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# Reading across Different Orthographies: Urdu, Arabic, Hindi and English

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Running Head: READING ACROSS DIFFERENT ORTHOGRAPHIES

Reading across Different Orthographies: Urdu, Arabic, Hindi and English

By

Amna Mirza, M.A.

Dissertation

Submitted to the Department of Psychology

In Partial Fulfillment of the Requirements for the Degree

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## Abstract

Research on relationships across literacy skills for multiple languages suggests the need for a complex framework that includes linguistic typology as well as cognitive and cultural variables (Schwartz, Geva, Share, & Leikin, 2007). Literature shows that bilinguals activate both languages they know for all linguistic tasks regardless of which language is being used at the time (Kroll & Bialystok, 2013). In that case, learning a third or any additional language is qualitatively different than second language (L2) acquisition. Findings for readers of Roman scripts demonstrate that L1 reading and L2 proficiency influences L2 reading (Cummins, 1979). The current research examined the learning processes for bilinguals learning English as their second language and one of three languages as their first language, Urdu, Arabic and Hindi. These languages were selected because they share either scripts (Urdu & Arabic) or linguistic typologies (Urdu & Hindi). No previous research has examined the effects of learning to read two or three languages where vocabulary, script, morphological and syntactic structures are either shared or dissimilar in terms of different components. Data are presented in three studies. The first study explored how Urdu-English bilinguals perform on L2 (English) word reading when they learn to read English prior to learning to speak English in Pakistan as compared to Urdu-English bilinguals in Canada who learn to speak English prior to learning to read English. The second study explored whether Urdu-English bilinguals take advantage of learning Arabic (similar script as in Urdu language) as another language simultaneously while learning to read English (as L2) over Arabic-English bilinguals. The third study compared Urdu-English and Hindi-English bilinguals in Canada whose oral languages are mutually intelligible. All language groups were compared to each other to determine which factors; shared script, vocabulary, or morphological structure has the strongest influence on second language (English) reading

acquisition in these bilingual children. The findings of the first study showed different patterns for the Urdu-English bilinguals in Canada and in Pakistan. In Canada, there was transfer from L1 measures to L2 reading, while there was no transfer for the sample from Pakistan. The second study showed that the Urdu-English bilinguals had higher scores than the Arabic-English bilinguals on most measures across comparable locations. Therefore, it seems that Urdu-English speakers benefit from another language in similar script as their L1. The findings of the last study showed that L1 reading skills transfer to L2 only in alphabetic languages as compared to if L1 is an alpha-syllabic language in Urdu-English and Hindi-English speakers in Canada. The overall findings show effects of context of language learning and effects of L1 on variables related to English reading performance. They suggest that theories developed for English L2 learners in North America might not apply to English L2 learners in other linguistic contexts.

*Keywords:* bilinguals, second language acquisition, reading, orthographies.

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**I love you so much Nana Aboo!!!**

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### Reading across Different Orthographies: Urdu, Arabic, Hindi and English

Bilingualism is common worldwide and increasingly so as many people emigrate to new countries that involve learning another language in order to improve opportunities for success for themselves and their children. According to a report issued by Statistics Canada in 2016, 16.1% of the Canadian population reported themselves as foreign born and holding immigrant status in Canada with Hindi speakers (people from India) being the second highest group and Urdu speakers (people from Pakistan) being the group with the fifth highest number of recent immigrants. The census also revealed that 198 non-official languages are spoken in homes in addition to one or both of official languages of Canada (i.e., English and French). This number reflects the usage of various Asian languages 56% and Aboriginal languages 44% (i.e., Cree, Inuktitut, Ojibway, etc) among immigrant and non-immigrant people (Statistics Canada, 2016).

The term “bilingualism” is defined as knowing two languages (Gottardo & Grant, 2008; Valdez & Figueora, 1994). However, it is difficult to define bilingualism in a simple and consistent manner. Specifically, it is difficult to determine what it means to “know” a language due to the fact that some bilinguals are highly proficient in both languages they speak, showing a “native-like” control of the language. Other bilinguals show some initial command of vocabulary and syntax (Butler & Hakuta, 2004; Gottardo & Grant, 2008). Additionally, researchers suggest that native-like proficiency in both languages is rare (Grosjean, 1982), with most bilinguals clearly having a dominant language. Therefore, a factor to consider in defining bilingualism is when the two languages are learned in relation to each other (Gottardo & Grant, 2008) (see below for a more detailed discussion of types of bilingualism). Therefore, it is reasonable to say that bilingualism can result in varying levels of proficiency in each language in terms of oral or

written language skills (Brutt-Griffler & Varghese, 2004; Genesee, Paradis, & Crago, 2004; Valdez & Figueora, 1994).

Additionally, many people around the world are multilingual. Currently, the term “multilingualism” is used to distinguish people who speak more than two languages (Grosjean, & Li, 2013). Similar to the definition of bilingualism, there are challenges in defining what it means “to know” two or more languages. Multilingualism can include the development of an additional non-native language in a foreign context (people who live on a permanent basis somewhere else in the world than their native countries and speak and learn to read more than two languages) (Schwartz, Geva, Share, & Leikin, 2007). These individuals speak their native language in their homes, learn another language as their national language (i.e., Urdu in Pakistan, Hindi in India) and often learn English as their school and work language. This situation is relatively. The languages selected for the current set of studies include Urdu, Arabic and English as first languages and English as a second language. These languages were selected based on shared scripts (Urdu & Arabic) or shared linguistic typologies (Urdu & Hindi). Although these people know more than two languages and can be defined as multilinguals they are often referred to as bilinguals instead of multilinguals in the research literature because only two of their languages are systematically measured. These research designs are often the result of multilinguals only sharing two of their languages in common. In contrast the largest sample of participants in the current study is Urdu speakers, who are systematic multilinguals. They learn Urdu as their national language sometimes in addition to another regional language, they learn to read, speak and understand Arabic as their religious requirement and finally they learn English as their school and work language (Mirza, Gottardo & Chen, 2017). Despite knowing three to four languages only Urdu and English will be examined systematically. Many of the Hindi speakers



in this sample, also speak more than two languages. However, for simplicity, the participants will be referred to as bilinguals throughout this document.

Research on different languages has shown that finding relationships among all languages a person knows is difficult and requires a complex framework, which can be culturally or linguistically specific (Schwartz et al., 2007). Researchers have found that bilinguals activate both languages in their mind, regardless of which language is being used at the time (Jared & Kroll, 2001; Kroll & Bialystok, 2013). In that case, learning a third or any additional language is qualitatively different than second language acquisition (Cenoz, 2003; Cenoz & Genesee, 1998). For example, some children may learn to read in two alphabetic languages as their L1 and L2 while in other cases bilinguals learn to read in another or third language which can be either a non-alphabetic language (a character-based language or alpha-syllabic language). It is, therefore clear that research conducted on bilingualism should be separated from the research designed to understand the language and literacy skills of multilingual learners.

The present study helps in understanding the language and literacy skills of bilingual and multilingual children in North America and comparative groups in their native countries who have either Urdu, Arabic or Hindi as their first language and learn to read and speak English as their second language. Interestingly, both Urdu and Hindi speakers might also be considered as multilinguals. Two conditions support this possibility: First, Urdu and Hindi share characteristics of oral language (linguistic features) and are mutually intelligible. Second, most Urdu speakers and some Hindi speakers might be Muslim and learn to read and speak Arabic to enable them to read and understand the Quran (their Holy Book) (See table 1 and 2 for languages and their properties).

The present research was further divided into three sub-studies and comparisons were made across language groups. The first study conducted comparisons between students who spoke and read Urdu and English from Pakistan with students who spoke and read Urdu and English in Canada. The second study compared students who spoke and read Arabic and English in Saudi Arabia to students who spoke and read Arabic and English in Canada. This study also conducted comparisons across languages (Urdu-English bilinguals from Pakistan were compared to Arabic-English bilinguals from Saudi Arabia and Urdu-English and Arabic-English bilinguals from Canada and Saudi Arabia were compared to each other). The last study had comparisons between Urdu-English and Hindi-English bilinguals from Canada. These groups with different first languages (L1) were also compared in terms of their English skills. Finally, within-group comparisons were made in terms of English skills and L1 skills.

### **Roadmap**

The following sections discuss basic concepts related to bilingualism and multilingualism followed by an introduction to the process of learning to read. The second chapter of this research focuses on theoretical models of reading in different languages. Following this is an examination of different components of reading development such as the role of orthography and phonological skills in reading development across different language systems. Finally, a discussion of the methods, that were used in all three sub-studies, findings, and discussions are presented.

### **Bilingualism and Multilingualism**

The process of understanding oral language and literacy skills involved in reading and writing can lead researchers to tease apart independent contributions of the language-general and language-specific skills and mechanisms in learning multiple languages (Mirza, Gottardo, &

Chen, 2017). Language-general mechanisms refer to the rules and applications used for phonemic awareness and morphological awareness and are applicable in all languages whereas language-specific mechanisms are usually strictly tied to one language and are not applicable in other languages, such as specific letter-sound correspondences or grammatical rules. Most of the research conducted in the past has looked at the cross-linguistic relationships among languages and literacy skills of bilingual and biliterate people (August & Shanahan, 2006; Prevoo, Malda, Mesman, & van IJzendoorn, 2016). Not all languages are alphabetic languages nor do all alphabetic languages share the same script. That is why it is possible that people can know two languages with completely different oral and written forms (e.g., Chinese-English bilinguals). Research in the area of bilingualism has progressed in terms of understanding the nature of relationships across languages with similar alphabetic scripts (e.g., Spanish and English) (Lindsey, Manis, & Bailey, 2003; Proctor, August, Carlo, & Snow, 2006) and different alphabetic scripts (e.g., Russian and English, English and Hebrew) (Abu-Rabia, 2001; Wade-Woolley & Geva, 2000). Some progress has been made in research comparing alphabetic and non-alphabetic languages such as Chinese-English speakers (Chow, McBride-Chang, & Burgess, 2005; Gottardo, Chiappe, Yan, Siegel, & Guo, 2006; Pasquarella, Chen, Gottardo, & Geva, 2015).

All these studies suggest that language and literacy skills are related to each other and first and second language skills can influence each other (Chang, 2013; Jiang, 2004; Koda, 1996). For example, Spanish-English speakers who are skilled in both languages might have strong language-general and language-specific skills. But it can be difficult to determine whether language-specific or language-general mechanisms are involved in differentiating good and poor readers when the languages share many features. Therefore, researchers are now using different

methods to understand these relationships across languages in greater depth. For example, do language-general mechanisms influence the relationships across typologically different orthographies (e.g., reading an alphabetic script, English and Arabic)? Alternately, are cross-linguistic relationships the result of similarities in orthography or linguistic typology (e.g., the Roman alphabet)? In most cases these bilingual immigrants learn to speak a language before they learn to read or sometimes learn to speak and read simultaneously (Bialystok, Luk, & Kwan, 2005; Snow, Burns, & Griffin, 1998). In western cultures, it is uncommon for children to learn to read a language before they learn to speak the language (e.g., English). However, children in other parts of the world often learn to read a language prior to learning to speak (e.g., English as a foreign language) (Asfaha, Beckman, Kurvers, & Kroon, 2009; Dubeck, Jukes, & Okello, 2012). For example, in many eastern countries (e.g., public schools in Pakistan, India, Bangladesh and many other developing countries) children are introduced to the English alphabet in their early elementary years, most often by the age of six or seven, through their school (private or public). However, in both private and public schools children learn to speak English after they learn to read the language. The educational system in Pakistan, India and Saudi Arabia is divided into the public sector and the private sector. Children of elite classes in Pakistan, India and Saudi Arabia have the privilege to study in the private sector schools (Panezai & Channa, 2017). Children, who are enrolled in the private schools, study English in Grade 1 and onward, and English is the medium of instruction in these private schools. On the other hand, public schools in Pakistan use Urdu, in India use Hindi and in Saudi Arabia use Arabic or another first/regional language as the medium of instruction in their classrooms. They mostly rely on outdated teaching methods mainly Grammar Translation Method (GTM) to teach English in later grade levels (Zeeshan, 2013; Panezai & Channa, 2017). This method involves

translating written text from one language to another. Vocabulary and even specific sentences can be learned through rote repetition. Rote learning is defined as the memorization of information/material based on repetition (Zeeshan, 2013). The purpose is to make students/children able to quickly recall the material by frequent repetitions with any reference to meaning being incidental.

### **Bilingualism in the Canadian Context**

Although Canada is officially defined as a multicultural and multilingual country (Statistics Canada, 2016), in reality many children born to immigrant parents show a pattern of language loss. These children begin school fluent in their family L1. However, due to the large number of first languages known by children in many urban classrooms, and the lack of a single, common minority group, the language of the classroom is English. Not only is English immersion instruction conducted in the classroom, but English is also the common language of the playground. Therefore, children show a pattern of L1 loss and dominance in their L2. In fact, these immigrant children often show dominance in their L2 after having attended school in Canada for several years (Statistics Canada, 2016). Some immigrant parents in Canada attempt to preserve their L1 at home and encourage L1 literacy through heritage language classes, which are held after school and/or on weekends. Therefore, although these immigrant children are able to communicate orally in their L1 to various levels of proficiency, they often have strong oral language skills in English and often acquire English literacy prior to literacy in their L1. The main goal of the present study was to determine whether bilingual children who live in western culture and learn to speak and then read an alphabetic language before they learn to read and write (English as their second language) differ from the children who live in their heritage culture, eastern culture and learn to read and write the same language (English, their second

language) prior to learning to speak the language. To investigate these differences, it is important to understand how the processes of learning to read, write and speak differ in both language learning contexts. To that purpose, the next section of this paper discusses the development of reading and writing among children and different components of reading that support this process.

### **Introduction to Reading and Writing**

The process of learning to read is interesting because it requires learners to integrate many of their human capacities such as visual perception, reasoning and imagination. The ability to read and write is a key requirement for participation in contemporary society and has direct consequences for health and life expectancy (Rindermann & Ceci, 2009). Knowledge of these skills has progressed but over the past two decades questions remain in particular, about whether some of the major theoretical frameworks of reading development are applicable to complex reading contexts such as learning a language as a foreign language. For instance, the role of words, the importance of lexical features or the assumption that all words must have a definite meaning (e.g., articles such as “the” is necessary in English and French) do not apply to all languages and writing systems (Wallot, 2014). According to Wallot (2014) the process of reading and writing started with the introduction of the first symbolic form of writing that was introduced for book keeping. These systems became modernized over centuries and currently include forms such as emailing and texting in addition to more traditional forms of literacy involving print form (Wallot, 2014). In the current era, people are using these systems in almost every area of life and they serve as a common medium for communication across countries, cultures and languages.

Wallot (2014) described that written manuscripts also allow authors to communicate with their audience across time and distance. The same concept has been followed in other areas of life such as the reader-writer relationships in media, schools, universities, offices, friends and families. We cannot ignore the modern forms of informational technology that have replaced the classic forms of hard copies (books, newspapers and letters) with electronic versions such as emails replacing letters and eBooks being preferred by some to books. Therefore, it is reasonable to say that reading and writing is a form of communication that has been developed to serve a communicative function (Wallot, 2014).

### **History of Models of Reading Development**

Cattell (1949) was one of the several investigators to study reading at the letter, word, and sentence level using tachistoscopic methods (a method used for testing children in their schools on reading comprehension for speed reading) (Cattell, Maxwell, Light & Unger, 1949). His research revealed some basic facts about reading. For example, it is much easier for readers to read longer letter strings when they are grouped into real words as compared to random letters (non-words). He also suggested that it is easier for beginning readers to pronounce a monosyllabic word as compared to sounding out a letter. Based on his research findings, it can be concluded that reading is a synthetic process in which a reader reads a word by recognizing a word as a whole. In conclusion to his and some other researchers' (Erdmann & Dodge, 1898) findings, it is inevitable to title the process of reading as *Total Shape*, which describes skilled reading as holistic recognition of words. Combined, this work suggests that skilled readers who are familiar enough with a specific vocabulary can easily access 22-letter long words in their lexicon. The suggestion was made by Erdmann and Dodge, (1898) who tested some participants

on German language, in which it is possible to compound several nouns into a single word. The findings of this research support their explanation of word reading as a synthetic process.

Wundt's (1900) research specifically focused on the effective presentation time of words in the tachistoscope, which was prolonged by after-image effects (Farr, 1983). His findings suggest that for successful reading of extremely long words, readers must attend to multiple parts of these words at the same time. In the late 1970s, Coltheart (1978, 2005) introduced the "*dual-route model*" to the debate regarding whether word reading was an analytic versus synthetic process. In this theory, he incorporated both analytic and synthetic processes into one theory of word reading. The simple explanation of this theory is that reading a word either goes through a direct (synthetic) or indirect (analytic) route. In the direct route, a word is mapped directly onto its representation in the mental lexicon and that process is called synthetic reading. The indirect route of word reading is when individual letters of the word need to be recognized and the phonology of the word has to be reconstructed through its spellings. In the process of indirect route word reading, the next level after accessing the word in the lexicon is mapping the constructed representation. Additionally, reading speed is an important component of reading because using the direct route for reading permits faster word reading as compared to indirect route of word reading (Coltheart, 1978, 2005). Research on reading development conducted by Seidenberg (2007) suggests that the process of learning to read depends on establishing mappings between phonology and orthography and that can be considered as language-general learning mechanism. However, the *Dual Route Model* has faced some criticism in terms of its application in all languages and the writing systems they follow. In an attempt to resolve this concern, the process of reading development was examined across languages and orthographies. In this document, the term "orthography" is referred as a visual unit of each language, such as



English orthography is written in an alphabetic script and the term “script” is referred as a writing system that is either alphabetic or morphosyllabic (e.g., Roman script, Kanji).

### **Orthographic Depth Hypothesis**

Languages differ in terms of orthographies, and alphabetic orthographies vary in terms of how they are written. They can be shallow with transparent (regular and consistent) grapheme-phoneme correspondence (e.g., Spanish and Italian) or deep with ambiguous mapping between spelling and sound (e.g., English and French) (Bar-Kochva, & Breznitz, 2014). To understand the process of learning to read in such languages, Katz and Frost (1992) introduced the *orthographic depth hypothesis* that addresses the reading strategies readers follow in different orthographies.

There are two versions of Orthographic Depth Hypotheses (ODH), the strong ODH and the weak ODH (Katz & Frost, 1992). The *Strong ODH* states that phonological representations are derived only from assembled phonology and are sufficient for naming the objects and making lexical decisions in a shallow orthography. According to this explanation, rapid naming in shallow orthographies is only a pre-lexical analytic process and does not involve lexical access. That means *strong ODH* is not applicable to orthographies that have typically been used in research on word perception.

Serbo-Croatian is an interesting test case because oral forms of the two languages are almost identical while Serbian is written in Cyrillic script whereas Croatian is written in Roman script. For instance, in a shallow language like Serbo-Croatian, accrediting pronunciation as a main predictor is not possible. Specifically, Serbo-Croatian language does not represent syllabic stress. In this language, stress is completely predictable for two-syllable words and not possible for words with more than two syllables. As a result, the final syllable is left with no stress at all.

Single and two syllable words make up a large part of normal running text and can be pronounced by an average of pre-lexical sub word analysis. Yet, most of the words are more than two syllables in length and can only be pronounced correctly by accessing the lexicon. Also, in this language there are some specific rules regarding phonemes that a letter must represent only one phoneme at a time. The discussed linguistic structure suggests that Serbo-Croatian language is not a perfect example of shallow orthography therefore, it is hard to associate and explain strong orthographic depth hypothesis. In the current study, Urdu and Hindi represent mutually intelligible languages written with different scripts.

The *weak ODH* includes word specific orthography that complements phonology as the main predictor. In reading, phonology is needed for the pronunciation of printed words not only from pre-lexical letter-phonology correspondences, but also from lexical phonology. According to the *weak ODH*, the next step in reading is visual orthographic addressing of lexicon: a search process that looks at spellings of a whole word or morpheme with its stored phonology. It is also suggested that this process works more efficiently in shallow orthographies (Koda, 2005). Katz and Frost (1992) supported the *weak ODH* with regards to word recognition as a lexicon decision task. The criticism they faced by other colleagues (Feldman & Turvey, 1983; Lukatela & Turvey, 1990a) stated that Serbo-Croatian necessarily involves pre-lexical (i.e., assembled) phonology but not the lexical phonology. Van Orden, Pennington and Stone, (1990), and Perfetti, Bell, and Delaney (1988) found the same results in their studies regarding the involvement of pre-lexical phonology but only in the English language. Yet, they did not argue about the exclusive involvement of assembled phonology in word processing except that assembled pre-lexical phonological information without syllables stress information is necessary for identifying

the words in the English lexicon. Therefore, it is possible to have problems for exclusively phonological mechanisms in some cases while reading with irregularly spelled words.

The current study dealt with four different languages, which are represented by three different scripts, specifically Urdu, Arabic, Hindi and English. Therefore, it is necessary to discuss and compare the strong and weak version of the ODH in order to facilitate our understanding of the process of reading development in the targeted languages.

Research conducted by Katz and Frost (1992) suggests that single-language research is adequate only for testing the *strong ODH*. As mentioned earlier, the *strong ODH* is connected to shallow orthographies, and suggests not using lexically stored information for naming tasks (measures of vocabulary). Therefore, this *ODH* can be used in indicating the effects of phonological coding that are dominant in representations of orthography. To conclude, it might be easy to find effects of phonological coding in the languages like Serbo-Croatian, and hard to find the same effects in the Hebrew language, and by extension other Semitic languages such as Arabic. According to the *Orthographic Depth Hypothesis*, it is possible to argue that phonological coding is the main predictor in the Serbo-Croatian language but not of deep orthographies or character-based languages (e.g., Hebrew or Chinese). These comparisons can only be made if the experimenter has used a similar experimental design. Consequently, these types of studies are hard to design because of the complexity and role of various rules in each language that are only applicable in that orthography but not any other.

Consistent with this argument, it is hard to find effects of phonological coding in the English language by using the lexical decision paradigm (Perfetti et al., 1988). Yet, it is possible to find phonological effects in a language like English by using a more sensitive technique such as the *backward masking paradigm*. Also, stated earlier, in *weak ODH* orthographic knowledge

and pre-lexically assembled phonological information is used at the same level in accessing the lexicon. Moreover, the degree used to separate the functionality of orthographic knowledge and pre-lexically assembled phonological information from each other is the structural relationship between orthography and lexical entry. Considering the arguments made here for both *Strong* and *Weak ODH* we will examine the nature of the orthography used to write the languages being studied, specifically Urdu, Arabic and Hindi, to determine the variables used in the process of learning to read these languages, such as vocabulary, phonological processing, morphological awareness and orthographic knowledge. Languages differ in consistency of phonology represented in the orthography that results in developmental differences in lexical grain size. Consequently, people follow different strategies in learning to read when they experience different levels of difficulty with reading across orthographies. To explain that process the next section of the paper will discuss the Psycholinguistic Grain Size theory of reading development.

