, ɲ, f, s, j, l
Winnipeg	p, b, t, d, k, g, m, n, f, v, s, z, ʃ, ʁ, w, ɥ, j, l	p, b, t, d, k, g, m, n, f, v, s, z, ʁ, w, j, l	p, b, t, d, k, g, m, n, f, v, s, z, ʁ, j, l	p, b, t, d, k, g, m, n, f, v, j, l	p, b, t, d, k, g, m, n, f, v, s, z, ʁ, j, l	p, b, t, k, m, n, f, s, z, ʁ, j, l

*Emerged consonants: produced at least once by more than 75% of the children in each group.
**Mastered consonants: produced at least once by more than 90% of the children in each group.

Appendix C - ESPP Task

ESPP word opportunities and scoring template (MacLeod et al., 2014).

Grille d'évaluation pour l'ESPP

Nom:______________________ Date d'évaluation: ______________ Age: ________

École:______________________ Date de naissance: ______________

Nom de l'évaluatrice(teur): ______________________ 1ère langue: ______________ (Autre langue:__________)

Mot cible	API	Production de l'enfant (en API)	Niveau d'indice (1, 2, 3)	# C bien produites	Le chiffre de gauche indique la ligne pour inscire la consonne* dans le tableau de droite (✓ si bien produit; sinon, indiquer le phonème produit en API)	
train	/tʁɛ̃/	______	__	__/2	26 tʁ ____	
bloc	/blɔk/	______	__	__/3	21 bl ____	9 k ____
crayon	/kʁɛjɔ̃/	______	__	__/3	24 kʁ ____	20 j ____
tambour	/tãbuʁ/	______	__	__/3	5 b ____	
bague	/bag/	______	__	__/2	10 g ____	
tasse	/tɑs/	______	__	__/2	3 t ____	12 s ____
fourchette	/fuʁʃɛt/	______	__	__/4	8 f ____	
champignon	/ʃãpiɲɔ̃/	______	__	__/3	18 ʃ ____	13 ɲ ____
douche	/duʃ/	______	__	__/2	6 d ____	18 ʃ ____
banane	/banan/	______	__	__/3	1 n ____	1 n ____
singe	/sɛ̃ʒ/	______	__	__/2	12 s ____	19 ʒ ____
chocolat	/ʃʌkʌlʌ/	______	__	__/3	9 k ____	
biscuit	/biskɥi/	______	__	__/4	29 skɥ ____	
framboise	/fʁãbwɑz/	______	__	__/5	23 fʁ ____	28 bw ____
tomate	/tɔmat/	______	__	__/3	2 m ____	3 t ____
chandail	/ʃãdaj/	______	__	__/3	6 d ____	20 j ____
gant	/gã/	______	__	__/1	10 g ____	
robe	/ʁɔb/	______	__	__/2	17 ʁ ____	5 b ____
jupe	/ʒʏp/	______	__	__/2	19 ʒ ____	4 p ____
yogourt	/jɔguʁ/	______	__	__/3	20 j ____	10 g ____
valise	/valiz/	______	__	__/3	16 v ____	7 z ____
bijoux	/biʒu/	______	__	__/2	19 ʒ ____	
persil	/pɛʁsi/	______	__	__/3	4 p ____	
viande	/vjãd/	______	__	__/3	27 vj ____	6 d ____
beigne	/bɛɲ/	______	__	__/2	5 b ____	13 ɲ ____
fève	/faɪv/	______	__	__/2	16 v ____	
pomme	/pʌm/	______	__	__/2	4 p ____	2 m ____
fleur	/flaœʁ/	______	__	__/3	22 fl ____	
cochon	/kɔʃɔ̃/	______	__	__/2	18 ʃ ____	
poisson	/pwasɔ̃/	______	__	__/3	25 pw ____	12 s ____
nid	/ni/	______	__	__/1	1 n ____	
oiseau	/wazo/	______	__	__/2	14 w ____	7 z ____
lapin	/lapɛ̃/	______	__	__/2	11 l ____	4 p ____
cheval	/ʃœval/	______	__	__/3	16 v ____	11 l ____
canard	/kanɑʁ/	______	__	__/3	9 k ____	
mouton	/mutɔ̃/	______	__	__/2	2 m ____	3 t ____
zèbre	/zɛbʁ/	______	__	__/3	7 z ____	30 bʁ ____
éléphant	/elefã/	______	__	__/2	11 l ____	8 f ____
girafe	/ʒiʁaf/	______	__	__/3	17 ʁ ____	8 f ____
huit	/ɥɪt/	______	__	__/2	15 ɥ ____	

* Pour simplifier cette analyse, seulement 1 production de chaque consonne par position dans le mot est conservé.

Phonème par ordre développemental[1]					
		initiale	médiane	finale	stimulable?
		(✓ si bien produit; sinon indiquer le phonème produit en API)			
1	n				
2	m				
3	t				
4	p				
5	b				
6	d				
7	z				
8	f				
9	k				
22	fl				
10	g				
11	l				
12	s				
13	ɲ				
14	w				
15	ɥ				
16	v				
17	ʁ				
18	ʃ				
19	ʒ				
20	j				
21	bl				
23	fʁ				
24	kʁ				
25	pw				
26	tʁ				
27	vj				
28	bw				
29	skɥ				
30	bʁ				

Calcul du ratio de consonnes bien produites[2]	
Nombre de consonnes bien produites=	
Nombre de consonnes cibles=	
Si l'enfant a produit toutes les consonnes = 103 consonnes cibles	
Ratio de consonnes bien produites =	

[1] *Pour normes développementales, consulter MacLeod et al (2011)*

[2] *Pour normes développementales, consulter MacLeod et al (2014)*

Commentaires:

1