### **The Psycholinguistic Grain Size Theory of Reading Development**

Language learning differences develop among children in early years and are related to lexical representations across languages. These differences might affect access to one's lexicon and processes used to read words even in adulthood. Processing strategies and lexical organization, that are the key features of skilled reading in different orthographies, are also influenced by different developmental constraints in the writing systems one's language uses (Ziegler & Goswami, 2005). According to the *Psycholinguistic grain size theory* there are clear differences in reading accuracy and reading speed across orthographies. These differences reflect the differences in phonological recoding and reading strategies among different orthographies. Children, who learn to read consistent orthographies such as Finnish, Greek, German, or Italian, rely mainly on grapheme–phoneme recoding strategies because the relationship between

graphemes and phonemes is straightforward. On the other hand, children who learn to read inconsistent orthographies such as English, Danish and French, cannot rely only on grapheme-phoneme information because the consistent units of these languages are considered larger grain sizes in psycholinguistic grain size theory (e.g., the words “contemporary” and “postulate”). In regards to the different strategies readers follow, and difficulties they experience in different orthographies, it is important to explain psycholinguistic grain size theory in detail. The present study addresses the theories that have been developed to explain reading patterns in completely different alphabetic orthographies.

Ziegler and Goswami (2005) conducted research in cross-linguistic contexts and have tried to explain reading development across languages. They proposed three factors that contribute to the process of reading: *availability, consistency and granularity*. Availability refers to the ease of access of different sound units prior to reading. Consistency can be seen in the associations between each sound and symbol of the language. Granularity refers to the level of mappings between the sound and symbol in that language to determine if they are larger or smaller units. This literature also suggests that the nature of reading instruction holds an important place in reading development. Therefore, the *psycholinguistic grain size theory* model of reading development explains the process of reading development as the abstraction of optimal mappings between orthographic units and sounds of the language.

**Components of Psycholinguistic Grain Size Theory.** This section explains the role of the three factors of psycholinguistic grain size theory in reading development. All three factors, availability, consistency and granularity, contribute equally in the process of learning. For instance, if a writing system represents sound units that are easy to access in everyday speech (e.g., syllables in Japanese) versus representing phonemes such as French, this should facilitate

the process of learning to read. Also, if the correspondence between sounds and symbols are consistent and predictable (e.g., Spanish), then the process of learning to read becomes easier. Eventually, the factor of granularity helps with the writing system and representation of sounds at one particular lexical level. However, granularity works slightly differently in some languages like English, in which we have both larger and smaller units simultaneously (e.g., *cove* as a regular word, *love* and *dove* as other common pronunciations). Therefore, it is important to recognize the grain size of the phonological unit as the first step and determine whether the symbol maps are large versus small, and fine versus coarse grained.

According to this view of learning to read, the process must be easier for the languages that contain only fine-grained grapheme-phoneme units (e.g., Finnish with only phoneme level units) as compared to the languages in which mappings to symbol units are more than one-unit size (e.g., English) (Gottardo, Collins, Baciu, & Gebotys, 2008). In English, minimal sound units (e.g., /ai/) could be represented by a single letter /I/ and with a multiple letter string /igh/. In this case, learners of multiple languages are presented with challenging situations when the same graphemes represent different phonemes across the different languages that they read. For example, some letters in Urdu, Arabic and Farsi languages represent same sounds without any specific reason: (sound-k) is represented by two different letters and (sound-s) is represented with three different letters. It is also important to acknowledge that psycholinguistic grain size theory does not incorporate the role of scripts outside the alphabetic writing system (e.g., Hindi-an abugida language). Many researchers have worked with this theory as language-general but not language-specific domains (e.g., Yang, McCandliss, Shu, & Zevin, 2009). More work in the area needs to be done to determine the clear pathways in the process of reading development which can be universal and applied to all language systems.

**Grain Size in Different Languages.** A beginning reader acquires knowledge of correspondence between graphic symbols and units of sounds in the process of learning to read their specific language. Bilingual readers must acquire sound-symbol correspondences across languages or orthographies (e.g., English-Urdu or English-Hindi) (Share, 1995; Ziegler & Goswami, 2006). These correspondences depend on the writing system in terms of which component, phoneme, syllable or morpheme, represents the language units in that orthography (Asfaha, Kurvers & Kroon, 2009). It is very clear that phonological awareness holds the most important place in the development of reading in all orthographies. Ziegler and Goswami (2005) tested differences in the development of phonological recoding and its levels across languages. In a study of early reading development in European languages Seymour, Aro, and Erskine (2003) found that deep and inconsistent orthographies (e.g., English) showed slower progress as compared to shallow and consistent orthographies (e.g., Finnish). The *Psycholinguistic Grain Size Theory* (PGST) addresses these differences in shallow versus deep orthographies (Ziegler & Goswami, 2005). This theory explains developmental differences in reading across orthographies (discussed earlier) in terms of the *availability* of phonological units, the *consistency* of mapping between spelling and sound and the *granularity*, or grain size, of the scripts. These features address the three core problems that language learners face at the very beginning stages of reading. However, the PGST was not used to explain results of previous research by Durgunoğlu and Oney, (1999), Gombert, (1992), Gombert, and Fayol, (1992) and Liberman, Shankweiler, Fischer, and Carter (1974). Specifically, the first factor *availability* does not apply in all languages and orthographies because not all phonological units are equally accessible in all languages. Second, *consistency* must be addressed as some graphemes have different pronunciations and some have different spellings while others are consistent. Third, *granularity*

that is using larger grain size in orthography means there is a larger number of orthographic units in some languages that do not use alphabetic systems (e.g., more characters in Chinese as compared to number of letters in English).

The concerns related to the three factors of *PGST* cannot be ignored as they are interconnected in the process of acquiring early phonological recoding skills. For example, use of easily accessible syllable units with larger grain size facilitates reading for the beginner reader as compared to orthography that holds smaller units of grain size. Furthermore, basic grain size in each orthographic system does not always overlap with the grain size of the teaching methods (Ziegler & Goswami, 2006). Therefore, it is important to determine how each of the three features of psycholinguistic grain size theory are used in the first stage of learning to read among beginning readers. More specifically, availability and consistency might be most applicable in this particular study as the languages used in the study are alphabetical and alpha-syllabic.

Ziegler and Goswami (2005, 2006) used multiple European languages to explain the psycholinguistic grain size theory such as English and Danish (inconsistent orthographies) and Italian and Spanish (consistent orthographies). According to that, in some orthographies, one letter can have multiple pronunciations (i.e., English and Danish) whereas, in some alphabetical languages one letter is always pronounced in the same way (i.e., Greek, Italian or Spanish). Similarly, some orthographies have phonemes with multiple spellings (i.e., English, French and Hebrew) whereas others always have the same spellings (i.e., Italian). They also tried to apply this theory to the Turkish language, which has a rich morphological structure. Another study done by Nag (2007) compared beginning reading skills of English language learners with Kannada speakers (an Indic language with 470 Akshara symbols in it). The findings of this study focused on the impact of the last feature of psycholinguistic grain size theory (granularity). It



was found that children learning to read the Kannada language were hindered by the large number of Akshara syllables. Winskel and Widjaja (2007) conducted a study on the beginner readers of the Indonesian language, an orthographically transparent language, in which the syllable is a salient unit (e.g., /ibu/ means “mother”). Findings of this study indicated that the phoneme is the prominent phonological unit in the early acquisition of reading and spelling in the Indonesian language. However, the syllable also plays a significant role, mostly when children read long multisyllabic affixed words. This finding highlights the flexibility of grain size used by beginner readers/learners that is dependent on developmental stages that characterize learning to read in a language, characteristics of the language and its orthography and the level of difficulty of learning to read. Findings also suggest that beginners have to achieve higher levels of syllabic knowledge and basic phonemic knowledge to be able to spell or read a word. Conversely, all these cross-linguistic findings (Lee, Uttal & Chen, 1995; Nag, 2007; Seymour et al., 2003) suggest the validity of psycholinguistic grain size theory in learning non-alphabetic orthographies.

Researchers face some unique challenges while conducting comparisons among different scripts and languages such as designing a study that can only be done in specific cultural and educational traditions. Two early studies (e.g., Bruck, Genesee, & Caravolas, 1997; Ellis & Hooper, 2001) tried to conduct comparisons of early reading acquisition in different languages that had been taught nationally but faced the same type of problems. First, all of these studies were conducted only on alphabetic languages (English, French, and Welsh) and second, they were bound with cultural and educational barriers used in each region. Ellis and Hopper (2001) compared Welsh and English readers and found Welsh readers relied more on an alphabetic decoding strategy due to the transparency of their orthography. An example from the tasks used

in the study is word reading. Overall, word length showed 70% of reading latency in Welsh and only 22% in English. Also, Welsh readers made mistakes pronouncing non-words, whereas English speaking children made more real word substitutions. Findings suggest that the orthographic transparency of a language can have a deep effect on the rate of acquisition and style of reading adopted by the language learners.

Asfaha, Kurvers and Kroon (2009) investigated the relative importance of two of the key features of psycholinguistic grain size theory, *availability* and *granularity*, with early readers in different languages and scripts of African countries. This study compared two different systems of writing: an abugida (Ge'ez) and the alphabetic Latin scripts. Their expectations in the study were that reading is dependent on the *availability* of phonological units in the spoken language and the *consistency* of mappings between phonological and orthographic units and that these components must be helpful in the process of reading (Asfaha et al., 2009). Lastly, the *granularity* of the mappings would support the process of learning to read. However, the findings of this study suggest that children showed better results in reading and spelling in the syllable-based orthography as compared to Latin script (Asfaha et al., 2009). Furthermore, they also found that the total number of basic units that must be learned in syllable-based orthography were much higher than Latin orthography. These key findings suggest that *availability* holds a more important place in PGST as compared to *granularity* in the initial stages of learning to read and spell. The next section of paper that addresses the process of reading development among children.

### **Process of Reading Development**

Research in reading development suggests that when young children begin the process of learning to read, they have to learn the code used by their culture for representing speech using

“visual symbols” (Ziegler & Goswami, 2005). The next step for learners is to match these symbols to units of sounds, which is called phonology. Mostly, this relationship between phonology and symbols is systematic (e.g., English language, symbol L is always pronounced /l/) but not applicable to all letters in the English alphabet (symbol C sometimes is pronounced as /s/ for cell and other times as /k/ for cat). To understand this information children must access their lexicons where all of these symbols and their sounds are stored (as per Seidenberg & McClelland, 1989). The last stage of this process is to apply all sounds from a word as a whole which is called “phonological recoding”. Phonological recoding is considered the most important element of reading (Ziegler & Goswami, 2005) because this process functions independently and allows children to recode words that they have heard but have not seen before (Ehri, 1992; Share, 1995). However, in order to recode successfully, children have to find shared grain sizes in the symbol system (orthography) and phonology of their language. Successful achievement of this process helps learners map these two constructs. In conclusion, the role of phonological processing holds the most important place in reading development as the quality of grain size and phonological representations come prior to the mappings and recoding of symbols in the process of reading (Elbro & Pallesen, 2002; Perfetti, 2007; Wydell & Butterworth, 1999).

**Reading Development in Different Scripts.** The above discussion of the process involved in reading development dealt with the universal criteria of reading, but another important question is yet to be discussed. This question asks how children learn about the script of a language that differs from the script they learned as their first language. Most of the research conducted in the past, and concrete theoretical accounts about reading development, does not deal with this process of understanding theories of reading in different languages and scripts. It is

not clear that all developed theories of reading in the context of one language or script can account for phenomena seen in other writing systems.

Research available in the literature is inconclusive with regards to the mechanisms of reading within and across languages (Carson, Carrell, Silberstein, Kroll, & Kuehn, 1990; Miller, Heilmann, Nockerts, Iglesias, Fabiano, & Francis, 2006). More research is required to explain how learning to read occurs across languages and across scripts. It is well known that languages and scripts differ and require different or modified models of reading to explain developmental pathways and proficiencies (Nag & Snowling, 2013). Although all major theories of reading development have tried to explain the process it is still hard to decide whether these theories are applicable to the languages targeted in the current studies, specifically Urdu, Hindi and Arabic. To examine the challenges children face when they learn to read these languages, the next section of the paper looks at the predictors of word reading and fluency across different languages that vary in orthography and the consistency of sound-symbol relations.

### **Word Reading**

Nation (2009) described reading as a complex cognitive process of decoding symbols to derive meanings. Readers use a variety of reading strategies during this process of decoding and comprehension (Nation, 2009). Since good comprehenders rely on a considerable degree of knowledge of words many children who are diagnosed with poor comprehension skills are also poor in word reading (Perfetti & Hart, 2002). Perfetti and Hart (2002) introduced the *Lexical Quality Hypothesis*, which presents the idea that high quality word representations are characterized by strong reciprocal links among phonological, orthographic and semantic knowledge based on a modification of the connectionist theory of reading (Seidenberg & McClelland, 1989). They considered this process as a whole by explaining that knowledge of one

area should facilitate the other. It is suggested that partial knowledge of a word improves learning of that particular word's form and meaning (Adolf, Frishkoff, Dandy & Perfetti, 2016). Rosenthal and Ehri (2008) used the *lexical quality hypothesis* for teaching the pronunciations and meanings of rare words. Results of this study showed that children associate a spoken word with a picture (picture-word pair format). These findings were also supported by the findings of Ricketts, Bishop and Nation (2009) that followed the same strategy of learning non-words through paired-associate paradigm. In conclusion, it appears that possessive familiarity with words form facilitate word learning. In this process, memory representations access the links of information in long-term memory, which are easy to retrieve. Long-term memory provides the cues from stored phonological, orthographic and semantic information to activate the representation (Reichle, Rayner, & Pollatsek, 2003). Research conducted on vocabulary labels had defined these representations as *partially known words* or *frontier words* because they are already familiar to the reader in their oral form (Durso & Shore, 1991; Reichle & Perfetti, 2003). This view suggests that the cognitive process involved in word reading is different for words that are completely unknown (novel words) as compared to known words. Known words must be decoded when they are initially read, but subsequently these words that were auditorily familiar are accessed in memory, which is called sight word reading. Later on, they start reading all words automatically by sight, which is the most efficient way to read words in text (Ehri, 2005).

Regarding this view of word reading, the question is raised of whether first language helps second language acquisition. Also, if first language (L1) helps second language (L2) acquisition then are there any differences between learning languages that have different scripts (e.g., English, Urdu) as compared to languages that have the same scripts (e.g., Urdu and Arabic)

but not the same oral language, or languages with different writing systems and similar oral languages (e.g., Urdu and Hindi).

**Word Reading Development in Bilinguals.** Studies that examined reading development suggest that language and literacy skills are related to each other and that first language (L1) and second language (L2) skills can influence each other (Chang, 2013; Jiang, 2004; Koda, 1996). For example, Spanish-English speakers who have good language and literacy skills in Spanish tend to have strong skills in English, their L2 (Durgunoğlu, Nagy & Hancin-Bhatt, 1993; Gottardo, 2002; Lindsey, Manis & Bailey, 2003). Three exclusive models (theories) of reading in second language are described here. The *linguistic interdependence hypothesis* states that strong L1 skills are related to strong L2 skills (Cummins, 1979). The *script dependent hypothesis* highlights the role of differences in script with cross-linguistic relations being greater for languages with similar orthographies than for languages with different orthographies (Geva & Siegel, 2000). Strong versions of the *linguistic interdependence hypothesis* suggest cross-linguistic relationships within constructs (e.g., morphological skills, phonological awareness), while other researchers have suggested that some skills are more likely to be related across languages than other skills (Durgunoğlu, 2002; Geva & Wang, 2001 for reviews). For example, lower level phonological skills and higher-level comprehension skills are more likely to be related across languages for each construct (Durgunoğlu, 2002; Gottardo, Yan, Siegel & Wade-Woolley 2001; Lindsey, Manis & Bailey 2003). In contrast, skills that deal with linguistic structures such as syntax, morphology, and vocabulary show differential levels of transfer based on similarities between languages (Geva & Siegel 2000; Gottardo 2002; Pasquarella, Chen, Lam, Luo & Ramirez 2011; Ramirez, Chen, Geva & Kiefer 2010). Although extensive research has been conducted on the role of L1 skills on L2 skills, examination of the role of L2 skills on L1

skills is less common (Bialystok & Herman, 1999; Cook, 2003; Gottardo, Javier, Farnia, Mak & Geva, 2014).

Bidirectional cross-linguistic relationships between languages with different linguistic typologies and orthographic systems provide the opportunity to examine language-specific and language-general mechanisms. Although cross-linguistic relationships have been found for languages with similar orthographies or linguistic typologies (e.g., the Roman alphabet), do language-general mechanisms influence the relationships across typologically different orthographies. For instance, how is reading related across an alphabetic script versus an alphasyllabary, a segmental writing system in which consonant–vowel sequences are written as a unit and each unit is based on a consonant letter, and vowel notation is secondary?

When young children begin the process of learning to read, they learn the code used by their language to represent speech and how the symbols map onto speech. The key precursor to word reading in an alphabetic language is phonological awareness (Hulme, Snowling, Caravolas, & Carroll, 2005). Many researchers accept the notion that phonological awareness includes a range of linguistic subcomponents from syllables, to onsets and rimes to phonemes (Anthony & Lonigan, 2004; Stanovich, 1990). The size of the phonological unit that is most highly related to reading might be related to the specific language or might be related to the learner's L1 (Gottardo, Pasquarella, Chen & Ramirez, 2015; Jimenez, Alvarez, Monzo, & Hernandez-Valle, 2000; Ziegler & Goswami, 2005). For example, phonemic awareness is related to reading a shallow alphabetic orthography such as Spanish.

Even in an irregular language such as English this relationship between phonemes and graphemes is usually systematic (e.g., the symbol L is usually pronounced /l/). Phonological recoding is considered a crucial element of reading (Ehri, 2015) because this process allows

children to recode words that are heard but have not been seen before (Ehri, 2015; Share, 1995). Successful decoding requires mapping graphemes to phonemes and determining the rules of the cipher to read accurately and fluently (see above for a discussion of the psycholinguistic grain size theory). However, the size of the phonological unit that maps onto the symbol is less clear for Hindi (see below).

Linguistic theory has also examined relations between oral proficiency in the L1 and L2 in an attempt to build theoretical models of bilingualism (Cook, 2003). Because both languages are in one ‘mind’, they must interact in bilinguals. However, the degree and direction of overlap has been the subject of debate in theories of second language acquisition. For example, Cook (2003) suggested that L1 and L2 relations are bidirectional and provided evidence of L2 influences on the L1 in highly skilled users of each language (also see Chow, McBride-Chang, & Burgess, 2005). The present study explored the variables related to reading in Hindi and English, in bilingual Hindi-English speaking children.

### **Predictors of Word Reading and Reading Fluency**

Evidence suggests that phonological processing plays the most important role in word reading (Georgiou, Parrila, & Papadopoulos, 2008). The role of phonological processing in word reading is described in terms of three aspects: phonological awareness, phonological short-term memory and rapid automatized naming (RAN) (Wagner & Torgesen, 1987). These three factors predict the rate of reading acquisition in almost all alphabetic languages that vary in orthographic consistency (e.g., De Jong & van der Leij, 1999; Holopainen, Ahonen, & Lyytinen, 2001; Muter, Hulme, Snowling, & Stevenson, 2004; Parrila, Kirby, & McQuarrie, 2004; Wagner & Torgesen, 1987). Georgiou et al., (2008) suggest that past research in the area of reading development had assumed that the models of reading development were generalizable across languages (e.g.,



Frith, 1985; Marsh, Friedman, Welch, & Desberg, 1981). However, there is not enough evidence of cross-linguistic studies to support their assumption. Also, previous research does not use orthographic processing as the predictor of reading development. The term “orthographic processing” was defined as the ability to use visual-orthographic information in processing words in early reading development (e.g., Barker, Torgesen, & Wagner, 1992). Georgiou, et al (2008) suggested that there are two main predictors of word reading: orthographic processing skills (related to the Psycholinguistic Grain Size Theory) and RAN (phonological processing). Also, these predictors contribute differently in the process of learning languages that vary in orthographic consistency.

### **Importance of Phonological and Orthographic Skills for Alphabetical Languages**

**Role of Phonological Awareness in the Process of Learning to Read.** The first step in learning to read an alphabetic language is to learn the alphabetic rules. Sometimes the use of these rules differs by age and instruction in different languages (Bitan & Karni, 2003, 2004; Bitan, Manor, Morocz, & Karni, 2005; Brooks & Miller, 1979; Farrington-Flint Wood, Canobi, & Faulkner, 2004; Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; Van Orden, Stone & Pennington, 1990; Walton, Walton, & Felton, 2001). Ehri (1991, 2005) distinguished four different ways of word reading: decoding, analogizing, prediction and sight word reading. In decoding, also called phonological recoding, readers can either sound out and blend graphemes into phonemes, or work with larger chunks of letters to blend syllabic units into recognizable words. Share (1995) described phonological recoding (print-to-sound transition) as a self-teaching mechanism which enables the learner to independently acquire orthographic representations required for rapid naming and visual word recognition. In analogizing, readers use words they already know to read new words—for example, using the known word *bottle* to

read *throttle* (Goswami, 1986). The third way of reading is by prediction, using context and letter clues to guess unfamiliar words (Tunmer & Chapman, 1998). The fourth way of reading words is called sight word reading, in which our brain recognizes the words by just looking at them because we have read these words previously.

The application of reading related rules can be different for adults as compared to children who learn to read a second orthography in their mid-adulthood because their existing linguistic knowledge, cognitive skills and educational experience can influence the process of second language acquisition (Detey & Nespoulous, 2008; Erlam, 2005; Gottardo, Koh, Chen & Jia, 2017; Hamada & Koda, 2008, 2011; Koda, 1996, 1999; Laufer, 1997; Muljani, Koda, & Moates, 1998; Skehan 1991; Sparks, Patton, Ganschow, & Humbach, 2009, 2012; Tong, Irby, Lara-Alecio, & Mathes, 2010). Previous research suggests that adults acquire a second language according to the orthographic grain sizes (Bitan & Karni, 2003, 2004; Bitan et al., 2005; Brooks & Miller, 1979). This grain size sensitivity includes rimes that facilitate language learning process (Ziegler & Goswami, 2005). Yet, the importance of phonological awareness skills in second language acquisition is unclear. However, phonetic coding skills have been related to second language acquisition and played the role of a strong predictor (Skehan, 1991). It is clear that learning a second language involves learning new grapheme-phoneme correspondences and rules that influence decoding speed and accuracy (Bitan & Karni, 2003, 2004; Bitan et al., 2005; Brooks & Miller, 1979). Research has shown that instruction focusing on larger grain units results in learning to read new words faster as compared to smaller grain units (Brooks & Miller, 1979). Also, new language learners are more sensitive to multiple grain sizes and have an advantage especially when they begin to learn an alphabetic language (Ziegler & Goswami, 2005). In an orthographic system with many rime families (e.g., English), rapid decoding is

boosted by proper recognition of rimes in terms of speed and accuracy of word recognition with rime analogies. An example is the word “cat” and “hat” or “pound” and “found”. This example is explicitly related to inconsistent orthographies like English because not all words can be decoded accurately based on the rule of letter-by-letter pronunciation (e.g., night/light) (Goswami, 1999; Goswami, 1990). For language learners, following the rule of letter-by-letter correspondence is a cause of frequent errors as compared to following the rule of recognizing larger orthographic patterns in which rimes, which promotes higher word reading accuracy.

The case is slightly different when language learners learn to read a consistent orthography. For example, in the German language, learning rime patterns improves the speed of decoding. This process works because unknown words will be quickly decoded when rimes are familiar to the reader (e.g., land/strand or Hund/Mund). Accordingly, for language learners, this skill is not only required for word recognition in inconsistent orthography, but also in consistent orthographies (Brennan, & Booth, 2015). In alphabetic orthographies, word recognition is usually facilitated by quick and accurate identification of larger patterns. With the presented evidence about the influence of grain size instruction in second language learners (Bitan & Karni, 2003, 2004; Bitan et al., 2005; Brooks & Miller, 1979) it is still unknown how instruction about grain size helps with rime patterns. It remains arguable that phonological awareness affects the process of second language acquisition or learning a new orthography.

**Role of Orthography in Reading.** The connectionist model originally posited by Seidenberg and McClelland (1989) suggests that the process of learning to read words depends on establishing mappings among phonology, orthography and semantics. However, learning to read an orthography is also dependent on whether it is an alphabetic or non-alphabetic writing system and the consistency of sound-symbol mappings (see above) (Katz & Frost, 1992; Perfetti

& Harris, 2013; Share, 2014). Languages represent units of speech of different sizes from syllables to smaller units, specifically phonemes. In order to become skilled readers of an alphabetic orthography, readers must learn how to map phonemes onto graphemes (Share, 1995). Other units can also be represented by orthographies and are perceived as psychologically real by speakers of those languages, such as, native speakers of English perceive onsets and rimes as psychologically real (Treiman, Kessler, Knewasser, Tincoff, & Bowman, 2000). If the same processes were used to read words in different languages, this would suggest a general reading mechanism.

When examining different writing systems, script-specific differences in relation to typological features will affect reading development. For example research on learning to read an alpha-syllabic language is in the initial stages, with most recent research on learning to read Akshara being conducted in India (Nag & Perfetti, 2014). This research highlights the importance of orthography-specific investigations in the reading science. Because phonemes are represented as modifications to the base form of Akshara (see above), a larger number of symbols/Akshara must be learned to read this alphasyllabic language. The total number of symbols to be learned in alphasyllabic orthography (200 to 500 syllables; Hindi language) is usually much larger as compared to the number of symbols to be learned in an alphabetic system (24 to 26 letters; English, Urdu and Arabic languages). Research studies in reading acquisition suggest that the pace of learning depends on the size of symbol set such that Latin scripts with 20 to 40 letters are expected to be learned by the end of the first year in school with some variability based on the consistency of the grapheme-phoneme correspondences (Seymour, Aro & Erskine, 2003). However, languages with Akshara symbols have between 200 to 500 symbols that vary in frequency of appearance in script. The large number of symbols and the relatively low frequency

of some sound-symbol correspondences results in children learning symbols by fourth grade or later (Nag, 2007).

**Orthographic Consistency and Phonological Processing.** In the area of reading development, many cross-sectional and longitudinal studies were conducted on languages that vary in orthographic consistency. These studies have presented conflicting findings that define the role of phonological processing skills in reading acquisition (Anthony & Lonigan, 2004). Compton (2003) and Georgiou, Parrila, and Kirby (2006) conducted their studies on English monolingual children and showed that the contribution of phonological awareness is a strong predictor in word reading throughout elementary school. Although RAN predicts word decoding skills, it depends on the time limit and on the type of RAN task used in the study (e.g., letter and digit naming vs. colour and object naming), along with the reading capability of the children (Meyer, Wood, Hart, & Felton, 1998; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004). There are some conflicting findings reported in the literature regarding the contribution of phonological short-term memory as well. Research done by Swanson and Alexander (1997) and Swanson and Howell (2001) showed that phonological short-term memory was a predictor of word reading. Whereas, Parrila et al. (2004) and Torgesen, Wagner, Rashotte, Burgess, and Hecht, (1997) reported phonological awareness and RAN were very weakly related to word reading. The body of literature conducted on orthographically consistent languages showed that phonological awareness was either not the main predictor of word reading (e.g., Aarnoutse, van Leeuwe, & Verhoeven, 2005; Harris & Giannouli, 1999; Holopainen et al., 2001) or might be important only for first two years of schooling (e.g., de Jong & van der Leij, 2002; Landerl & Wimmer, 2000; Leppänen, Niemi, Aunola, & Nurmi, 2006). It is also suggested that the effect of consistent spelling-sound correspondences is strongly related to securing phonological

recoding skills in early years and stages of learning to read (Caravolas, 2006; Porpodas, 1999; Wimmer, Landerl, & Schneider, 1994).

Overall, there are mixed reviews available in the literature regarding the role of RAN compared to phonological awareness in predicting reading development in consistent orthographies (e.g., de Jong & van der Leij, 1999, 2002; Mayringer, Wimmer, & Landerl, 1998; Wimmer, Mayringer, & Landerl, 2000). To conclude, it is reasonable to say that phonological awareness and RAN are related to word reading, but contribute differently to reading. RAN tends to be associated with the use of reading-speed measures only in consistent orthographies and reading accuracy tends to be associated to phonological awareness only in inconsistent orthographies.

**Orthographic Consistency and Processing.** Research has not yet provided a full understanding of the role of orthographic processing in predicting reading development. Past studies and their findings have yielded mixed reviews by explaining the differences between the consistency, the conceptualization and the operationalization of different orthographies (Hagiliassis, Pratt, & Johnston, 2006). Wagner and Barker (1994) summarized 11 different definitions of orthographic processing. One definition given by Stanovich and West (1989) is “orthographic processing is the ability to form store and access orthographic representations” (p. 404). Perfetti (1984) defined orthographic processing as “the knowledge of letter patterns a reader uses while reading” (p. 47). In a recent study, Georgiou et al (2008) defined orthographic processing as children’s sensitivity to the orthographic structure of words. A study conducted by Torgesen et al. (1997) suggests that orthographic processing plays an important role in Grade 4 and 5 word reading accuracy and reading comprehension. Studies conducted in a bilingual context have found some contradictory results (Arab-Moghaddam & Senechal, 2001). Arab-

Moghaddam and Senechal (2001) examined the effects of phonological and orthographic processing skills on reading in Farsi and English. It is also notable that this study was conducted on languages that have inconsistent orthographies. Farsi bilingual children in Grade 2 and 3 residing in Canada were tested on the measure of word reading. Results showed similar predictors of word reading in both languages: English and Farsi. Phonological and orthographic processing skills played a major role in reading development in both English and Farsi. Interestingly, orthographic processing skills were highly prominent when compared to phonological processing skills in both languages. Another study conducted on vowelized Hebrew and English showed positive results but only for English and it was only phonological skills that predicted reading acquisition in Hebrew (Geva, Wade-Woolley, & Shany, 1993). It is also notable that vowelized Hebrew is perfect in grapheme-phoneme correspondence. The contrast found in various studies suggest that only orthographic processing is the main predictor of reading acquisition in English, but its role in consistent languages is still unclear (Georgiou, Parrila, & Papadopoulos, 2008).

**Issues in the Assessment of Reading and Comprehension Skills in Relation to Orthography.** There are a few issues with the process of assessments of reading and comprehension skills that have been faced by the researchers. The first factor is *Orthographic Transparency*. Considering the fact that the process of reading is related to orthographic transparency, it is possible that the variations linked to the characteristics of the orthography are observed in the trajectories of reading acquisition (Seymour, 2005; Seymour, Aro, & Erskine, 2003) and the cognitive mechanisms that are essential components of reading acquisition in typical and atypical development (e.g., Italian orthography, example of typical development) (Landerl et al., 2013; Moll et al., 2014; Tobia & Marzocchi, 2014a, 2014b). Consequently, Share

(2008) suggested that the models of reading development and testing these models on single languages are misleading. He also suggested that the extension of observing the children learning orthographies with various degrees of transparency is important to understand this process. An example is the role of single components of the Simple View of Reading (Hoover & Gough, 1990), specifically decoding and language comprehension, which predict reading comprehension and change in relation to the orthography and its transparency.

However, in opaque orthographies (e.g., English), decoding is the main predictor of reading comprehension at the beginning stage of learning for poor decoders. Whereas, people who have advanced reading skills, it is the oral comprehension skills that play the role of the main predictor (Florit & Cain, 2011). For example for Italian orthography, which is a shallow, regular and consistent orthography, where oral comprehension has been proven to be the main predictor of reading comprehension in first graders and reading accuracy is a significant but minor predictor of reading comprehension (Tobia & Bonifacci, 2015). Additionally, in transparent orthographies it is reading speed that predicts the reading impairment as compared to reading accuracy. This happens because the high grapheme-phoneme consistency is achieved faster which allows a reader to achieve the higher levels of reading accuracy early on (Barca, Burani, Di Filippo, & Zoccolotti, 2006; Cossu, Gugliotta, & Marshall, 1995; Tressoldi, Stella, & Faggella, 2001). Also, reading speed has been shown to be the most difficult skill to treat in dyslexic adults (Pizzoli, Lami, Palmieri, & Solimando, 2011). Therefore, Moll et al (2014) suggested that the role of phonological skills and rapid automatized naming is moderated by orthographic transparency.



### **Role of Other Components of Language in Reading Development**

**Syntactic Awareness.** When young children comprehend a word or a sentence they tend to focus on the sentence's meaning as compared to its grammatical context to make judgements (Bialystok & Ryan, 1985). Usually, it is hard for children between four to six years-old to determine a grammatical mistake in a sentence (e.g., 'I want water drink,' compared to 'I want water to drink'). However, Davidson, Raschke, and Pervez (2009) suggested that bilingual children are better at detecting grammatically incorrect sentences than monolingual children. They discussed in their study whether bilingualism or differences in properties of the languages affect syntactic awareness. Bishop, McDonald, Bird, and Hayiou-Thomas, (2009) found that nine to eleven-year-old monolingual children had difficulty identifying grammatically incorrect sentences. On the other hand, Davidson and colleagues (2009) conducted a study on Urdu-English bilinguals aged four to five years old and found that these bilingual children were able to detect grammatical errors in sentences. However, these findings were specifically applicable to Urdu-English bilinguals because of the structure of the Urdu language. Some examples of grammatically incorrect Urdu sentences were: "A boy is putting on her shirt" rather than "A boy was putting on his shirt" or "I want water drink" rather than; "I want water to drink". The limitations of this study suggested that future studies on the Urdu language should include the role of grammatical gender in understanding Urdu nouns. This linguistic difference is a reason why Urdu bilinguals detected grammatical gender mistakes in English better than the English monolinguals (Davidson et al., 2009).

**Script Awareness.** Script awareness refers to the knowledge of the orthography of the acquired language. It is important to discuss how children read two different languages with two different scripts and writing systems. Usually, bilingual learners have to learn the writing

conventions of the second language which can differ in deep mapping principles (writing system) and its visual formation (script) (Perfetti, Liu, Fiez, Nelson, Bolger, & Tan, 2007). However, another interesting factor is that the kind of script (alphabetic vs non-alphabetic or alpha-syllabic) that the children learn to read has an impact on the strategies used to learn to read (Ziegler & Goswami, 2006). It is suggested that children can easily transfer their letter-sound and alphabet knowledge to their second language if the languages show minor differences in script (Levin, Shatil-Carmon, & Asif-Rave, 2006).

The strength of association of phonological awareness across the different component skills of reading differs and is moderated by the nature of the script. Among alphabetic scripts, phoneme awareness is a significant predictor of reading fluency in transparent orthographies (e.g., Spanish) but a predictor of reading accuracy in opaque orthographies (e.g., English) (Ziegler et al., 2010). Similarly, although the unit of significance may differ in different scripts—syllable for Chinese, phoneme for English, syllable-phoneme for Hindi—the processing skills for phonological units are explicitly involved in learning to read (Perfetti, 1988).

### **Links between Sounds and Symbols in a Language**

A general aspect of learning to read is making effective links between the sounds and symbols in a language. This is required because it helps in establishing and patterns of sounds and symbols that represent a word. Nag and Snowling (2013) suggest that accuracy in mappings is important for skilled reading in all languages. There are other studies that showed the role of rapid digit naming as the predictor of reading across languages (Ding, Richman, Yang, & Guo, 2010; Nag & Snowling, 2012; Puolakanaho, Ahonen, Aro, Eklund, Leppänen, Poikkeus, & Lyytinen, 2008; Ziegler et al., 2010). Rapid naming is related to the speed of visual and phonological processing. However, we cannot ignore individual differences on this task to

predict reading skills across different orthographies. Accordingly, these differences suggest that variables associated with RAN are also associated with cross-modal mappings and are only a language general phenomenon (Puolakanaho et al., 2008). Also, people who are poor in rapid naming tasks are at high risk of reading failure. Nag and Snowling (2013) concluded that both language-specific and language-general cognitive demands of learning to read differ across scripts in terms of the challenges faced by language learners. To understand the process, it is important to discuss whether first language skills help in learning a second language and whether language-general-specific features are transferable to second or third languages.

### **Does First Language Help in Learning Second Language**

In Canada, it is common these days to have children starting their schools at the age of 4 as bilinguals and multilinguals. Although some children start schooling with minimal or limited levels of oral language skills achieved for L2, some children come with zero to no exposure at all to their second language. Bilingual children who come to school with zero exposure to their L2 are often put into programs that are designed to help young children with second language acquisition. In some situations young children begin school literate in their first language and display unbalanced biliteracy skills in their early years at school (Shum, Ho, Siegel, & Au, 2016). Consequently, it is hard for educators to determine bilingual children that are at risk for reading difficulties. Another challenge for educators is deciding whether children should be assessed in their first or second language. To address these issues Shum and colleagues (2016) conducted a study to determine cross-linguistic relationships between Chinese and English bilinguals. These languages differ in terms of their written form as English is an alphabetic language whereas Chinese is a character-based language. Researchers used the linguistic interdependence hypothesis (Cummins, 1979) to design this study that states that second

language development depends on first language proficiency, but only when intensive exposure to the L2 begins. According to that hypothesis positive transfer of language-related cognitive skills can occur between a first and second language, only after achieving certain thresholds in both languages. This transfer is referred to as “common underlying proficiency (CUP)”, that is skills and metalinguistic knowledge acquired in one language can be accessed during the process of second language acquisition (Cummins, 1981). The linguistic interdependence hypothesis addresses both language-specific and language-general knowledge and skills. An extension to this theoretical framework was presented by Cummins (1981) under the name of “central processing hypothesis”, also known as the “Universal Hypothesis”. This hypothesis addressed the underlying cognitive processes that contribute to literacy development in different languages regardless of orthography (Shum et al., 2016). Contrary to this hypothesis, the script dependence hypothesis (Frost, Katz, & Bentin, 1987) focused on the importance of orthographic transparency in the execution of component skills in reading (see above). According to this hypothesis shallow orthographies such as Spanish and Finnish have more predictable grapheme-phoneme correspondences as compared to deep orthographies (e.g., English and French). Also, these variations in orthographies can lead to different problems in the process of reading development across languages (Landerl et al., 2013; Ziegler & Goswami, 2006).

Consistent with the above suggestions that cognitive skills and the role of similarities and differences between the two orthographies transfer between first and second language, it will be interesting to know how this process works for children who are multilinguals and learn to read two alphabetic languages with same orthography (Urdu and Arabic) and one language with different orthography (English their L2). Also, the fact that some cognitive abilities are common to all languages and scripts and other are more language-script-specific (Shum et al., 2016)

further research is required to determine the skills that are language-general and language-specific.

Another point of interest is when these skills transfer from one language to another, to what extent does this transfer occur across different orthographies (e.g., English and Chinese). For languages such as English and Chinese with completely different orthographies it is unclear whether skills transfer when learning to read one after the other (Gottardo, Koh, Chen & Jia, 2017; Shum, Ho, Siegel, & Au, 2016). However, the degree that languages are related to each other when the alphabetic writing systems differ offers different comparisons and contrasts which have not featured prominently in the literature. The current research looked at the role of orthographic differences in four different languages: English, Urdu, Arabic and Hindi to determine whether skills related to reading are similar for these particular language groups. To explore the skills required to read each language we will discuss the languages involved in this study. Languages used in the present study were selected based on two conditions: languages that are similar in script and share some vocabulary used by two different nations with similar cultures (Urdu and Arabic) and languages that are similar in linguistic typology, vocabulary, morphology and phonology (Urdu and Hindi) used by two identical nations from the same region of South Asia.

### **Urdu Language**

The Urdu language was introduced in the 17th century in central Asia and became the national language of Pakistan in the 20th century after the War of Independence in 1947. The term “Urdu” is derived from Turkish word “ordu” and means “Army” or “Camp”. In its initial journey the Urdu language was widely spoken by Muslim soldiers as their code language in the conquest of Ancient India and Eastern Persia. Many of these soldiers belonged to Arabian

countries, Turkey and mainly Persia. Thus, Urdu became more common among Persians. Shortly after conquests Urdu became the dominant language of Persia at the government level and became more commonly used by other ethnic groups in the region. Urdu blended with the dominant regional language of the time, which was the precursor of Hindi and had Sanskrit. Currently the Urdu language is associated with the Muslim community of some South Asian countries such as Pakistan where it is the national language and some parts of India and Bangladesh where it appears as a regional language (Gracia, 2014).

The Urdu language overlaps significantly with Hindi as well as Farsi vocabulary as well as being influenced by Arabic and English vocabulary. The main grammatical structure of the Urdu language is based on the blend of Arabic and Turkish elements and Sanskrit including some unique elements. The overlap between Hindi (modern Sanskrit) and Urdu in their spoken forms has led to the term the “Hindustani language” to describe languages that evolved through a mixture of local dialects with Sanskrit. Many words are also imported from English due to Pakistan’s colonial past and current influences of globalization and success of the film industry of India and Pakistan.

In Urdu, all nouns are classified by gender, masculine and feminine (Gracia, 2014). Urdu verbs have different forms as well depending on gender and number of subjects involved in a sentence in a context. Urdu is classified as a subject, object and verb (SOV) language because of the default order of the subject, object and verb (Ahmed, & Alvi, 2002). The Urdu language marks more than one version of past tense like absolute past, near past and distinct past, and it is possible to translate English sentences to any one of these Urdu tenses.

In sociolinguistic theory, Urdu is considered to be a classic example of digraphia: a linguistic situation in which different scripts are used to write the same language (Ahmad, 2011).

The oral Hindi and Urdu language share many components, such as syntax and vocabulary, but differ in their script. The sound-symbol relations represented by the writing system and the visual-orthographic properties of the writing systems are quite different for the two languages. It is also true that Urdu is a very challenging language for its readers and speakers because of the combination of Farsi-Arabic script as well as its morphological system having inherent grammatical forms based on its linguistic roots.

**Urdu Script.** Urdu script is written "in a cursive", context-sensitive Farsi-Arabic script from right to left. Urdu has an alphabet of 57 letters (Afzal, & Hussain, 2001) and 15 diacritic marks. Urdu orthography inherits some characteristics from Arabic such as the optional use of diacritic marks: a glyph added to a letter (Cardona & Jain, 2007). In Urdu, short vowels are not considered letters on their own but applied above or below a consonant by using appropriate diacritics (Humayoun, & Hammarstrom, 2006).

The primary orthographic structure of Urdu is similar to Arabic and depends on the three forms of letters, which can be written according to their position in the word: initial, middle and final form. In Urdu, all letters represent consonants and diacritics represent vowels (Mirza, 2014). The Urdu language uses only lower case letters and can be written in paragraph indentation.

### **Arabic Language**

Arabic is the fourth most common language with more than 300 million native speakers worldwide, and Arabic is an official language of 27 countries (Abu-Rabia, & Taha, 2006). In addition to learning spoken Urdu, Muslim children from Pakistan learn to read Arabic script. As the language of the Quran, the Holy book of Islam, Arabic is also widely used throughout the Muslim world and attached to the Muslim community. Arabic belongs to the Semitic group of

languages, which also includes Hebrew and Amharic, the main language of Ethiopia (Abu-Rabia & Siegel, 1995; Meara & Ryan, 1991).

**Arabic Dialect.** “Dialect” is a social variety of a language, which can be distinguished by its pronunciation, grammar, and vocabulary and is recognized as different from the standard literacy, language and speech pattern of the specific culture in which it exists (Schiling-Estes, 2006). A debate in the literature involves whether dialect affects language and literacy skill acquisition. Studies conducted on second language acquisition supported the effect of dialect in reading skill acquisition by controlling the role of socio-economic status (SES), race, phonological processing and vocabulary size (August et al., 2009). Hart and Risley (1995) found some differences between different races and effect of dialect and SES on reading skills but not in the languages used and tested in this study.

There are many Arabic dialects such as Classical Arabic, which refers to the language of the Quran and is used in formal written texts and literary pieces. It was originally the dialect of Makkah, the present dialect of Saudi Arabia (Abu-Rabia & Siegel, 1995). The other commonly used dialect of Arabic is Modern Standard Arabic. It refers to the adapted form of the classical Arabic; and is used in books, newspapers, on television and radio, in the mosques, and in conversation between educated Arabs from different countries (e.g., at international conferences and business meetings). Local dialects vary from region to region, which means that a speaker of Arabic in Morocco may face difficulty understanding a speaker of Arabic from Iraq, even though the language is labeled as being Arabic in both cases (Abu-Rabia & Siegel, 1995).

**Arabic Script.** Arabic script depends on a consistent letter-sound alphabetical system with 28 letters in it. All letters are consonants, but some also serve as long vowels. In Arabic, vowels are not part of the alphabet, and skilled readers usually read non-vowelized text. Short



vowels are represented with additional diacritics which can be omitted. Short vowels patterns are dependent on a word's meaning, inflection and its function in a sentence (Abu-Rabia & Siegel, 1995). Arabic words are based on trilateral (three letters) roots, and various derivatives are formed by the addition of affixes and vowels. Semantically related words based on roots may look identical (homographs) if they are written without vowels (Abu-Rabia & Siegel 1995; Heywood & Nahmad, 1965; Meara & Ryan, 1991). It is recommended that poor readers read text with vowels because without them, most of the isolated words may be read in different ways and have different meanings. Context is important for both good and poor readers of Arabic because in Arabic, a verb usually comes at the beginning of the sentence and the word order in a sentence is verb-subject-object (VSO) (Abu-Rabia & Siegel 1995; Heywood & Nahmad, 1965; Meara & Ryan, 1991).

### **Arabic Versus Urdu Script: Similarities and Differences**

As described above Arabic and Urdu scripts have many similarities. Arabic and Urdu are written from right to left in cursive form, and letters within words must be combined when possible (Hussain & Afzal, 2001). There are six letters in the alphabet, which cannot be joined to a following letter and there are spaces within words when these letters appear. Mostly, letters have three forms to appear in the word; word-initial, word-medial, and word-final in both Urdu and Arabic scripts (Abu- Rabia, 2001; Saiegh & Joshi, 2014). Both languages are written in a shallow orthography when written with vowels and in deep orthography, when written without vowels (Abu-Rabia & Siegel, 2003; Frost et, al., 1987). The main difference is that un-vowelized Arabic preserves the root word while un-vowelized Urdu results in a word written in consonants and long vowels. Therefore, there is a good match between the morphology of Arabic and its script. For Urdu, the script and its representation of vowelized and un-vowelized forms do not

necessarily match the morphology of the language. Despite the fact that both Urdu and Arabic languages share their scripts and some vocabulary no research studies have conducted any cross-linguistic comparison between groups who speak and read these two languages. The present study aims to explore reading patterns of the speakers of these two languages. Also, research has not examined whether Urdu bilinguals obtain any benefit over Arabic bilinguals when they learn to speak and read English as their second language. The fact that Urdu language borrows 20% of the vocabulary from English language (Mirza, 2014) might also help these speakers when they begin to learn the English language as compared to Arabic speakers.

### **Hindi Language**

Hindi is the national language of India and most widely spoken language within the region along with many other regional languages. A recent survey revealed that Hindi is now one of the most widely spoken languages in the world (Pandey, 2014). However, the process of estimating the exact number of native Hindi speakers is difficult because many people in India speak Hindi as their second language. This is because India has very diverse communities with citizens who spoke many languages. The Indian Census of 2011 shows that only 41% of Indian natives speak Hindi as their first language. Within India it is widely spoken in north-central regions of the country, but much less in the southern parts of country. Hindi is spoken as the primary language in the provinces/states of Madhya Pradesh and Uttar Pradesh and some regions of Nepal and Bangladesh. Due to global migration other communities of Indians speaking Hindi live in the United Kingdom, America, Australia, New Zealand, Canada and South Africa.

As stated above, Hindi and Urdu are essentially dialects of the same language despite their differential association with the regions of India and Pakistan. As mentioned in the description of the Urdu language, Hindi also borrows some vocabulary from other languages;

Sanskrit, Persian and Arabic. Similar to Urdu, Hindi is influenced by English vocabulary, especially in colloquial Hindi. Knowing that Urdu and Hindi share many features with each other it is reasonable to say that Hindi and Urdu are different versions of the same language. The languages differ on vocabulary and mainly in formal and literary styles. Literary Hindi draws from Sanskrit whereas literary Urdu draws from Persian and Arabic. However, in colloquial Hindi-Urdu, the vocabulary is similar with small differences. For example, Hindi has a greater influence from Sanskrit vocabulary and Urdu has a greater influence from Farsi vocabulary. Grammatically, the two languages are basically identical. As mentioned above, some people refer to the languages as “Hindustani language” and consider Hindi and Urdu both as two primary dialects of this language. Hindi is written and read from left to right whereas Urdu is written and read from right to left.

**Hindi Script.** Hindi is written with the Devanāgarī script. Hindi orthography has elements of an alphabetic script and a syllabary, resulting in it usually being characterized as an abugida orthography (Share & Daniel, 2014). Abugida orthographies, such as Hindi, represent speech at two levels, the syllabic level and the phonemic level (Salomon, 2000). Each orthographic symbol is referred to as an “Akshara”, which contains elements of the consonant and the vowel. The surface organization of each unit is typically based on a symbol block with one or more phonemic markers. Therefore, Akshara can represent a vowel /V/, a consonant /C/, a consonant with the inherent or unmarked vowel /a/ or other marked vowels /Ca/, /CV/, and consonant clusters with either the inherent or marked vowels (e.g., /CCa/, /CCV/, /CCCV/). A rule of re-syllabification determines the mapping of word level phonology for each specific Akshara. Also, when Akshara appears as a single unit then it is typically an orthographic syllable but when it appears in a string then language-specific rules are applied to those Akshara.

Consequently, Akshara units map to multiple levels of phonology (Patel, 1996; Patel & Soper, 1987). The script also consists of some dots on some letters that mark nasal sounds in pronunciations. In Hindi texts, all symbols represent a syllable.

**Children's Reading Development in Akshara Language.** Scripts not only differ in appearance (visual form of symbols) but also in a way in which the symbols map onto sounds used in the speech stream. Each language and script is the combination of syllables and phonemes. An example is the combination of two phonemes /m/ and /ai/ that makes the syllable unit /mai/. These alpha-syllabic scripts are used in South Asia and include Hindi, Tamil, and Bengali (Salomon, 2000). Comparing different writing systems with obvious differences that are script-specific it is expected that these typological features will effect reading development. Research in reading suggests that the pace of learning depends on the size of symbol set such as Latin scripts that have 20 to 40 letters. In these languages, the symbol systems are expected to be learned by the end of first year in school (Seymour, 2005). Whereas, languages with Akshara symbols have somewhere between 200 to 500 symbols, with many symbols being less frequent and children are expected to learn all symbols by their third or fourth grade (Nag, 2007). On the other hand, Chinese language with thousands of characters are expected to be learned by grade 6 or beyond (Shu, Chen, Anderson, Wu & Xuan, 2003).

**The Science of Reading; A Perspective on an Akshara Language.** The previous sections discussed many views of reading orthographies based on their status being consistent versus inconsistent, shallow versus deep and alphabetic versus non-alphabetic writing systems (Frost, 2012; Perfetti and Harris, 2013; Share, 2014). Research on learning to read an alpha-syllabic language has not been studied and discussed extensively. A research conducted on

alpha-syllabaries by Nag, (2014) highlighted the role and importance of orthography-specific investigations in the reading science.

**Orthographic Characteristics in Hindi and Urdu Languages.** The differences among languages as either being inconsistent versus consistent and alphabetical versus alphasyllabic have been discussed. This following section highlights the orthographic characteristics of Hindi and Urdu languages as alphasyllabic versus alphabetic language. Despite the ease of oral language transfer for Urdu and Hindi speakers who speak a language that shares its vocabulary and phonology, the different writing systems influence the processes used to learn to read. The process of learning to read these completely distinct writing systems makes the comparison difficult because children from the same age group differ in their skill levels in both languages. The following section discusses the models/patterns that children follow when they learn to read these languages. Discussing these models will help explain and clarify the design for the current study.

### **Links between Theories and Reading Urdu or Hindi**

According to the Dual route model, skilled readers use two different routes to access the meaning of printed words in almost all languages. These routes include a direct route that accesses the lexical entry of familiar words, and an indirect route, which uses phonological recoding for unfamiliar words (Coltheart, Curtis, Atkins, & Haller 1993; Coltheart, Rastle, Perry, Langdon, & Ziegler 2001; Dijkstra, Grainger, & van Heuven 1999; Perry, Ziegler, & Zorzi 2007). The selection and use of these two routes depends on the relative grapheme-to-phoneme transparency (or shallowness) of a writing system, also proposed by Frost and Katz (1992) in the Orthographic Depth Hypothesis. Some previous findings in the area show that readers of shallow orthographies like Serbo-Croatian or Italian depend heavily on the phonological assembly route,

whereas readers of deep orthographies (e.g., un-vowelized Arabic and Hebrew), rely on using a direct access route in word recognition (Frost et al., 1987; Roman & Pavard, 1987; Tabossi & Laghi, 1992). According to these hypotheses the process of word reading (representations of word phonology in spelling) help readers of shallow orthographies to convert spelling to sound and then provide access to meanings of read words. In contrast, deep orthographies have inconsistent or ambiguous spellings. These representations force readers to rely on internal, visually-based representations of whole words, which help in retrieving meaning. These internal representations are usually well organized by providing easy access to more familiar items as compared to less familiar words (Rao, Vaid, Srinivasan, & Chen, 2011). Although, many cross-linguistic comparison studies looked at the grammatical component of languages (Chen, Yamauchi, Tamaoka, & Vaid, 2007; Shen & Forster, 1999; Simpson & Kang, 1994), the focus of the current study does not require an in-depth discussion of the grammatical structure of the two targeted languages, Urdu and Hindi.

**Bilingual Hindi learners.** Although census information points to a large number of bilingual Hindi speakers in India, very little research has been conducted on reading in bilinguals or multilinguals who speak Hindi as one of their languages. To fill the gap this research is particularly interesting because most Hindi speakers learn to speak and read additional languages that are represented by different orthographies. For example, many Hindi-English speakers learn to read their native language written in an alphasyllabary as well as reading English, which is written in the Roman alphabet. Hindi-Urdu speakers who read Urdu must learn to read the Arabic alphabet, which is represented in a shallow and deep form, specifically with and without vowel markers. A series of studies examined the role of orthographic depth in shaping visual word recognition in bilinguals who spoke Hindi and Urdu (Rao, Vaid, Srinivasan, & Chen,

2011). Although these two languages share a common spoken form, the written forms differ in terms of orthographic, structural and visual differences as well as directionality (Kelkar, 1968). Two experiments were conducted with Hindi/Urdu biliterate university students (Rao et al., 2011). The first experiment examined the effects of providing the same form/ orthography on priming (i.e., Hindi prime – Hindi target; Urdu prime – Urdu target). In all cases, the phonology overlapped between the prime and the target. Results of the study showed that form-related primes increased speed and accuracy for words written in Hindi orthography to a greater extent than for Urdu words (Rao et al., 2011). These effects supported the hypothesis that Hindi is represented by a more consistent mapping between symbols and sounds than Urdu. The purpose of the second experiment was to isolate the effects of phonological overlap and visual script overlap in priming. Therefore, primes were presented in Roman script while the targets were presented in Hindi or Urdu. This manipulation was designed to separate the visual form from the phonological form of an item. Consistent with researcher expectations, the results of the study showed greater naming speed and accuracy for the Hindi items than the Urdu items (Rao et al., 2011). These results suggest the benefits of reading a shallower orthography with more “available” or orthographic units such as Hindi as compared to Urdu. Although research has been conducted examining cross-linguistic effects of reading Hindi and Urdu, the effects of reading English and Hindi, languages commonly spoken by Hindi bilinguals, have not been examined. The current study examined whether skills related to reading a deep alphabetic orthography, English, are related to reading a shallow, alphasyllabic orthography, Hindi, in bilingual children.

**Learning to Read Alpha-Syllabic Orthography.** At present, all known studies of reading acquisition of an alpha-syllabary were conducted with monolingual speakers in India.

These studies examined challenges encountered by children learning to read Kannada as well as other alpha-syllable languages of Bengali, Hindi, and Tamil. The results of the studies concluded that the causes of reading difficulties in these languages could be explained by multiple domains (Nag, Treiman & Snowling, 2010). These studies usually deal with children with reading disabilities, as the identification and remediation of reading disabilities is the most pressing need for schools. For instance, Prakash and Joshi (1995) reported that children with dyslexia had poor knowledge of the Akshara and experienced additional difficulties in auditory sequential memory, syllable processing, visual-verbal processing, and visual processing. The results were replicated in other studies that explained children's challenges with learning the Kannada symbols (Prema & Karanth, 2003). Gupta, (2004) found the same results for Hindi speakers, specifically that children with dyslexia do not only struggle with reading accuracy and speed as compared to skilled readers but that they also face difficulties with orthographic learning of the phonemic markers in the language. Considering the large number of symbols (between 200 and 500) in an alpha-syllabic language, it is clear that the orthography plays an important role in predicting performance among poor readers. Additional factors related to weaknesses found in poor comprehenders can be accounted for by the difficulties with visual learning (Nag et al., 2010). Although these findings were replicated in many studies, the research did not examine factors related to word reading in bilingual learners.

### **English Learning in a Foreign Language Context**

Worldwide, from children to adults, researchers and educators have developed an interest in adopting evidence-based language learning approaches. This trend leads researchers to investigate individual language learning strategies (LLS) people follow while learning foreign languages. The most common global trend is to learn to speak and read English in a foreign



language context to enhance educational and employment opportunities. This goal to acquire English occurs in European countries, in Asian countries (e.g., China, Japan) and in developing countries (e.g., Pakistan, Philippines). In many cases, students learn to read English prior to or at the same time as learning to speak English, often becoming better at decoding than speaking English. Conclusively, research in this area suggests that all language learners use a variety of learning strategies sometimes consciously and at other times unconsciously (Hong-Nam & Leavell, 2006).

**Language Learning Strategies.** Language learning strategies refer to “strategies that contribute to the development of the language system which the learner constructs and which affect learning directly” (Hardan, 2013; Rubin, 1987, p. 23). Furthermore, language learning strategies have also been defined as steps chosen to facilitate the acquisition, storage, retrieval and use of information by the language learner (Oxford, 1990). More specifically, it is the special thought or behavior that helps the language learner in comprehending, learning and retaining new information. To summarize, language learning strategies do not only facilitate the learner in becoming more efficient in learning but also in using language and increasing learners’ self-directed learning. The following study aimed to explore the language learning processes related to reading in Urdu-English, Arabic-English and Hindi-English bilingual children in a foreign context (their native country) and in a societal language context (Canada).

### **Goals of the Present Studies**

The present studies aimed to extend the limited research on the process of learning to read in non-European languages. The studies targeted languages with similarities and differences in linguistic typology or orthography. Specifically, this research extended existing literature by determining whether groups of children follow the same patterns when they learn to read in

languages with shared script and vocabulary but different linguistic typologies (Arabic and Urdu) as when they learn to read in languages with shared vocabulary and morphological structure but different scripts (Urdu and Hindi). Additionally, as discussed above, bilinguals in this study had two different language learning experiences. In North America, bilinguals learn to speak their second language (English) prior to learning to read it as compared to bilinguals in their native countries who learn to read English (L2) prior to or at the same time as learning to speak English. Also, did these groups differ in their English learning? The language groups (Urdu, Arabic and Hindi) were compared to each other in order to determine which factors; shared script, vocabulary, or morphological structure have the strongest relationships to reading acquisition in these bilingual children.

### **The Present Studies**

#### **Overall Design**

Overall, this research examined the relationship across literacy related skills for multiple languages; Urdu, Hindi, Arabic and English in five groups of bilinguals (Urdu-English bilinguals in Pakistan and Canada, Arabic-English bilinguals in Saudi Arabia and Canada and Hindi-English bilinguals in Canada). It was expected that bilinguals who read two versions of the same script, Urdu and Arabic, would have an advantage in handling two languages written using the same script. However, Urdu speakers also have an extra benefit of sharing their oral language with Hindi speakers. Therefore, the main focus of this study was to examine variables related to second language acquisition (English) in speakers of three languages (Urdu, Hindi and Arabic). These groups of bilinguals lived in one of two contexts either in the Canadian context or bilinguals in the country of origin (Pakistan, India and Saudi Arabia).

### **Overall Research Questions**

The following five research questions were examined using the whole sample from all three language groups:

1) Are there within- and across-language differences between the bilingual groups learning English and one of these three languages, Hindi, Urdu, Arabic in terms of their language learning patterns? More precisely, how does learning to speak a language prior to learning to read it influence language acquisition (vocabulary) and variables related to reading?

a) Are linguistic subskills (e.g., morphology, phonology, vocabulary) similarly related to each other for each group? Morphology is expected to be more highly related to Arabic reading. For Urdu and Hindi, phonological processing is more likely to be related to reading.

b) Are the variables related to reading (vocabulary and phonological awareness) similar for all of the groups?

2) Are there group differences for Urdu and Hindi speakers in terms of their morphological and phonological awareness and in terms of relations between these skills and reading skills?

a) Do Arabic and Urdu bilinguals perform differently on orthographic measures based on their country of residence, specifically North America or their native countries? Are relations between orthographic processing and reading similar for the children in different locations? All students in their native countries are expected to perform better than students in Canada in their L1.

### **Overall Participants**

Overall, a sample of 256 bilinguals eight to ten-year-old children were included. The children had one of three languages as their L1, Urdu, Arabic and Hindi, and were learning

English. Seventy-six Urdu-English bilinguals were tested in Pakistan, fifty Urdu-English bilinguals were tested in Canada for Study 1. Study 2 included 40 Arabic-English bilinguals from Saudi Arabia and 40 Arabic-English bilinguals from Canada, who were compared to the Urdu-English bilinguals, in Study 1. In Study 3, 50 Hindi-English bilinguals and 50 Urdu-English bilinguals from study 1 from Canada were tested. Participants were recruited from many different International Language Schools in the region of Waterloo, Ontario Canada. There were not any additional criteria for children to be able to participate in the study regarding the length of time attending the language school. Children in Pakistan and Saudi Arabia were tested in their public or private schools. All children in the study lived in middle class and upper middle-class neighborhoods. Children and their parents self-selected to either participate or not in the study. That is, they decided based on the information they received about the study, whether or not they wished to participate. For the children, informed consent from parents was obtained and the children assented before starting the tasks in each session.

### **Procedure**

In all three studies, children were tested in their first language, specifically Urdu, Arabic or Hindi, and in English, their second language. All children were tested in two testing sessions depending on their availability and the level of interest. All the testing conducted in individual testing sessions. The first step of this study prior to the data collection was to translate or adapt all the standardized English measures into the Urdu and Hindi languages. Measures that were used in Arabic language were standardized (Asadi, Shany, Ben-Semon, & Ibrahim, 2014). The second step of this study was participant recruitment in all regions (Pakistan, Saudi Arabia and Canada). Parents of the children gave their initial consent and filled out the demographic questionnaire. All of the testing in Canada was conducted individually at their language schools.

However, children in their native countries were tested in their public schools. Children gave their verbal assent before starting each testing session. All of the tests in English and Arabic had stopping rules to prevent frustration by discontinuing the test if it became too difficult for them. Testing in the Urdu and Hindi languages did not have standardized stopping rules as compared to measures in the English and Arabic testing session. Children were given each item in each test for a maximum of three seconds to decide whether they knew the item or not and were moved to the next item to prevent frustration with the task.

Testing sessions in each language lasted for roughly about 45 to 50 minutes to test the participants. All participants were compensated by the \$10.00 gift card after the second testing session. Parents of all participants were informed and thanked by the primary investigator at that time about the completion of study and asked if they wish to receive major findings of the study.

### **Planned Analyses**

The analyses for these studies were conducted by using within-subjects and between-subject designs. The within-subjects component of the analyses examined performance on English and Urdu, English and Hindi, and English and Arabic measures of vocabulary, reading, phonological awareness, morphological awareness, orthographic knowledge and reading comprehension. The between-subjects component of the analyses examined performance on Urdu in relation to English measures of reading, vocabulary and phonological awareness across locations. Another component of the between-subjects analyses examined participant's performance on English measures in regard to their first language. Additionally, regression based analyses were used to examine relationships among variables for each group.

Correlations, t-tests and regression analyses were performed using the raw data. Unless otherwise specified, a significance level of .05 was used and all tests were two-tailed.

Descriptive statistics are presented separately for each language used in the study.

### **Study 1: Urdu-English Bilinguals from Pakistan and Canada**

#### **Research Questions for Study 1**

Based on the exploratory nature of this study, the following research questions were explored in Study 1.

1. Are there group differences between Urdu-English bilinguals in Pakistan and Canada in terms of their performance on Urdu and English measures used in the study?
2. Are variables similarly related to each other in both languages (Urdu and English) of bilinguals across countries?
3. Finally, are within-and-cross-linguistic predictors of Urdu and English word reading similar across countries?

#### **Design: Study 1**

Cross-linguistic comparisons were conducted among Urdu speakers from Pakistan and Canada in this study. Participants were tested on the measures of word and pseudo-word reading, vocabulary, morphology, phonological skills, orthographic knowledge and reading comprehension. Groups were created based on their place of residence; Urdu-English bilinguals from Pakistan and Urdu-English bilinguals from Canada.

#### **Participants: Study 1**

A sample of 126 bilingual eight-to-ten-year-old children, 76 Urdu bilinguals in Pakistan and 50 Urdu bilinguals in Canada, were tested in their native country, Pakistan or Canada. Canadian participants were recruited from three different International Language Schools in the region of Waterloo, Ontario Canada. Children had been enrolled in language schools for a range of minimum of six months to a maximum of 24 months. Children in Pakistan were tested in their public or private schools. That is, they decided based on the information they received about the

study, whether or not they wish to participate. Demographic information was collected through a questionnaire completed by the parents of each participant. This questionnaire was designed to identify the percentage of usage of their L1, Urdu at home, their country of origin, the number of books in L1 at home, and other information about their home environment (see below).

### **Demographics: Study 1**

The key findings of the demographic questionnaire used with Urdu-English bilinguals in Pakistan and Canada are described in the following section. The *Demographic/ Family Language Questionnaire* was given to the parents along with the consent forms in order to determine what language(s) the parents and children speak at home. This questionnaire also obtained information about the factors that influence a child's ability to learn a second language and their verbal ability. This questionnaire was given in English in Canada and in the societal or dominant language in the other countries in the study. Parents were offered help with translation if they needed any by the research assistants of the study. The following section explains the items being used in designing this language and demographic questionnaire.

The first part of family language questionnaire looked at the demographic information such as the child's age and grade. This part also asked for the information regarding child's record of attending school within or outside of his/her native country using yes/no questions. Almost 94% of families in Pakistan reported that their children had always attend their schools in Pakistan and 74% of families in Canada that their children had always attended their schools in Canada. Six percent of families in Pakistan reported that their children had attended somewhere between 12 to 18 months outside of Pakistan. Countries mentioned were Middle-East; Dubai, Muscat, Oman and Bangladesh. Twenty six percent of families in Canada reported that their



children had attended schools outside of Canada. Countries mentioned were USA, Australia, Dubai, Pakistan, England, Muscat and Saudi Arabia.

The second part of the language questionnaire included basic information about child's oral language and literacy skills. For example, has your child ever received any extra help in any of the following areas of reading, writing, speaking or math? Parents could choose as many answers as are appropriate for their child. None of the parents of Urdu-English bilinguals reported any extra help in the areas mentioned in both countries, Pakistan and Canada. Parents were then asked about the child's status in the residing country, whether he or she was born in Canada. 74% of Urdu-English bilinguals tested in Canada were Canadian citizens and were born in Canada. Parents of the children in Pakistan did not receive this question on their form of the language questionnaire.

The next section of the questionnaire examined the language use in the home. Example items included what language or languages are spoken at home, what is the child's first language and what other language(s) does the child speak at home? Fifty six percent of the families in Pakistan reported that Urdu was their first or home language whereas 87% of families in Canada reported that Urdu is their home language. Thirty one percent of families in Pakistan had Punjabi as their home language and the rest 13% reported having other regional languages as their home language such as Pushto, Saraiki and Sindhi. Thirteen percent of families in Canada reported that they had a language different from Urdu language as their home language. Languages mentioned were Punjabi and Pushto. Parents were also asked to judge their child's best language and the frequency of the child's first language use with other family members at home (parents, other siblings or grandparents if they live within the same house).

The same information was requested about the child's frequency of second language use with his/her family members at home and outside of home with friends. Almost 97% of the families in Pakistan reported that their children speak frequently in their L1 with other family members at home and with friends outside of home. The rest of 3% of families did not answer this question. Thirty one percent of families in Canada reported that their children were able to understand and somewhat respond in their L1 while communicating with other family members at home but do not communicate in L1 with their peers outside of home. Sixty four percent of families reported that their children do not communicate in L1 with other family members and friends and 5% of the families did not answer to this question.

The last part of this section looked at the child's frequency of watching television in his/her first and second language in two separate questions followed by the frequency of reading books in the first and second languages. Eighty seven percent of families in Pakistan and 96.8% of families in Canada reported that their children watch television, YouTube and use other electronic media in English. Ninety one percent of families in Pakistan reported that their children read books in both Urdu and English languages equally at school and have no additional reading time in any of the languages at home. Eighty six percent of families in Canada reported that their children read only in English at homes and they do not own any books in Urdu language. There were few families in both countries, Pakistan and Canada who did not answer to this question.

In the next section of the family language questionnaire, each parent had to provide some demographic information about themselves and their linguistic abilities. Sample questions were: what is your native language, what is your highest level of education and what is your occupation? Thirty four percent of fathers in Pakistan had master's degrees and were working in

their field of education and 86% of mothers had undergraduate degrees and were homemakers. Seventy eight percent of fathers and 94% of mothers in Canada had master's degrees and in 76.4% of the families both parents worked. Parents were also asked to judge their level of understanding, speaking, reading and writing of both their native and second language on Likert scale ranging from 1 (being none) to 10 (being very fluent). Fifty six percent of parents in Pakistan reported their ability of speaking, reading and writing in English as somewhat fluent (rated as 5) whereas the rest of population in the sample did not answer this question. On the other hand, 92% of families in Canada reported that they fluently read, spoke and wrote in English language.

An additional part of the questionnaire was included only for participants to be tested in Canada. This section tried to address the child's exposure to his/her first language. Questions included: how many hours of the day your child receives instruction in his/her native language and the reasons why parents decided to send their child to international language school for first language instruction. Sixty eight percent of families reported that their children receive instruction in their native language and the other 32% reported that they give instruction to their children in English language. Almost 97% of the families reported that they send their children to weekend language school, so their children can have at least some exposure to their first language and are able to understand communicate in their L1 when they visit their parents' native country. The rest of 3% of the families reported that they send their children to weekend language school as an extra-curricular activity to learn their L1, Urdu.

### **Measures**

Measures were administered in English and children's first language, specifically Urdu, Hindi or Arabic. When possible, standardized measures were administered. In the cases where

standardized measures did not exist, measures were translated or adapted. In some cases, translations were not appropriate because of the nature of the language. In these cases, measures were created to measure a given construct in the language, while working within the constraints of the language.

### **English Measures**

The following are the English measures were used on all language groups (Urdu, Arabic and Hindi) in all three studies, therefore, only this section explains English measures. A battery of English measures was administered to each participant in all three countries; Pakistan, Saudi Arabia and Canada. The measures assessed the following areas: word reading, reading comprehension, vocabulary knowledge, oral language skills, phonological awareness, orthographic knowledge and morphological skills. All of the English measures were standardized tests that exhibited high reliability and validity. All four different types of skills that were measured in this study are discussed in the following section.

**English Word Reading.** Two subtests of the Woodcock Reading Mastery Test, Word Identification and Word Attack subtest (Woodcock, 1991), were used to measure the English reading ability of words and pseudo-words.

**The Woodcock Word Identification.** This task contained 106 words. The words in the list were arranged according to a level of increasing difficulty from high frequency monosyllabic words (e.g. is) to low frequency multisyllabic words (e.g. zeitgeist). The word list was shown to children using standardized instructions including that this task is not timed. Participants were asked to read the words out loud. The experimenter stopped administering the task after six consecutive errors in a set were made by the participant. Raw scores on this test consisted of the number of words that were read correctly. A maximum score of 106 could be scored on this task.

Raw scores were converted into standardized scores for final analyses. Based on the Word Identification manual (Woodcock, 1991) the reliability of this test was  $\alpha = .92$  (Woodcock, 1991).

**The Woodcock Word Attack.** This task contained of 45 pseudo-words of increasing difficulty level from monosyllabic words with common letter patterns (e.g. dee) to multisyllabic pseudo-words with less common letter patterns (e.g. pnomocher). The pseudo-word list was shown to the participants who were informed that this task is not timed. They had to read the pseudo-words out loud. The participants were stopped from continuing the tasks after six consecutive errors in a set. Raw scores on this task were the sum of words that were read correctly. A maximum score of 45 could be scored on this task. Raw scores were converted into standardized scores. The Cronbach's alpha for this measure was .77.

**Oral Language Skills.** English oral language skills were measured by a measure of expressive vocabulary, the Expressive One Word Picture Vocabulary Test (EOWPVT-SBE, Brownell, 2000). This test measured the ability to name pictures of objects, actions and concepts, and is normed for ages 2 to 70+ years. A total of 170 pictures of different objects and actions were shown to the participants, one picture at a time and they were asked to name it. The names of the pictures were presented with an increasing difficulty level. Participants were stopped from continuing the task after six consecutive errors in a set. This task took 10 to 15 minutes to administer. Participants were assigned one point for labeling the picture correctly according to the manual (EOWPVT-SBE, Brownell, 2000). Raw scores were calculated using the basal and ceiling rules provided in the test manual and were converted into standardized scores. Based on the manual, the reliability of this measure was .95 (EOWPVT-SBE, Brownell, 2000).

**Phonological Processing Skills.** Phonological awareness in English was measured by using the Elision subtest of the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999). There were six practice items in the task that were administered to the children in order to familiarize them with the task before starting the final 20 items. Children were asked to repeat a word (e.g. cup) without saying a part of the word (e.g. /k/). For this task the answer had to be a meaningful word in English e.g. (up). Testing was discontinued after three consecutive errors. This task had a maximum score of 20. In the first section, children had to delete the first syllable of a compound word such as “tooth” from the word “tooth brush”. In the second section, they had to delete the middle letters from the given word such as the /l/ from “sling” to form “sing”. Raw scores were converted into standardized scores according to the instructions given in the manual. Based on the manual the reliability of this measure was .79 (CTOPP; Wagner, Torgesen, & Rashotte, 1999).

**English Reading Comprehension.** A subtest from the Woodcock Language Proficiency Battery-Revised (Woodcock, 1991) was used to measure English reading comprehension. There were 43 items in this measure with first four items presented in multiple-choice format that required the participants to point to the picture represented by a phrase. The remaining items measured the participant’s skill in reading a short passage and identifying a missing key word. Participants had to state a word that would be appropriate in the context of the passage. Testing was discontinued after six consecutive errors in a set. Based on the manual, the reliability of this test Cronbach’s  $\alpha$  was .89 (Woodcock, 1991).

**Orthographic Skills.** This task was administered to assess the orthographic knowledge of children in English (L2). There were two sub-sections of this task. Each section had fifteen items with two practice items in each. The first section of the task required participants to select

the correct spelling of real word. Each item presented two possible spellings of targeted word and both spellings were phonetically correct. An example of this section is word “dream” and “dreem”. The correct answer in this case was “dream”. Upon completion of the first section they were directed to second section of the task, which consisted of made-up words with two possible spellings of the words, such as “ploid” and “ployn”. The correct answer in this example was “ploid”. A total score of 30 could be achieved on this. Raw scores were converted into standardized residuals in SPSS for final analyses. The Cronbach’s alpha was .87 on this measure.

**Morphological Skills.** A measure of morphological structure was administered to the children to determine their morphological awareness in their second language. This measure of morphological decomposition consisted of 28 items with two practice items at the beginning of the task. Children were given a root word and they had to modify the target word to the correct form in order to fit in the given sentence with a blank in it. An example of the item is: the given word is, “driver” and the sentence is “Children are too young to -----“. The answer in this case was “drive”. A total score of 28 could be achieved in this task by receiving a score of one on each correctly given answer. Raw scores were used to calculate the standardized residuals in SPSS to use in final analyses. The Cronbach’s alpha was .71 on this measure.

### **Urdu Measures**

The following section discusses the Urdu measures that assessed: word and pseudo-word reading, reading comprehension, vocabulary knowledge, oral language skills, phonological awareness, orthographic knowledge and morphological skills. No standardized measures were available in Urdu. Most of the measures were the adapted versions translated from the English language into Urdu by the primary investigator. Some tasks such as the measure of phonological awareness, orthographic knowledge and morphological decomposition could not be translated

appropriately, therefore, they were adapted and recreated by the primary investigator of the study.

**Urdu Word reading.** As mentioned earlier, Urdu standardized measures were not available to administer, so the primary investigator of the study created two word lists. The lists were created one with vowels, one without vowels by taking words from children's Urdu textbooks based on the Grade three and four curriculum used in Pakistan. Each word list consisted of 30 items in it and items were different in both lists because words can be represented with and without vowels, two lists were created. The first list had words with vowels in it and the second word list consisted of words without vowels. These words gradually increased in level of difficulty. Participants were asked to continue reading the words until the end of the list. A score of one was given for each correct word read by the participants. A raw score of 30 could be obtained in this task. Standardized residuals were used as standardized scores in data analysis (see procedures). The Cronbach's alpha was calculated to measure the internal consistency of the tasks, word reading with and without vowels task. The Cronbach's alpha was .92 on word reading with vowels and .75 on word reading without vowels for Urdu-English bilinguals in Pakistan. The Cronbach's alpha was .83 on word reading with vowels and .89 on word reading without vowels for Urdu-English bilinguals in Canada.

**Urdu Reading Comprehension.** Grey Oral Reading Test – 4 (Translated Urdu Version Form – A) GORT - 4: This task was administered to assess reading comprehension ability in Urdu. This test helps to measure the four different areas of reading comprehension; oral reading rate, accuracy, fluency and comprehension. First six stories, were translated from GORT – 4 Form – A in Urdu language to be used in Urdu testing sessions. The primary investigator of this study translated all stories in Urdu from English version and then they were translated back into



English to countercheck the translations and to avoid the mistakes. Children read all of the stories orally. Following are the four sub-sections of this task that were assessed through this measure.

*Rate* is the amount of time taken by the participant to read a story. Time in seconds for each story was summed up at the end to determine the rate score for the measure.

*Accuracy* is the student's ability to pronounce each word in the story correctly. The total number of errors were compared to the range of scores given in the scoring manual. Accuracy scores for each story were summed up to calculate the total scores in this category.

*Fluency* refers to the student's rate and accuracy scores combined. Time taken by a participant on each story was added to the accuracy score in order to obtain the fluency score.

*Comprehension* refers to the appropriateness of the student's responses to questions about the content of each story. A score of one was given for each correct response for each story and highest score on one story could be a score of five.

This test is designed for children and adults 6-18 years old. It had two parallel forms; Form A and Form B including 14 stories in each form. Five multiple-choice questions followed each story in both forms. The first six stories from "Form A" were taken from the GORT- 4 and translated into the Urdu language. This task took 15-20 minutes to administer, which varied person to person according to their reading abilities. This test helped to identify the children's problems in reading comprehension and determined the strength and weaknesses of a student. The Cronbach's alpha was .42 on this measure for Urdu-English bilinguals in Pakistan and .94 for Urdu-English bilinguals in Canada. It is acknowledged that the Cronbach's alpha for the Urdu-English bilinguals in Pakistan on this task was lower than the acceptable range. Further

work is required in translating the reading comprehension task from English to Urdu or developing a measure that is widely applicable across countries in different contexts.

**Urdu Vocabulary Knowledge.** The Expressive One Word Picture Vocabulary Test was translated into Urdu. This test was used to assess expressive vocabulary in Urdu (EOWPVT-SBE, Brownell, 2000). A total of 170 pictures of different objects and actions were shown to the participants one picture at a time, and they were asked to name the pictures in Urdu. The pictures were presented at levels of increasing difficulty. Because this measure was not a standardized measure of vocabulary in Urdu language, participants were not stopped from continuing the task at any particular number of errors. However, when they began to reach the equivalent of ceiling they were shown six pictures on a page and were asked if they know the names of the pictures. They were given five seconds to decide whether they knew the name of the picture, before they moved to the next set of pictures. This procedure was used to avoid the frustration with this task. This task took 10 to 15 minutes to administer. Participants were assigned one point for labeling the picture correctly according to the manual (EOWPVT-SBE, Brownell, 2000). The total number of “correctly named items” were the raw scores. Raw scores were used to calculate the standardized residuals in SPSS to be used in final analyses. The Cronbach’s alpha was .94 on this measure for Urdu-English bilinguals in Pakistan and .91 for Urdu-English bilinguals in Canada.

**Urdu Phonological Processing.** The Elision task was translated into Urdu. This subtest was based on the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999) and was used to measure phonological awareness skills in Urdu. These words were not the exact translation of English version. Real words from Urdu vocabulary were used to create a phonological task in Urdu by using the format of English CTOPP Elision task. There were ten items in this measure where children had to delete one phoneme of the word. For first

few items children had to delete the initial phoneme of the word. The next few items required the deletion of middle phoneme and the last few items required the deletion of the last phoneme of the word. This task was consistent with the Elision task of CTOPP in that the deletion of any phoneme the answer was the real word. Because this measure was not a standardized measure of phonological awareness in Urdu language, participants were not stopped from continuing the task at any particular number of errors. However, when they began to reach the equivalent of ceiling they were presented the items quickly and were asked if they know the any of them. The maximum of 10 could be scored on this task. Raw scores were used to calculate the standardized residuals in SPSS and for final analyses. The Cronbach's alpha was calculated on this measure. The Cronbach's alpha was .63 for Urdu-English bilinguals in Pakistan and .90 for Urdu-English bilinguals in Canada.

**Urdu Measure of Orthography.** This task was developed by the primary investigator of the study to measure the orthographic knowledge of children in the Urdu language. There were 10 items in this task. For each item children were presented with three different spelling of one word, although each spelling represented real pronunciation of given item. They had to pick one out of three spellings for each item. All ten items in this task consisted of real words from Urdu vocabulary. A total score of 10 could be acquired for this task. Raw scores were converted into standardized residuals in SPSS for final analyses. The Cronbach's alpha was calculated on this measure. The Cronbach's alpha was .33 on this measure for Urdu-English bilinguals in Pakistan and .48 for Urdu-English bilinguals in Canada. Although, the Cronbach's alpha for the Urdu-English bilinguals in Pakistan and Canada was lower than the acceptable range for the orthographic task, the importance of the construct and the lack of another available orthographic measure, means that analyses were conducted using the measure. All values for this mean must

be interpreted with caution. Further work is required in developing a measure that is widely applicable across countries in different contexts.

**Urdu Morphological Measure.** This measure assessed morphological awareness of children in their first language. This measure was also designed by the primary investigator of the study. There were ten items in this measure. Each item consisted of a real root word. Children were asked to provide at least three derived words that could be created based on the given root word. Children had to provide answers for all ten items. A total score of 30 could be achieved in this task. Raw scores were converted into standardized residuals in SPSS for final analyses. The Cronbach's alpha was .97 on this measure for Urdu bilinguals in Pakistan and .78 for Urdu bilinguals in Canada.

## **Results for Study 1: A Comparison between Urdu-English Bilinguals from Pakistan and Canada**

The following section explains the exploratory analyses conducted on Urdu-English bilinguals from Pakistan and Canada in study 1.

### **Descriptive Statistics (Urdu-English Bilinguals in Pakistan)**

All 76 participants (30 boys and 46 girls), ( $M_{\text{age}} = 9.02$ ,  $SD = .88$ ) were included in the analyses. Table 3 illustrates the means and standard deviations for each task for all of the participants. As mentioned earlier, Urdu measures were not available in standardized versions, therefore the primary investigator created the Urdu measures by translating and adapting from English measures.

### **Descriptive Statistics Study 1 (Urdu-English Bilinguals in Canada)**

The next set of data was collected from Urdu-English bilingual speakers residing in Canada. All 50 participants (22 boys and 28 girls), ( $M_{\text{age}} = 8.88$ ,  $SD = .82$ ) were included in the analyses. Table 4 illustrates the means and standard deviations for each task for all of the participants. Visual inspection of the data showed no floor or ceiling effects for any of the Urdu and most of the English measures except English measure of orthographic processing which showed the possibility of ceiling effects among Urdu-English bilinguals in Canada. This suggests that non-significant relations could be a result of a restricted range and that the task could have been made more difficult to increase the range of potential responses.

### **Comparisons of Gender for Study 1**

An independent samples t-test was conducted to determine gender differences in this sample. The analysis revealed no differences in terms of the performance of the participants on

any of the Urdu and English measures. Therefore, gender was not included as a variable of interest in any further analyses.

### **Within-Language Comparisons across Countries**

The next step in the analyses involved group comparisons across countries for the English and Urdu measures with Urdu-English bilinguals. All 76 participants from Pakistan and 50 participants from Canada were included in this comparison. Independent samples t-tests were conducted to compare participants' performance on Urdu and English measures used in the study. As expected significant differences were found for most of the measures except Urdu orthographic choice task and English word reading. Not surprisingly, Urdu-English bilinguals from Pakistan had higher scores on Urdu measures as compared to Urdu-English bilinguals in Canada and Urdu-English bilinguals from Canada had higher scores in English measures as compared to Urdu-English bilinguals from Pakistan (See Table 5). Given the number of comparisons, a conservative p-value of less than .01 was considered significant.

### **Correlational Analyses (Urdu-English Bilinguals in Pakistan)**

The associations between L1 (Urdu) variables, L2 variables (English) and across languages (Urdu & English) were analyzed. Mainly these correlations were exploratory and used to help make the decision about which variables to include in the regressions (along with theory). and are presented in three separate sections. The first section reports all relations among Urdu variables, the second section reports the relations among variables in English and the third section describes relationships across variables for both languages. Due to the size of correlation matrix, this particular section was divided into subsections, which highlighted significant correlations.

**Relationships among L1 (Urdu) Variables.** Word reading with and without vowels in Urdu were significantly correlated,  $r_{(74)} = .744, p < .001$  (see Table 6). Vowelized reading was also significantly correlated with vocabulary,  $r_{(74)} = .830, p < .001$ , phonological awareness,  $r_{(74)} = .907, p < .001$ , morphological decomposition,  $r_{(74)} = .458, p < .001$  and the measure of orthographic choice,  $r_{(74)} = .772, p < .001$ . Measures of reading comprehension did not correlate with word reading with vowels in this sample.

Word reading without vowels in Urdu was significantly correlated with vocabulary  $r_{(74)} = .701, p < .001$ , phonological awareness,  $r_{(74)} = .741, p < .001$ , morphological decomposition,  $r_{(74)} = .342, p = .002$  and the measure of orthographic choice,  $r_{(74)} = .693, p < .001$ . Word reading without vowels in Urdu did not correlate with reading comprehension in this sample.

Urdu vocabulary was significantly correlated with Urdu phonological awareness,  $r_{(72)} = .832, p < .001$ , morphological decomposition,  $r_{(72)} = .370, p = .001$  and the measure of orthographic choice,  $r_{(72)} = .723, p < .001$ . Urdu vocabulary was not correlated with Urdu reading comprehension. Urdu phonological awareness test was significantly correlated with morphological decomposition,  $r_{(74)} = .521, p < .001$ , orthographic choice,  $r_{(74)} = .792, p < .001$ , and reading comprehension,  $r_{(74)} = .278, p < .05$ . Urdu morphological decomposition was significantly correlated with orthographic choice task,  $r_{(74)} = .304, p = .008$ . This measure was not correlated with the measure of reading comprehension. These findings can be seen in Table 6.

**Summary of the Key Findings:** Urdu word reading with and without vowels, vocabulary knowledge, phonological and morphological awareness and orthographic choice task were significantly correlated with each other. Performance on this measure of Urdu reading comprehension was not correlated with most of the other Urdu measures.

**Relationships among L2 (English) Variables.** English word reading was significantly correlated with English pseudo-word reading,  $r_{(74)} = .827, p < .001$ , vocabulary,  $r_{(74)} = .875, p < .001$ , phonological awareness,  $r_{(74)} = .605, p < .001$ , morphological decomposition,  $r_{(74)} = .777, p < .001$ , orthographic choice,  $r_{(74)} = .291, p = .011$  and reading comprehension,  $r_{(74)} = .418, p < .001$  (see Table 7). English pseudo-word reading for this sample of bilinguals was significantly correlated with English vocabulary,  $r_{(74)} = .775, p < .001$ , phonological awareness,  $r_{(74)} = .679, p < .001$ , morphological decomposition,  $r_{(74)} = .669, p < .001$ , orthographic choice,  $r_{(74)} = .304, p = .008$  and reading comprehension,  $r_{(74)} = .376, p = .001$ .

English vocabulary was significantly correlated with English phonological awareness,  $r_{(74)} = .649, p < .001$ , morphological decomposition,  $r_{(74)} = .790, p < .001$ , orthographic choice,  $r_{(74)} = .371, p = .006$  and reading comprehension,  $r_{(74)} = .466, p < .001$ . English phonological awareness was significantly correlated with morphological decomposition,  $r_{(74)} = .618, p < .001$  and reading comprehension,  $r_{(74)} = .290, p = .011$  and was not correlated with English orthographic choice task. English morphological decomposition was significantly correlated with orthographic choice task,  $r_{(74)} = .275, p = .016$  and reading comprehension,  $r_{(74)} = .376, p = .001$ . English orthographic choice task was not correlated with English reading comprehension. These findings can be seen in Table 7.

**Summary of the Key Findings:** English word and pseudo-word reading, vocabulary knowledge, phonological awareness and morphological decomposition were significantly correlated with each other. English orthographic choice was not correlated with English phonological awareness.

**L1 and L2 Variables.** Due to the large number of variables examined, the section on cross language comparisons is divided into six further subsections according to each construct:



word reading, vocabulary, phonological awareness, morphological awareness, orthographic choice and reading comprehension.

**Relationships among L1 (Urdu) and L2 (English) Variables in Pakistan.** Urdu word reading with vowels was negatively correlated with English word reading,  $r_{(74)} = -.735, p < .001$ , pseudo-word reading,  $r_{(74)} = -.588, p < .001$ , vocabulary,  $r_{(74)} = -.799, p < .001$ , phonological awareness,  $r_{(74)} = -.509, p < .001$ , morphological decomposition,  $r_{(74)} = -.706, p < .001$  orthographic choice task,  $r_{(74)} = -.135, p = .247$  and reading comprehension,  $r_{(74)} = -.572, p < .001$ .

Urdu word reading without vowels was also negatively correlated with English word reading,  $r_{(74)} = -.559, p < .001$ , pseudo-word reading,  $r_{(74)} = -.449, p < .001$ , vocabulary,  $r_{(74)} = -.602, p < .001$ , phonological awareness,  $r_{(74)} = -.427, p < .001$ , morphological decomposition,  $r_{(74)} = -.626, p < .001$  and reading comprehension,  $r_{(74)} = -.242, p = .035$  and was not correlated with the English orthographic choice task.

Urdu vocabulary was negatively correlated with English word reading,  $r_{(74)} = -.656, p < .001$ , pseudo-word reading,  $r_{(74)} = -.510, p < .001$ , vocabulary,  $r_{(74)} = -.690, p < .001$ , phonological awareness,  $r_{(74)} = -.402, p < .001$ , morphological decomposition,  $r_{(74)} = -.615, p < .001$ , orthographic choice task,  $r_{(74)} = -.397, p < .001$  and reading comprehension,  $r_{(74)} = -.519, p < .001$ . Urdu phonological awareness test was also negatively correlated with English word reading,  $r_{(74)} = -.687, p < .001$ , pseudo-word reading,  $r_{(74)} = -.488, p < .001$ , vocabulary,  $r_{(74)} = -.729, p < .001$ , phonological awareness,  $r_{(74)} = -.390, p = .001$ , morphological decomposition,  $r_{(74)} = -.648, p < .001$  and reading comprehension,  $r_{(74)} = -.547, p < .001$  and was not correlated with the English orthographic choice task.

Urdu morphological decomposition was negatively correlated with English word reading,  $r_{(74)} = -.328, p = .004$ , pseudo-word reading,  $r_{(74)} = -.234, p = .42$ , vocabulary,  $r_{(74)} = -.338, p = .003$ , phonological awareness,  $r_{(74)} = -.218, p = .05$ , morphological decomposition,  $r_{(74)} = -.316, p = .005$  and was not significantly correlated with the orthographic choice task and reading comprehension. Urdu orthographic choice was negatively correlated with English word reading,  $r_{(74)} = -.494, p < .001$ , pseudo-word reading,  $r_{(74)} = -.340, p = .003$ , vocabulary,  $r_{(74)} = -.625, p < .001$ , phonological awareness,  $r_{(74)} = -.390, p = .001$ , morphological decomposition,  $r_{(74)} = -.552, p < .001$ , reading comprehension,  $r_{(74)} = -.430, p < .001$  and was not correlated with the English orthographic choice task.

Urdu reading comprehension task was not significantly correlated with any of the English variables except being negatively correlated with English reading comprehension,  $r_{(74)} = -.246, p = .032$ . These findings can be seen in Table 8.

**Summary of the Key Findings:** English word and pseudo-word reading, vocabulary knowledge, phonological awareness and orthographic decomposition were negatively correlated with most of the Urdu variables tested in the study with the exception of Urdu reading comprehension.

### **Correlational Analyses: Urdu-English Bilinguals in Canada**

The associations between L1 (Urdu) variables, L2 variables (English) and across languages (Urdu & English) were analyzed and are presented in three separate sections. The first section reports all relations among Urdu variables, the second section reports the relations among variables in English and the third section describes relationships across languages for the key variables.

**Relationships among L1 (Urdu) Variables.** Word reading with and without vowels in Urdu were significantly correlated with each other,  $r_{(48)} = .690, p < .001$ . Urdu word reading was also significantly correlated with phonological awareness,  $r_{(48)} = .298, p = .036$ , and morphological decomposition,  $r_{(48)} = .537, p < .001$ . Urdu word reading with vowels was not correlated with Urdu vocabulary, orthographic choice task and reading comprehension.

Word reading without vowels in Urdu was significantly correlated with phonological awareness,  $r_{(48)} = .413, p = .003$  and morphological decomposition,  $r_{(48)} = .705, p < .001$ . Urdu word reading without vowels was not correlated with other Urdu measures.

Urdu vocabulary was significantly correlated with performance on Urdu phonological awareness,  $r_{(48)} = .534, p < .001$  and morphological decomposition,  $r_{(48)} = .369, p = .008$ . Urdu vocabulary was not correlated with Urdu morphology, orthographic choice and reading comprehension. The Urdu phonological awareness test was only significantly correlated with morphological decomposition,  $r_{(48)} = .512, p < .001$  and did not show any significant relationship with the Urdu orthographic choice task and reading comprehension. Urdu morphological decomposition was significantly correlated with orthographic choice task,  $r_{(48)} = .337, p = .017$  and reading comprehension,  $r_{(48)} = .311, p = .028$ . The Urdu orthographic choice task was significantly correlated with Urdu reading comprehension,  $r_{(48)} = .286, p = .044$ . These findings can be seen in Table 9.

**Summary of the Key Findings:** Urdu word reading with and without vowels and vocabulary knowledge were the only variables, which were significantly correlated with phonological awareness and morphological decomposition. Reading comprehension was correlated with morphological and orthographic processing.

**Relationships among L2 (English) Variables.** English word reading was significantly correlated with English pseudo-words reading,  $r_{(48)} = .704, p < .001$ , vocabulary,  $r_{(48)} = .729, p < .001$ , phonological awareness,  $r_{(48)} = .705, p < .001$ , morphological decomposition,  $r_{(48)} = .505, p < .001$ , orthographic choice,  $r_{(48)} = .391, p = .005$  and reading comprehension,  $r_{(48)} = .586, p < .001$ . English pseudo-word reading for this particular bilingual sample was significantly correlated with English vocabulary,  $r_{(48)} = .585, p < .001$ , phonological awareness,  $r_{(48)} = .584, p < .001$ , morphological decomposition,  $r_{(48)} = .398, p = .004$ , orthographic choice,  $r_{(48)} = .512, p < .001$  and reading comprehension,  $r_{(48)} = .466, p = .001$ .

English vocabulary was significantly correlated with English phonological awareness,  $r_{(48)} = .809, p < .001$ , morphological decomposition,  $r_{(48)} = .610, p < .001$ , orthographic choice,  $r_{(48)} = .373, p = .008$  and reading comprehension,  $r_{(48)} = .629, p < .001$ . English phonological awareness was significantly correlated with morphological decomposition,  $r_{(48)} = .663, p < .001$ , orthographic choice,  $r_{(48)} = .483, p < .001$  and reading comprehension,  $r_{(48)} = .740, p < .001$ . English morphological decomposition was significantly correlated with orthographic choice task,  $r_{(48)} = .429, p = .002$  and reading comprehension,  $r_{(48)} = .519, p < .001$ . English orthographic choice task was significantly correlated with English reading comprehension,  $r_{(48)} = .527, p < .001$ . These findings can be seen in Table 10.

**Summary of the Key Findings:** All the English variables tested in the study were significantly correlated with each other in this bilingual sample.

**Relationships among L1 (Urdu) and L2 (English) Variables.** Due to the large number of variables examined, the section on cross language comparison is divided into six further subsections, according to each construct: word reading, vocabulary, phonological awareness, morphological awareness, orthographic knowledge and reading comprehension.

Urdu word reading with vowels was significantly correlated with English word reading,  $r_{(48)} = .303, p = .033$  and English morphological awareness,  $r_{(48)} = .283, p = .047$ . Urdu word reading without vowels was significantly correlated with English vocabulary,  $r_{(48)} = .323, p = .022$  and English morphological decomposition,  $r_{(48)} = .357, p = .011$ . Urdu word reading without vowels was not correlated with any other variable tested in the English language.

Urdu vocabulary was significantly correlated with English word reading,  $r_{(48)} = .437, p = .002$ , pseudo-word reading,  $r_{(48)} = .321, p = .023$ , vocabulary,  $r_{(48)} = .429, p = .002$ , phonological awareness,  $r_{(48)} = .581, p < .001$ , morphological decomposition,  $r_{(48)} = .540, p < .001$  orthographic choice task,  $r_{(48)} = .327, p = .021$  and reading comprehension,  $r_{(48)} = .603, p < .001$ . Urdu phonological awareness test was significantly correlated with English word reading,  $r_{(48)} = .544, p < .001$ , pseudo-word reading,  $r_{(48)} = .316, p = .025$ , vocabulary,  $r_{(48)} = .548, p < .001$ , phonological awareness,  $r_{(48)} = .517, p < .001$ , morphological decomposition,  $r_{(48)} = .507, p < .001$  and reading comprehension,  $r_{(48)} = .432, p = .002$ .

Urdu morphological decomposition was significantly correlated with English word reading,  $r_{(48)} = .305, p = .031$ , vocabulary,  $r_{(48)} = .360, p = .010$ , phonological awareness,  $r_{(48)} = .371, p = .008$ , morphological decomposition,  $r_{(48)} = .530, p < .001$  and reading comprehension,  $r_{(48)} = .280, p = .049$ . However, Urdu orthographic choice and reading comprehension were not correlated with any of the English measures tested in the study. These findings can be seen in Table 11.

**Summary of the Key Findings:** English variables, specifically word and pseudo-word reading, vocabulary and morphological decomposition, were significantly correlated with Urdu vocabulary, phonological and morphological awareness.

**Regression Analyses: Urdu-English Bilinguals in Pakistan**

To explore significant predictors of word reading in Urdu and English for this particular sample, hierarchical regression analyses were conducted and are presented in the next section.

**Within Language Variables Related to (L1) Urdu Word Reading.** Variables were selected based on previous theoretical and empirical results as well as whether they were significantly correlated with the variables of interest. To explore significant predictors of Urdu word reading with vowels, a hierarchical regression analysis was conducted. The following variables were used in this hierarchical analysis and each variable was entered for each step in the following order: Urdu morphological awareness, orthographic choice task, phonological awareness and vocabulary. Urdu word reading was entered as dependent measure. To ensure that the regression model estimates of the coefficients were stable and that the standard errors for the coefficients were not inflated, a multicollinearity diagnosis analysis was conducted for all the regression analyses. The Variance Inflation Factors and Tolerance values were within the acceptable range (below 10 and above .10, respectively), suggesting that none of the variables was redundant. The total variance explained for Urdu word reading was  $R^2 = .852$ ,  $F_{(4, 73)} = 99.44$ ,  $p < .001$  (See Table 12). Although, these variables were related to word reading when entered as the first and second steps, Urdu phonological awareness and vocabulary were the only variables uniquely related to Urdu word reading,  $\beta = .625$ ,  $t_{(73)} = 5.77$ ,  $p < .001$  and  $\beta = .212$ ,  $t_{(73)} = 2.50$ ,  $p = .015$ , respectively.

**Within Language Variables Related to (L2) English Word Reading.** To explore significant predictors of English word reading, a hierarchical regression analysis was conducted. All the steps from previous regression analyses were followed for this particular analysis. A four-step hierarchical regression analysis included following variables in each step: English

orthographic choice, phonological awareness, morphology and vocabulary. The total variance explained for English word reading was  $R^2 = .783$ ,  $F_{(4, 69)} = 62.37$ ,  $p < .001$  (See Table 13).

English vocabulary was the only variable uniquely related to English word reading,  $\beta = .699$ ,  $t_{(69)} = 7.17$ ,  $p < .001$ , although other variables were related in prior steps.

**Cross-Linguistic Variables Related to (L1) Urdu Word Reading.** To explore cross-linguistic predictors of Urdu word reading, English phonological awareness, orthographic choice, word reading, pseudo-word reading, morphology and vocabulary were entered for each step of 6-step hierarchical regression analysis. The total variance explained for Urdu word reading was  $R^2 = .667$ ,  $F_{(6, 67)} = 22.35$ ,  $p < .001$  (See Table 14). English vocabulary was the only variable uniquely related to Urdu word reading,  $\beta = -.662$ ,  $t_{(67)} = -4.06$ ,  $p < .001$ . All relationships were negative.

**Cross-Linguistic Variables Related to (L2) English Word Reading.** To explore cross-linguistic predictors of English word reading, Urdu variables were entered in a step-wise hierarchical analysis in following steps: Urdu word reading without vowels, morphological awareness, phonological awareness, vocabulary, orthographic choice and word reading with vowels. The total variance explained for English word reading was  $R^2 = .557$ ,  $F_{(6, 67)} = 14.05$ ,  $p < .001$  (See Table 15). Urdu word reading with vowels was the only variable uniquely related to English word reading,  $\beta = -.618$ ,  $t_{(67)} = -2.87$ ,  $p = .005$ . However, this and other relationships were negative.

### **Regression Analyses (Urdu-English Bilinguals in Canada)**

To explore the significant predictors uniquely related to word reading in Urdu and English for Canadian bilinguals, hierarchical regression analyses were conducted and are presented in the next section.

**Within Language Variables Related to (L1) Urdu Word Reading.** To explore significant predictors of Urdu word reading with vowels, a hierarchical regression analysis was conducted. The following variables were used in this hierarchical analysis and each variable was entered for each step in this order; Urdu orthographic choice, phonological awareness, morphological awareness, vocabulary and word reading without vowels. Urdu word reading was entered as dependent measure. To ensure that the regression model estimates of the coefficients were stable and that the standard errors for the coefficients were not inflated, a multicollinearity diagnosis analysis was conducted for all the regression analyses. The Variance Inflation Factors and Tolerance values were within the acceptable range (below 10 and above .10, respectively), suggesting that none of the variables was redundant. The total variance explained for Urdu word reading was  $R^2 = .490$ ,  $F_{(5, 44)} = 8.46$ ,  $p < .001$  (See Table 16). Although Urdu morphological awareness was related to Urdu word reading in first step, Urdu word reading without vowels was the only variable uniquely related to Urdu word reading,  $\beta = .625$ ,  $t_{(44)} = 4.10$ ,  $p < .001$ .

**Within Language Variables Related to (L2) English Word Reading.** To explore significant predictors of English word reading, a hierarchical regression analysis was conducted. All the steps from previous regression analyses were followed for this particular analysis. A four-step hierarchical regression analysis included the following variables for each step: English morphological awareness, orthographic choice, phonological awareness and vocabulary. The total variance explained for English word reading was  $R^2 = .574$ ,  $F_{(4, 45)} = 15.17$ ,  $p < .001$  (See Table 17). None of the variables were significantly related to English word reading in final step, although, some of them were related in previous steps.

**Cross-Linguistic Variables Related to (L1) Urdu Word Reading.** To explore cross-linguistic predictors of Urdu word reading, English orthographic choice, vocabulary,



phonological awareness, morphological awareness, word and pseudo-word reading were entered in each step of 6-step hierarchical regression analysis. The total variance explained for Urdu word reading was  $R^2 = .227$ , with non-significant final model,  $F_{(6, 43)} = 2.10$ ,  $p = .072$  (See Table 18). English word reading was the only variable uniquely related to Urdu word reading,  $\beta = .498$ ,  $t_{(43)} = 2.15$ ,  $p = .037$ .

**Cross-Linguistic Variables Related to (L2) English Word Reading.** To explore cross-linguistic predictors of English word reading, Urdu variables were entered in a step-wise hierarchical analysis in following steps: Urdu orthographic choice, morphological awareness, vocabulary, word reading without vowels, word reading with vowels and phonological awareness. The total variance explained for English word reading was  $R^2 = .402$ ,  $F_{(6, 43)} = 4.80$ ,  $p = .001$  (See Table 19). Urdu word reading with and without vowels were uniquely related to English word reading,  $\beta = .336$ ,  $t_{(43)} = 2.03$ ,  $p = .048$  and  $\beta = -.398$ ,  $t_{(43)} = -2.02$ ,  $p = .049$ , respectively. However, Urdu word reading with vowels was positively related to English word reading, while Urdu word reading without vowels was negatively related to English word reading. Urdu phonological awareness was also related to English word reading,  $\beta = .467$ ,  $t_{(43)} = 3.04$ ,  $p = .004$ .

### **Discussion for Study 1: A Comparison between Urdu-English Bilinguals from Pakistan and Canada**

This study compared language and reading development of Urdu-English bilinguals in Pakistan and Canada. These Urdu-English bilinguals differed from each other in terms of their language learning patterns across countries. The first Urdu-English bilingual group from Pakistan learned to speak their first language (Urdu) at home and learned to read Urdu at school at the age of three or four. These bilinguals learned to read English as their second language prior to learning to speak their L2 at school at the age of eight or nine (Grade 4 to 5), depending on whether they went to private or public school. The main difference between a private and public school is that public schools introduce English as a course-subject in grade six, whereas, in private schools the medium of instruction used by teachers is English from grade one. Urdu-English bilinguals in Canada learned to speak Urdu and English simultaneously in their homes and learned to read English prior to learning to read Urdu in their schools at around the age of 5.

Children were tested on the measures of word and pseudo-word reading, vocabulary, phonological and morphological awareness, orthographic knowledge and reading comprehension in both L1 and L2. The purpose of this study was to compare language and reading skills across countries to determine the path of language learning and reading development in a bilingual context. Research had established many models and theories for cross-linguistic relationships among languages and literacy skills of bilinguals and biliterate people especially when both languages bilinguals learn are alphabetic (i.e., Urdu and English) (August & Shanahan, 2006; Mirza, Gottardo, & Chen, 2017; Prevoo, Malda, Mesman & van IJzendoorn, 2016). Lindsey, Manis, and Bailey (2003) and Proctor, August, Carlo and Snow (2006) explain the nature of relationships across languages with similar alphabetic scripts (Spanish and English) in terms of

first language literacy skills being related to second language reading skills. Additionally, their findings suggest that this relationship only exists when bilingual children have developed first language literacy skills and that oral language proficiency in the first language is not sufficient for this relationship to exist. These cross linguistic relationships have been found in many other studies as well (Chang, 2013; Jiang, 2004; Koda, 1996). Yet, it is hard for bilingual researchers to explain the relationship between good and poor readers across languages when languages share many features. For example, it is difficult to clarify the relationships between language-specific or language-general mechanisms. Therefore, our main interest was to determine the relationship across typologically different orthographies, specifically reading alphabetic scripts in English and Urdu in greater depth.

The first part of the results section compared the performance of Urdu-English bilinguals on both Urdu and English variables across countries, Pakistan and Canada. Urdu-English bilinguals from Pakistan performed better on all of the Urdu measures as compared to bilinguals in Canada. The case was opposite when comparisons were conducted on English variables used in the study. Urdu-English bilinguals from Canada performed better than bilinguals in Pakistan on English measures. However, within group cross-linguistic comparisons showed that Urdu-English bilinguals from Pakistan performed better on Urdu variables as compared to English. On the other hand, Urdu-English bilinguals from Canada performed better on English as compared to Urdu measures with the exception of the following three measures, Urdu orthographic choice task and English word reading. These findings are consistent with many other studies conducted in bilingual contexts where children are learning to read in an alphabetic script (Chang, 2013; Jiang, 2004; Koda, 1996). Canadian Urdu-English bilinguals did better on English measures but were able to read Urdu words relatively well especially when they learned to read L1 only once a

week at weekend language schools. The ratio of Urdu literacy and language learning and its usage is much lower than their L2 acquisition and usage, suggesting that their L2 (English) is their dominant language. On the other hand, Urdu-English bilinguals in Pakistan performed better on Urdu measures but were able to decode English script even though they started learning to read English at the age of seven or eight regardless of when they learned to speak the English language. Research conducted by Asfaha, Beckman, Kurvers, and Kroon (2009) and Dubeck, Jukes and Okello (2012) on bilinguals who learn to read English as their second language prior to learning to speak suggested the same relationships we see in the current study. Mean comparisons conducted across groups also showed that oral language skills play an important role in second language acquisition supported by previous findings (Chang, 2013; Jiang, 2004; Koda, 1996). Urdu-English bilinguals from Pakistan and Canada learn to speak Urdu as their first language prior to learning to read or speak English but only use their L1 oral language skills across languages in Canada.

The next area of interest was to explore significant relationships across languages in both groups of Urdu-English bilinguals. The cross-linguistic correlational analysis conducted on Urdu-English bilinguals in Pakistan revealed negative correlations between English and Urdu measures except English reading comprehension and Urdu word reading. There can be many explanations for this relationship including the one that Urdu reading comprehension test was a translated version of the English reading comprehension test (GORT-4). As mentioned earlier in the literature review, Urdu shares some of its vocabulary with English, most of the words used in the stories were cognates. Therefore, it was easy for children to access the vocabulary in their lexicons while answering the comprehension questions as compared to their performance on other English variables tested in the study, which were negatively correlated with Urdu variables.

The negative correlation shows that this Urdu-English bilingual in Pakistan group is not using its L1 skills as reported with other groups in the literature to perform on English measures (Durgunoğlu, 2002). They are only performing on English measures by depending on their knowledge of the English language which they learned in the classrooms and which depends on instruction. These children are taught English language and literacy skills by the “*whole word memorization technique*” where there is no instruction given on phonemic and morphological awareness. English grammar is introduced mostly in higher elementary levels or in middle school. These children are not given instruction on the letter-sound knowledge as part of their primary literacy instructions, hence they do not have appropriate letter-sound information and trained higher level of skills in segmenting and blending the words.

On the other hand, Urdu-English bilinguals from Canada learn to read English in schools with instruction that includes detailed letter-sound correspondence and exercises of phonemic blending and segmenting. Cross-linguistic correlational analyses conducted on this group showed positive correlations between vocabulary, phonemic and morphological awareness. As mentioned earlier this Urdu-English bilingual group learns to speak L1 (Urdu) and L2 (English) simultaneously at homes, and Urdu shares its vocabulary with English. Therefore it is not surprising to see a positive relationship between Urdu and English vocabulary and measures of phonology and morphology. Additionally, these results are consistent with research that shows a relationship between L1 and L2 skills.

The next set of analyses was conducted to determine possible predictors of word reading in each language and group. The first analysis was conducted to predict within and cross linguistic predictors of Urdu word reading among Urdu-English bilinguals from Pakistan. The analyses showed that Urdu phonological awareness and vocabulary are the unique predictors of

Urdu word reading for this bilingual group. Previous research has shown that phonological processing plays a very important role in word reading (Georgiou, Parrila, & Papadopoulos, 2008). Wagner and Torgesen (1987) described the role of phonological processing in word reading with three further aspects: phonological awareness, phonological short-term memory and rapid automatized naming. Based on the findings of De Jong and van der Leij, (1999) and Holopainen, et al., (2001) and Muter, et al., (2004) and Parrila, et al., (2004) and Wagner and Torgesen, (1987) these three factors predict the rate of reading acquisition in almost all alphabetic languages that vary in orthographic consistency as can be seen in this case where Urdu phonology was one of the unique predictor of Urdu word reading. The other predictor of Urdu word reading was vocabulary in Urdu-English bilinguals from Pakistan. Previous research has discussed the links between oral and written language in developmental literacy research (Dickinson et al., 2003). According to the findings of a study conducted by Ouellette (2006) expressive vocabulary is a strong predictor of visual word recognition consistent with the findings of current study. Although some studies also described the relationship between oral and written language as mediated by phonological processing (Whitehurst & Lonigan, 1998). To determine this relationship, skilled readers must recognize words rapidly and accurately to achieve the higher levels of skilled reading (comprehension) and this particular research did not aim to measure higher levels of reading skill at this stage. Findings were consistent when English variables were explored to determine significant predictors of English word reading in Urdu-English bilinguals in Pakistan. It was English vocabulary that uniquely predicted English word reading in this group. The case was similar for the cross-linguistic exploration of predictors of word reading in this particular group, as English vocabulary predicted Urdu word reading.

The variables related to reading were examined in another analysis on Urdu-English bilinguals in Canada to determine within and cross-linguistic predictors of word reading in Urdu and English. Findings were replicated in most of the cases where English word reading was the unique predictor of Urdu word reading and Urdu word reading along with phonology were the unique predictors of English word reading. However, the case was slightly different for cross-linguistic predictors of English word reading. Along with Urdu phonology it was Urdu word reading that predicted English word reading uniquely in this particular bilingual group and in these cases, relationships were positive. There are mixed reviews in literature regarding transferring skills from L1 to facilitate L2 word reading. *The linguistic interdependence hypothesis*, Cummins (1981) is known as “*Universal Hypothesis*” which addresses the underlying cognitive processes that contribute to the literacy development in different languages regardless of orthography. In contrast to that, *the script dependence hypothesis* by Frost, Katz and Bentin (1987) (also see Geva & Siegel, 2000) states that shallow orthographies have more predictable grapheme-phoneme correspondences as compared to deep orthographies and these variations in orthographies lead to problems in process of reading development across languages. However, current findings are mixed. The data from Canada support the findings explained by *Universal Hypothesis* that cognitive process facilitate reading development in different languages across orthographies to support transfer from L1 to L2. The support for *Universal Hypothesis* was also replicated by the set of hierarchical analyses which explored within and cross-linguistic predictors of Urdu word reading in Urdu-English bilinguals in Canada. It was Urdu word reading without vowels and English word reading that uniquely predicted Urdu word reading. Overall, the data from Pakistan showed negative correlations between Urdu and English variables that were not consistent with Cummins (1981) whereas, positive correlations between Urdu and

English variables in Canada were consistent with Cummins (1981). The linguistic context in which the participants learned English, specifically in school only as a school subject in an immersion setting as a societal language, might influence the results. It also suggests that the *Universal Hypothesis* by Cummins (1981) needs to be revised to be applicable on language learning in different contexts as it only supported for Urdu-English bilinguals in North American context but not for Urdu-English bilinguals in Pakistan.



## **Study 2: A Comparison between Urdu-English and Arabic-English Bilinguals**

### **Research Questions for Study 2**

Based on the exploratory nature of this study, the following research questions were examined in Study 2.

1. Are there group differences between Arabic-English bilinguals in Saudi Arabia and Canada in terms of their performance on Arabic and English measures used in the study?
2. Are there any differences between Arabic-English and Urdu-English bilinguals from Saudi Arabia and Pakistan and both groups in Canada in terms of their performance on English measures used in the study?
3. Are variables similarly related to each other in both languages (Arabic and English) of bilinguals across countries?
4. Finally, are within-and-cross-linguistic predictors of Arabic and English word reading similar across countries?

### **Design: Study 2**

The first part of the study included cross-linguistic comparisons among Arabic-English speakers from Saudi Arabia and Canada. The second part of the study had comparisons across languages among Urdu-English bilinguals from Pakistan and Arabic-English bilinguals from Saudi Arabia in terms of their English skills. The last part of the study conducted cross-linguistic comparisons among Urdu-English and Arabic-English bilinguals in Canada on their English skills. Participants were tested on the measures of word and pseudo-word reading, vocabulary, morphology, phonological skills, orthographic knowledge and reading comprehension. Groups were created based on their place of residence; Urdu-English bilinguals from Pakistan and Canada and Arabic-English bilinguals from Saudi Arabia and Canada.

**Participants: Study 2**

A sample of 80 Arabic-English bilinguals eight to ten-year-old children, 40 Arabic-English bilinguals from Saudi Arabia and 40 Arabic-English bilinguals from Canada were tested in their native country, Saudi Arabia and in Canada. Participants in Canada were recruited from many different International Language Schools in the region of Waterloo, Ontario Canada. There were not any additional criteria for children to be able to participate in the study regarding the length of time attending the language school. Urdu-English bilinguals from Pakistan and Canada were the same children as in Study 1, therefore their descriptive statistics and other information can be seen in participant section of study 1 and Table 1, 2 and 3. Children in Saudi Arabia were tested in their public or private schools. All children in the study were taken from middle class and upper middle-class neighborhoods.

Demographic information was collected through a questionnaire completed by the parents of each participant. This questionnaire was designed to identify the percentage of usage of their L1, Arabic at home, their country of origin, the number of books in L1 at home, and other information about their home environment (see below).

**Demographics: Study 2**

The *Demographic/ Family Language Questionnaire* was given to the parents in Saudi Arabia and Canada along with the consent forms in order to determine what language(s) the parents and children speak at home. This questionnaire also obtained information about the factors that influence a child's ability to learn a second language and their verbal ability. This questionnaire was given in English in Canada and in the Arabic language in the Saudi Arabia in this study. The following section explains the items being used in designing this language and demographic questionnaire.

Based on the family questionnaire, it was determined that the usage of L1 and L2 at home with parents, siblings, and friends varied across the two groups. Arabic-English bilinguals in Saudi Arabia and Canada use spoken Arabic to communicate with their parents, siblings and friends more than both standard Arabic and English. Additionally, Arabic-English bilinguals in Canada use English language more than Arabic language to communicate with their siblings and friends. Also, most of the children who live in Saudi Arabia allocated more time to reading Arabic books and watching Arabic programs than English, in comparison to children who live in Canada, who spent more time in reading English books and watching English programs than doing the same activities in Arabic.

In terms of parental educational level, approximately 45% of the Saudi group had parents who had completed an undergraduate degree, 41% of parents had completed a professional or post-graduate degree. Another 9% had completed a college diploma, and the remaining 5% completed high school. Forty-eight percent of the Canadian group had parents who had completed undergraduate degrees, 33% of parents had completed post-graduate degrees, 12% who had completed a college diploma, and the remaining 7% of parents had completed high school.

### **Arabic Measures**

**Arabic Word reading.** The Individual Diagnostic Tests in the Assessment of Learning Disabilities in Arabic: Tests and Manual-Logat Elkaraa by Asadi, Shany, Ben-Semon, and Ibrahim (2014) was used to measure children's ability to decode the vowelized and un-vowelized real words and pseudo-words. The Vowelized and un-vowelized Real Word Reading subtests examine both the accuracy and fluency of reading words in Arabic. There were twenty items in each list. Children were asked to read each list separately. The words in each list were

increasingly difficult in terms of the number of syllables, phonological structure, and morphological complexity. Raw scores were calculated based on the number of correct responses in each word list. According to the manual the internal consistency of vowelized word reading was  $\alpha = .81$ , and un-vowelized word reading was  $\alpha = .81$  (Asadi, Shany, Ben-Semon, & Ibrahim, 2014).

The Pseudo-word Reading subtest measured children's ability to decode pseudo-words of the Arabic alphabet system both accurately and fluently. There were eighteen items in this subtest. The Cronbach's alpha on this task was  $\alpha = .81$  (Asadi, Shany, Ben-Semon, & Ibrahim, 2014).

**Arabic Reading Comprehension.** The Individual Diagnostic Tests in the Assessment of Learning Disabilities in Arabic: Tests and Manual-Logat Elkaraa (Asadi, Shany, Ben-Semon, & Ibrahim, 2014) was used to assess children's abilities to read and comprehend in Arabic. There were two passages in total that were presented in vowelized Arabic. Each passage followed multiple choice comprehension questions. Children were asked to read the passage and then answer the following questions. The Cronbach's alpha on this measure was  $\alpha = .81$ .

**Arabic Phonological awareness.** The Phoneme Deletion subtest of the Tests and Manual-Logat Elkaraa by Asadi, Shany, Ben-Semon, and Ibrahim (2014) was used to determine children's phonological awareness skills in Arabic. During the task, children were asked to delete either the initial phoneme or the last phoneme of the word. There were twelve items in this task that were organized according to their linguistic attributes. The list included both one-syllable and two-syllable words. The reported Cronbach's alpha was  $\alpha = .81$  for this task.

**Arabic Morphological awareness.** A Morphological Odd Word Out subtest of the Tests and Manual-Logat Elkaraa by Asadi, Shany, Ben-Semon, and Ibrahim (2014) was used to

examine children's morphological awareness. This task tested children's awareness of root knowledge in Arabic. There were twenty items in this task. Each item consisted of a set of four words. One word out of the four-word set of each item was phonologically similar to the other three words but not morphologically related to the set (e.g., سرد، درس، مدرس، مدرسة - translation: school, lesson, cold). Children were asked to identify the word within each set that did not relate to the rest of the set (e.g., سرد). Cronbach's alpha of this test was  $\alpha = .81$ .

**Arabic Orthographic knowledge.** The Cross Out the Wrong Word subtest of Tests and Manual-Logat Elkaraa (Asadi, Shany, Ben-Semon, & Ibrahim, 2014) was used to test children's orthographic knowledge in Arabic. The task included five practice items and fifty test items that involved judging the correct and incorrect spellings of the words. Throughout this task, children were asked to read the words and cross out incorrect spellings of the words. The examiner of the study recorded the total number of items resolved correctly in the given time. Cronbach's alpha of this subtest was  $\alpha = .81$ .

**Arabic Vocabulary.** The Picture Vocabulary subtest of the Tests and Manual-Logat Elkaraa (Asadi, Shany, Ben-Semon, & Ibrahim, 2014) was administered to measure children's vocabulary knowledge in Arabic. There were forty items in this test. The examiner of the study said a word aloud and children were asked to point out the correct picture out of the given set of four pictures in each item. Cronbach's alpha of this subtest was  $\alpha = .81$ .

As it is mentioned earlier that Urdu-English bilinguals were used from study 1, therefore all the details regarding Urdu measures can be seen in study 1.

### **Results Study 2: A Comparison between Urdu-English and Arabic-English Bilinguals**

This study involved two groups of Urdu-English (one group from Pakistan and the other group from Canada) and two groups of Arabic-English bilinguals (one group from Saudi Arabia and the other group from Canada). Descriptive statistics for Urdu-English bilinguals for Pakistan and Canada has been presented in the result section of first study (See Table 3 and 4, for details) therefore, descriptive statistics for only Arabic-English bilinguals will be presented in the first portion of this study's result section. The next section explains mean comparisons conducted across languages followed by the correlational analyses among variables used in both languages and finally regression analyses.

#### **Descriptive Statistics (Arabic-English Bilinguals in Saudi Arabia)**

All 40 participants (25 boys and 15 girls), ( $M_{\text{age}} = 8.48$ ,  $SD = .50$ ) were included in the analyses. Table 20 illustrates the means and standard deviations for each task for all of the participants. For Arabic testing, a standardized battery (Tests and Manual-Logat Elkaraa by Asadi, Shany, Ben-Semon & Ibrahim, 2014) was used to test following areas among Arabic-English bilinguals: word reading with vowels, word reading without vowels, pseudo-word reading, vocabulary, phonological awareness, morphological decomposition, orthographic choice knowledge and reading comprehension.

#### **Descriptive Statistics (Arabic-English Bilinguals in Canada)**

The next set of data was collected from Arabic-English bilingual speakers residing in Canada. All 40 participants (18 boys and 22 girls), ( $M_{\text{age}} = 8.82$ ,  $SD = .76$ ) were included in the analyses. Table 21 illustrates the means and standard deviations for each task for all of the participants. Visual inspection of the data showed no floor or ceiling effects for any of the Arabic, Urdu or English measures.

### **Comparisons of Gender: Study 2**

Independent samples t-tests were conducted to determine gender differences in this sample. The analyses revealed no differences in terms of the performance of the participants on Arabic and English measures in Saudi Arabia and Canada. Therefore, gender was not included as a variable of interest in any further analyses.

### **Within-Language Comparisons across Countries**

The next step of analysis involved group comparison across countries with Arabic-English bilinguals. All 40 participants from Saudi Arabia and 40 participants from Canada were included in these comparisons (see Amin, 2017 for similar analyses). Independent samples t-tests were conducted to compare participants' performance on Arabic and English measures used in the study. As expected significant differences were found in almost all of the measures across countries except Arabic word reading with vowels and pseudo-word reading. Arabic-English bilinguals from Saudi Arabia had higher scores in Arabic measures as compared to Arabic-English bilinguals in Canada and Arabic-English bilinguals from Canada had higher scores in English measures as compared to Saudi Arabia bilinguals (See Table 22).

### **Between Language Comparisons among Urdu-English and Arabic-English Bilinguals in Pakistan and Saudi Arabia**

The next step of the analyses involved group comparisons for English between Urdu and Arabic bilinguals. The first analysis was conducted on Arabic-English bilinguals from Saudi Arabia and Urdu-English bilinguals from Pakistan on the English measures. All 76 Urdu bilinguals and 40 Arabic-English bilinguals were included in these comparisons. Independent samples t-tests were conducted to compare participants' performance on English measures used in the study. Analyses revealed significant differences in performance on English variables

between Urdu-English bilinguals in Pakistan and Arabic-English bilinguals in Saudi Arabia. As can be seen, Urdu bilinguals did better on most of the English measures with the exception of English phonological awareness and English reading comprehension (See Table 23).

### **Between Language Comparisons among Urdu-English and Arabic-English Bilinguals in Canada**

The next step of the analyses involved group comparisons for English between Urdu-English and Arabic-English bilinguals from Canada. All 50 Urdu-English bilinguals and 40 Arabic-English bilinguals were included in these comparisons. Independent samples t-tests were conducted to compare participants' performance on English measures used in the study.

Surprisingly, analysis revealed significant differences between Urdu-English and Arabic-English bilinguals' performance on English phonological awareness, orthographic choice and reading comprehension. As can be seen in the mean comparisons Table 24, Arabic-English bilinguals performed slightly better on English measures of phonological awareness and reading comprehension, while the Urdu-English bilinguals in Canada performed better on English orthographic knowledge (See Table 24).

### **Correlational Analyses (Arabic-English Bilinguals in Saudi Arabia)**

The associations between L1 (Arabic) variables, L2 (English) variables and across L1 and L2 variables (Arabic & English) were analyzed. Mainly these correlations were exploratory and used to help make the decision about which variables to include in the regressions (along with theory). Correlations are presented in three separate sections. The first section explains all related variables in the Arabic language, the second section examines the relationships in the English language and the third section describes relationships across the languages (see Amin,



2017 for similar analyses). Due to the size of correlation matrix, this particular section was divided into subsections which highlighted significant correlations.

**Relationships among L1 (Arabic) Variables.** Word reading with and without vowels in Arabic were significantly correlated,  $r_{(38)} = .632, p < .001$ . Arabic word reading was also correlated with pseudo-word reading,  $r_{(38)} = .520, p = .001$ , vocabulary,  $r_{(38)} = .371, p = .018$ , phonological awareness,  $r_{(38)} = .715, p < .001$ , morphological decomposition,  $r_{(38)} = .506, p = .001$ , the measure of orthographic choice,  $r_{(38)} = .713, p < .001$  and reading comprehension,  $r_{(38)} = .586, p < .001$ . Word reading without vowels in Arabic was significantly correlated with pseudo-word reading,  $r_{(38)} = .553, p < .001$ , vocabulary  $r_{(38)} = .458, p = .003$ , phonological awareness,  $r_{(38)} = .558, p < .001$ , morphological decomposition,  $r_{(38)} = .398, p = .011$ , orthographic choice,  $r_{(38)} = .631, p < .001$  and reading comprehension,  $r_{(38)} = .543, p < .001$ .

Arabic pseudo-word reading was significantly correlated with Arabic phonological awareness,  $r_{(38)} = .545, p < .001$ , morphological awareness,  $r_{(38)} = .437, p = .005$ , orthographic choice,  $r_{(38)} = .522, p = .001$  and reading comprehension,  $r_{(38)} = .434, p = .005$ . Arabic pseudo-word reading was not correlated with Arabic vocabulary. Arabic vocabulary was significantly correlated with Arabic phonological awareness,  $r_{(38)} = .382, p = .015$ , morphological decomposition,  $r_{(38)} = .348, p = .028$  and reading comprehension,  $r_{(38)} = .391, p = .013$ . Arabic vocabulary was not significantly related with the Arabic orthographic choice task.

The Arabic phonological awareness test was significantly correlated with morphological decomposition,  $r_{(38)} = .511, p = .001$ , orthographic choice,  $r_{(38)} = .578, p < .001$ , and reading comprehension,  $r_{(38)} = .476, p = .002$ . Arabic morphological decomposition was significantly correlated with the orthographic choice task,  $r_{(38)} = .640, p < .001$  and reading comprehension,  $r_{(38)} = .624, p < .001$ . The Arabic orthographic choice task was significantly correlated with

Arabic reading comprehension,  $r_{(38)} = .547, p < .001$ . All presented findings can be seen in Table 25.

**Summary of the Key Findings:** Most Arabic variables were correlated with each other, with the exception of vocabulary, pseudo-word reading and orthographic knowledge.

**Relationships among L2 (English) Variables.** English word reading was significantly correlated with English pseudo-words reading,  $r_{(38)} = .739, p < .001$ , vocabulary,  $r_{(38)} = .746, p < .001$ , morphological decomposition,  $r_{(38)} = .734, p < .001$ , orthographic choice,  $r_{(38)} = .456, p = .003$  and reading comprehension,  $r_{(38)} = .811, p < .001$ . English word reading was not correlated with English phonological awareness. English pseudo-word reading for this particular bilingual sample was significantly correlated with English vocabulary,  $r_{(38)} = .637, p < .001$ , phonological awareness,  $r_{(38)} = .501, p = .001$ , morphological decomposition,  $r_{(38)} = .485, p = .002$ , orthographic choice,  $r_{(38)} = .437, p = .005$  and reading comprehension,  $r_{(38)} = .608, p < .001$ .

English vocabulary was significantly correlated with English morphological decomposition,  $r_{(38)} = .651, p < .001$ , orthographic choice,  $r_{(38)} = .549, p < .001$  and reading comprehension,  $r_{(38)} = .753, p < .001$ . English vocabulary was not correlated with English phonological awareness. English phonological awareness was not correlated with English morphological decomposition, orthographic choice and reading comprehension. English morphological decomposition was significantly correlated with the orthographic choice task,  $r_{(38)} = .347, p = .028$  and reading comprehension,  $r_{(38)} = .763, p < .001$ . The English orthographic choice task was significantly correlated with English reading comprehension,  $r_{(38)} = .483, p = .002$ . All presented findings can be seen in Table 26.

**Summary of the Key Findings:** Most of the English variables were correlated with each other. Phonological awareness was only correlated with one variable, pseudo-word reading.

**Relationships among L1 (Arabic) and L2 (English).** Due to the number of variables examined, the section on cross language comparisons is divided into eight further subsections, according to each construct: word reading with and without vowels, pseudo-word reading, vocabulary, phonological awareness, morphological awareness, orthographic choice and reading comprehension.

Arabic word reading with vowels was not correlated with any of the English measure except English phonological awareness,  $r_{(38)} = .621, p < .001$ . Arabic word reading without vowels was significantly correlated with English word reading,  $r_{(38)} = .335, p = .034$ , pseudo-word reading,  $r_{(38)} = .373, p = .018$ , phonological awareness,  $r_{(38)} = .681, p < .001$ , morphological decomposition,  $r_{(38)} = .365, p = .021$  and reading comprehension,  $r_{(38)} = .360, p = .022$ . Arabic word reading without vowels was not correlated with English vocabulary and the orthographic choice task. Arabic pseudo-word reading was only significantly correlated with English pseudo-word reading,  $r_{(38)} = .319, p = .045$  and phonological awareness,  $r_{(38)} = .572, p < .001$ . Arabic vocabulary was not correlated with any of the other English measures used in the study.

Arabic vocabulary was not correlated with any of the English measures. Arabic phonological awareness test was not correlated with any of the English measure except English phonological awareness,  $r_{(38)} = .446, p = .004$ . Arabic morphological decomposition was only significantly correlated with English phonological awareness,  $r_{(38)} = .345, p = .029$ . Arabic orthographic choice was not correlated with any of the English measure except English phonological awareness,  $r_{(38)} = .613, p < .001$ . Arabic reading comprehension was significantly

correlated with English phonological awareness,  $r_{(38)} = .538, p < .001$ . None of the other English measures were correlated with Arabic reading comprehension. All presented findings can be seen in Table 27.

**Summary of the Key Findings:** Unexpectedly, most of the Arabic and English variables were not significantly correlated with each other, except Arabic word reading without vowels which was correlated with several English variables.

### **Correlational Analyses (Arabic-English Bilinguals in Canada)**

The associations between L1 (Arabic) variables, L2 (English) variables and across languages (Arabic & English) were analyzed and are presented in three separate sections. The first section examines all related variables in the Arabic language, the second section explains the relationships in the English language and the third section mentions relationship across both languages. Due to the size of correlation matrix, this particular section was divided into subsections which highlighted significant correlations.

**Relationships among L1 (Arabic) Variables.** Arabic word reading with and without vowels were significantly correlated with each other,  $r_{(38)} = .641, p < .001$ . Arabic word reading was also correlated with pseudo-word reading,  $r_{(38)} = .889, p < .001$ , phonological awareness,  $r_{(38)} = .662, p < .001$ , and morphological decomposition,  $r_{(38)} = .493, p = .001$  and orthographic choice,  $r_{(38)} = .619, p < .001$ . Arabic word reading with vowels was not correlated with Arabic vocabulary and reading comprehension. Arabic word reading without vowels was significantly correlated with Arabic pseudo-word reading,  $r_{(38)} = .704, p < .001$ , vocabulary,  $r_{(38)} = .410, p = .009$ , phonological awareness,  $r_{(38)} = .337, p = .033$ , morphological decomposition,  $r_{(38)} = .442, p = .004$  and orthographic choice,  $r_{(38)} = .575, p < .001$ . Arabic word reading without vowels was not correlated with Arabic reading comprehension.

Arabic pseudo-word reading was significantly correlated with Arabic phonological awareness,  $r_{(38)} = .610, p < .001$ , morphological decomposition,  $r_{(38)} = .405, p = .009$  and orthographic choice,  $r_{(38)} = .608, p < .001$ . Arabic pseudo-word reading was not correlated with Arabic vocabulary and reading comprehension. Arabic vocabulary was significantly correlated with Arabic morphological decomposition,  $r_{(38)} = .545, p < .001$ , orthographic choice,  $r_{(38)} = .632, p < .001$  and reading comprehension,  $r_{(38)} = .704, p < .001$ . Arabic vocabulary was not correlated with Arabic phonological awareness.

Arabic phonological awareness test was significantly correlated with morphological decomposition,  $r_{(38)} = .496, p = .001$  and orthographic choice,  $r_{(38)} = .409, p = .009$ . Arabic phonological awareness was not correlated with Arabic reading comprehension. Arabic morphological decomposition was significantly correlated with the orthographic choice task,  $r_{(38)} = .644, p < .011$  and reading comprehension,  $r_{(38)} = .567, p < .001$ . Orthography. The Arabic orthographic choice task was significantly correlated with Arabic reading comprehension,  $r_{(38)} = .720, p < .001$ . All presented findings can be seen in Table 28.

**Summary of the Key Findings:** All Arabic variables tested in the study were correlated with each other with the exception of reading comprehension. Reading comprehension was correlated with vocabulary and morphological awareness.

**Relationships among L2 (English) Variables.** English word reading was significantly correlated with English pseudo-word reading,  $r_{(38)} = .692, p < .001$ , vocabulary,  $r_{(38)} = .532, p < .001$ , phonological awareness,  $r_{(38)} = .430, p = .006$ , morphological decomposition,  $r_{(38)} = .641, p < .001$  and reading comprehension,  $r_{(38)} = .613, p < .001$ . English word reading was not correlated with English orthographic choice. English pseudo-word reading for this particular bilingual sample was significantly correlated with English vocabulary,  $r_{(38)} = .512, p < .001$ ,

morphological decomposition,  $r_{(38)} = .639, p < .001$  and reading comprehension,  $r_{(38)} = .556, p < .001$ . English pseudo-word reading was not correlated with English phonological awareness and orthographic choice.

English vocabulary was significantly correlated with English phonological awareness,  $r_{(38)} = .331, p = .037$ , morphological decomposition,  $r_{(38)} = .621, p < .001$ , and reading comprehension,  $r_{(38)} = .706, p < .001$ . English vocabulary was not correlated with orthographic choice. English phonological awareness was significantly correlated with morphological decomposition,  $r_{(38)} = .488, p = .001$  and reading comprehension,  $r_{(38)} = .551, p < .001$ . English phonological awareness was not correlated with orthographic choice.

English morphological decomposition was significantly correlated with reading comprehension,  $r_{(38)} = .675, p < .001$ . Like other English measures this measure was not correlated with English orthography either. English orthographic choice was not correlated with reading comprehension. All presented findings can be seen in Table 29.

**Summary of the Key Findings:** All English variables tested in the study were significantly correlated with each other except the orthographic choice task for this particular sample.

**Relationships among L1 (Arabic) and L2 (English).** Due to the number of variables examined, the section on cross language comparisons is divided into eight further subsections according to each construct: word reading with and without vowels, pseudo-word reading, vocabulary, phonological awareness, morphological awareness, orthographic knowledge and reading comprehension.

Arabic word reading with vowels was significantly correlated with English word reading,  $r_{(38)} = .546, p < .001$ , pseudo-word reading,  $r_{(38)} = .375, p = .017$ , phonological awareness,  $r_{(38)}$

= .525,  $p = .001$ , English morphological awareness,  $r_{(38)} = .451$ ,  $p = .004$  and reading comprehension,  $r_{(38)} = .493$ ,  $p = .001$ . Arabic word reading with vowels was not correlated with English vocabulary and orthographic choice.

Arabic word reading without vowels was correlated with English word reading,  $r_{(38)} = .531$ ,  $p < .001$ , pseudo-word reading,  $r_{(38)} = .379$ ,  $p = .016$ , phonological awareness,  $r_{(38)} = .413$ ,  $p = .008$ , morphological decomposition,  $r_{(38)} = .395$ ,  $p = .012$  and reading comprehension,  $r_{(38)} = .329$ ,  $p = .038$ . Arabic word reading without vowels was not correlated with English vocabulary and the orthographic choice task.

Arabic pseudo-word reading was significantly correlated with English word reading,  $r_{(38)} = .480$ ,  $p = .002$ , pseudo-word reading,  $r_{(38)} = .347$ ,  $p = .028$ , phonological awareness,  $r_{(38)} = .487$ ,  $p = .001$  morphological awareness,  $r_{(38)} = .420$ ,  $p = .007$  and reading comprehension,  $r_{(38)} = .364$ ,  $p = .021$ . Arabic pseudo-word reading was not correlated with English vocabulary and orthographic choice. Arabic vocabulary was not correlated with any of the English measure used in the study.

Arabic phonological awareness test was significantly correlated with English word reading,  $r_{(38)} = .463$ ,  $p = .003$ , pseudo-word reading,  $r_{(38)} = .415$ ,  $p = .008$ , vocabulary,  $r_{(38)} = .360$ ,  $p = .022$ , phonological awareness,  $r_{(38)} = .515$ ,  $p = .001$ , morphological decomposition,  $r_{(38)} = .571$ ,  $p < .001$  and reading comprehension,  $r_{(38)} = .447$ ,  $p = .004$ . Arabic phonological awareness test was not correlated with the English orthographic choice task. Arabic morphological decomposition was significantly correlated with English vocabulary,  $r_{(38)} = .315$ ,  $p = .048$ , morphological decomposition,  $r_{(38)} = .404$ ,  $p = .010$  and reading comprehension,  $r_{(38)} = .396$ ,  $p = .011$ . Arabic morphology was not correlated with English word and pseudo-word reading, phonological awareness and orthographic choice.

The Arabic orthographic choice task was only significantly correlated with English phonological awareness,  $r_{(38)} = .387, p = .014$ . Arabic reading comprehension was not correlated with any of the English measure. All presented findings can be seen in Table 30.

**Summary of the Key Findings:** Arabic word reading with and without vowels and phonological awareness were the only variables which were significantly correlated with English variables tested in the study.

**Comparisons of Correlations among Urdu-English from Pakistan and Arabic-English Bilinguals from Saudi Arabia.** A correlation coefficient comparison was conducted between two bilingual groups to determine if correlations were significantly higher on English variables for one group. Because English measures were the only measures that were similar across language groups, only L2 measures were included in these analyses. Both Urdu-English and Arabic-English bilinguals from their native countries were included in the first comparison. This comparison was conducted based on the Pearson  $r$  value taken from correlation matrix (Table 7 from study 1 and Table 26 from study 2) and divided by total number of participants in each group to compute  $z$ -score.  $P$ -values were computed from obtained  $z$ -scores for each English variable (See Table 31 for details). Analyses revealed that Urdu-English bilinguals showed greater relationships among word reading, phonology, vocabulary, morphology, orthography and reading comprehension as compared to Arabic-English bilinguals.

**Comparisons of Correlation among Urdu-English and Arabic-English Bilinguals from Canada.** Another correlation coefficient comparison was conducted among the two bilingual groups in Canada to determine if correlations were significantly higher on English variables for one group. Both Urdu-English and Arabic-English bilinguals from Canada were included in this comparison analysis. This comparison was conducted based on the Pearson  $r$



value taken from correlation matrix (Table 10 from study 1 and Table 29 from study 2) and divided by total number of participants in each group to compute z-score. P-values were computed from obtained z-scores for each English variable (See Table 32 for details). Findings were consistent with previous groups' performance. Urdu-English bilinguals from Canada showed greater relationships among English phonology, word reading, vocabulary, orthography and reading comprehension as compared to Arabic-English bilinguals.

### **Regression Analyses (Arabic-English Bilinguals in Saudi Arabia)**

To explore the significant predictors of word reading in Arabic and English for this particular sample, hierarchical regression analyses were conducted and are presented in the next section (See Amin, 2017 for similar analyses).

**Within Language Variables Related to (L1) Arabic Word Reading.** To explore significant predictors of Arabic word reading with vowels, a hierarchical regression analysis was conducted. The following variables were used in this hierarchical analysis and each variable was entered in each step in the following order; Arabic morphological awareness, pseudo-word reading, vocabulary, un-vowelized word reading, orthographic choice knowledge and phonological awareness. Arabic word reading was entered as dependent measure. To ensure that the regression model estimates of the coefficients were stable and that the standard errors for the coefficients were not inflated, a multicollinearity diagnosis analysis was conducted for all the regression analyses. The Variance Inflation Factors and Tolerance values were within the acceptable range (below 10 and above .10, respectively), suggesting that none of the variables was redundant. The total variance explained for Arabic word reading was  $R^2 = .663$ ,  $F_{(6, 33)} = 10.84$ ,  $p < .001$  (See Table 33). Arabic phonological awareness and orthographic choice

knowledge were the only variables uniquely related to Arabic word reading,  $\beta = .393$ ,  $t_{(33)} = 2.80$ ,  $p = .008$  and  $\beta = .382$ ,  $t_{(33)} = 2.38$ ,  $p = .023$ , respectively.

**Within Language Variables Related to (L2) English Word Reading.** To explore significant predictors of English word reading, a hierarchical regression analysis was conducted. All the steps from previous regression analyses were followed for this particular analysis. A four-step hierarchical regression analysis included following variables on each step: English orthographic choice, phonological awareness, vocabulary, morphological decomposition and pseudo-word reading. The total variance explained for English word reading was  $R^2 = .676$ ,  $F_{(4, 35)} = 18.26$ ,  $p < .001$  (See Table 34). English vocabulary and morphological decomposition were the only variables uniquely related to English word reading,  $\beta = .424$ ,  $t_{(35)} = 2.97$ ,  $p = .005$ ,  $\beta = .411$ ,  $t_{(35)} = 3.19$ ,  $p = .003$ , respectively.

**Cross-Linguistic Variables Related to (L1) Arabic Word Reading.** To explore cross-linguistic predictors of Arabic word reading, English word reading, pseudo-word reading, morphological decomposition, vocabulary, orthographic choice and phonological awareness were entered on each step of 6-step hierarchical regression analysis. The total variance explained for Arabic word reading was  $R^2 = .512$ ,  $F_{(6, 33)} = 5.77$ ,  $p < .001$  (See Table 35). English phonological awareness was the only variable uniquely related to Arabic word reading,  $\beta = .670$ ,  $t_{(33)} = 4.42$ ,  $p < .001$ .

**Cross-Linguistic Variables Related to (L2) English Word Reading.** To explore cross-linguistic predictors of English word reading, Arabic variables were entered in a step-wise hierarchical analysis in following steps: Arabic word reading with vowels, pseudo-word reading, vocabulary, morphological decomposition, orthographic choice knowledge, phonological awareness and word reading without vowels. The total variance explained for English word

reading was  $R^2 = .173$ ,  $F_{(7, 32)} = .958$ ,  $p = ns$  (See Table 36). However, none of the Arabic variables was uniquely related to English word reading.

### **Regression Analyses (Arabic-English Bilinguals in Canada)**

To explore the significant predictors of word reading in Arabic and English for Canadian Arabic bilinguals, hierarchical regression analyses were conducted and are presented in the next section.

**Within Language Variables Related to (L1) Arabic Word Reading.** To explore significant predictors of Arabic word reading with vowels, a hierarchical regression analysis was conducted. The following variables were used in this hierarchical analysis and each variable was entered in each step in this order: Arabic morphological awareness, vocabulary, orthographic choice, word reading without vowels and phonological awareness. Arabic word reading was entered as dependent measure. To ensure that the regression model estimates of the coefficients were stable and that the standard errors for the coefficients were not inflated, a multicollinearity diagnosis analysis was conducted for all the regression analyses. The Variance Inflation Factors and Tolerance values were within the acceptable range (below 10 and above .10, respectively), suggesting that none of the variables was redundant. The total variance explained for Arabic word reading was  $R^2 = .705$ ,  $F_{(5, 34)} = 16.214$ ,  $p < .001$  (See Table 37). Arabic orthographic choice, word reading without vowels and phonological awareness test were the only variables uniquely related to Arabic word reading,  $\beta = .390$ ,  $t_{(34)} = 2.61$ ,  $p = .013$ ,  $\beta = .382$ ,  $t_{(34)} = 3.30$ ,  $p = .002$  and  $\beta = .394$ ,  $t_{(34)} = 3.43$ ,  $p = .002$ .

**Within Language Variables Related to (L2) English Word Reading.** To explore significant predictors of English word reading, a hierarchical regression analysis was conducted. All the steps from previous regression analyses were followed for this particular analysis. A

four-step hierarchical regression analysis included the following variables on each step: English morphological decomposition, vocabulary, phonological awareness, orthographic choice knowledge and pseudo-word reading. The total variance explained for English word reading was  $R^2 = .484$ ,  $F_{(4, 35)} = 8.21$ ,  $p < .001$  (See Table 38). English morphological decomposition was the only variable uniquely related to English word reading,  $\beta = .409$ ,  $t_{(35)} = 2.42$ ,  $p = .021$ .

**Cross-Linguistic Variables Related to (L1) Arabic Word Reading.** To explore cross-linguistic predictors of Arabic word reading, English pseudo-words, morphological decomposition, orthographic choice knowledge, vocabulary, word reading and phonological awareness were entered on each step of 6-step hierarchical regression analysis. The total variance explained for Urdu word reading was  $R^2 = .427$ ,  $F_{(6, 33)} = 4.09$ ,  $p = .004$  (See Table 39). English phonological awareness was the only variable uniquely related to Arabic word reading,  $\beta = .350$ ,  $t_{(33)} = 2.24$ ,  $p = .031$ .

**Cross-Linguistic Variables Related to (L2) English Word Reading.** To explore cross-linguistic predictors of English word reading, Arabic variables were entered in a step-wise hierarchical analysis in the following steps: Arabic orthographic choice, morphological awareness, vocabulary, pseudo-word reading, word reading with vowels, phonological awareness and word reading without vowels. The total variance explained for English word reading was  $R^2 = .448$ ,  $F_{(7, 32)} = 3.70$ ,  $p = .005$  (See Table 40). Arabic word reading without vowels was the only variable uniquely related to English word reading,  $\beta = .555$ ,  $t_{(32)} = 2.68$ ,  $p = .011$ .

**Discussion Study 2: A Comparison between Arabic-English and Urdu-English Bilinguals**

This study compared language and reading development of Arabic-English and Urdu-English bilinguals in Saudi Arabia, Pakistan and Canada. Arabic-English bilinguals were compared to each other based on their country of residence (Saudi Arabia versus Canada). Arabic-English bilinguals differ from each other in terms of their language learning patterns across countries. The Arabic-English bilingual group from Saudi Arabia learn to speak their first language (Arabic) at home and learned to read Arabic at school at the age of three or four. These bilinguals learn to read English as their second language prior to learning to speak the language in school at the age of five or six based on whether they go to private or public schools. This particular sample was recruited from private schools where English is introduced when children start their schooling at the age of four or five. Children attend schools with half of the medium of instruction in Arabic and half in English language (comparable to some French programs instruction in Canada). On the other hand, Arabic-English bilinguals in Canada learn to speak Arabic in their homes and learn to read English prior to learning to read Arabic in their schools at the age of 4. The third and fourth groups of bilinguals in this study were Urdu-English bilinguals from Pakistan and Canada.

All bilingual groups were tested on the measures of word and pseudo-word reading, vocabulary, phonological and morphological awareness, orthographic choice knowledge and reading comprehension in both L1 and L2. An additional measure of word reading without vowels was used in Arabic and Urdu. The main purpose of this study was to compare linguistic and reading abilities of Arabic-English bilinguals across cultures (Saudi Arabia and Canada) and across first languages (comparisons conducted between Arabic-English and Urdu-English bilinguals). Urdu-English bilinguals were included in this study because they learn to read

Arabic as their third or other language to allow them to read the Quran. The Urdu language also shares its script and vocabulary with Arabic. Urdu-English bilinguals only learn to read Arabic if they are living in Pakistan, but they learn to read and speak Arabic if they are living in any other part of world, especially in North America. The purpose of this exercise is to make them able to understand the language and script when they are learning to read it. However, the level of this other/third language acquisition is different across cultures. Urdu-English bilinguals from Pakistan formally learn to read Arabic in grade six but they are introduced to the script in their homes at a younger age. On the other hand, Urdu-English bilinguals from North America learn to read and speak Arabic simultaneously at weekend Islamic/language schools at older age (usually around seven to eight years old).

The first part of the analyses involved mean comparisons on Arabic and English measures between Arabic-English bilinguals across countries (Saudi Arabia and Canada). As expected, Arabic-English bilinguals from Canada performed significantly different (better) on English measures as compared to the Arabic-English bilinguals from Saudi Arabia. These findings were consistent with other bilingual studies where English becomes the dominant language of bilinguals in a North American context regardless of which language is acquired first (Amin, 2017; Mirza, Gottardo, & Chen, 2017).

The next set of comparisons was conducted across first languages in two different cultures (Urdu-English bilinguals from Pakistan versus Arabic-English bilinguals from Saudi Arabia and both language groups from Canada). Comparisons were conducted only on English variables because those were the only common measures used across groups. Analyses revealed that Urdu-English bilinguals from Pakistan performed significantly different (better) than Arabic-English bilinguals from Saudi Arabia on all of the English variables tested in the study.

Urdu-English bilinguals performed better on English variables because Urdu shares its vocabulary with English. There were many items in the measure of expressive vocabulary which were cognates, therefore, it was easy for Urdu-English bilinguals to respond as compared to Arabic-English bilinguals who find these names (objects, actions and concepts etc) unfamiliar or novel. Moreover, these differences can be explained by the cultural and societal differences in both countries. It is more common for children to study in private schools in Pakistan where English is medium of instruction for most part of their day as compared to Arabic-English bilinguals in Saudi Arabia. Exposure to the English language is prevalent in Pakistan in print and electronic media as compared to Saudi Arabia. It is more common to see billboards, commercials, advertisements and newspapers etc. in both languages, Urdu and English, as compared to Saudi Arabia where Arabic is a dominant language in each and every area.

The next analysis was a mean comparison of performance on English variables conducted between Urdu-English and Arabic bilinguals from Canada. As expected, there were not as many significant differences as were seen in previous group comparisons except Arabic-English bilinguals' higher performance on the measure of reading comprehension. Both groups' performance on English variables were not expected to be different because they belonged to same society and had similar school environments. They were going to schools where medium of instruction (English) was similar for both language groups and they had similar exposure to English language in terms of print and media.

Within-language correlational analyses with Arabic-English bilinguals in both groups, from Saudi Arabia and Canada were the next point of interest in this study. Results revealed significant relationships among Arabic word reading, pseudo-word reading, vocabulary, phonological awareness, morphological decomposition, orthographic choice and reading

comprehension in both groups. These findings are supported by research conducted by Perfetti and Hart (2002) which introduced the *Lexical Quality Hypothesis*. According to the *Lexical Quality Hypothesis*, high quality word representations are characterized by strong reciprocal links among phonological, orthographic and semantic knowledge. This explanation is a modification of *connectionist theory of reading* introduced by Seidenberg and McClelland (1989). According to these reading researchers, the process of reading is considered as an interconnected whole that explains how knowledge of one area facilitates the other areas and how the three areas are highly interconnected (i.e., orthography, phonology and meaning). It was also suggested that partial knowledge of a word improves learning of that particular word's form and meaning (Adolf, Frishkoff, Dandy & Perfetti, 2016).

Furthermore, bidirectional cross-linguistic relationships between languages with different orthographic systems were tested by cross-linguistic correlational analyses conducted on Arabic-English bilinguals from Saudi Arabia and Canada. The initial analyses revealed significant relationships among the measures of Arabic phonological awareness, English word reading without vowels, phonology, morphology, orthographic choice and reading comprehension. Durgunoglu (2002) suggested that some linguistic skills are more likely to be related across languages than other skills, such as lower level phonological skills and higher-level comprehension skills being related across languages for each construct. Cross-linguistic correlational analyses conducted on Arabic-English bilinguals from Canada revealed significant relationships among English word reading and Arabic pseudo-word reading, word reading with and without vowels and phonological awareness. English phonological and morphological awareness were also correlated with almost all of the Arabic variables except Arabic vocabulary, morphology and reading comprehension. These cross-linguistic and within-language



correlational analyses provided an opportunity to examine language-specific and language-general mechanisms in two different alphabetical languages, Arabic and English. Findings suggest that Arabic-English bilinguals use language-general mechanisms to perform in both languages they know (Arabic and English) regardless of where they live in and in which order they learn to read their L1 and L2.

The next set of analyses was conducted to determine possible predictors of word reading in both languages in each group. The first analysis was conducted to determine within language predictors of Arabic word reading in Arabic-English bilinguals from Saudi Arabia. Hierarchical regression analyses showed that Arabic phonological awareness and orthographical choice task are the unique predictors of Arabic word reading and English vocabulary and morphology are the unique predictors of English word reading among Arabic-English bilinguals in Saudi Arabia. Cross linguistic hierarchical regression analysis conducted on the same group showed that English phonological awareness is the only unique predictor of Arabic word reading and Arabic word reading without vowels is the only unique predictor of English word reading. These trends were seen in Study 1 and are consistent with literature (Georgiou, Parrila, & Papadopoulos, 2008; Wagner & Torgesen, 1987; de Jong & van der Leij, 1999; Holopainen, et al., 2001; Muter, et al., 2004; Parrila, et al., 2004), which suggested that three factors activated in phonological processing facilitate word reading in almost all alphabetical languages that vary in orthographic consistency as can be seen in this case. Dickinson et al (2003) and Ouellette (2006) promoted the links between oral and written language and showed that expressive vocabulary was a strong predictor of word reading as was found in this study.

The same set of analyses were conducted among Arabic-English bilinguals in Canada. Consistent with the other group of Arabic-English bilinguals it was Arabic orthography and

phonology that uniquely predicted Arabic word reading and English morphology uniquely predicted English word reading among this group of Arabic-English bilinguals. Cross-linguistic analyses conducted on the same group of Arabic-English bilinguals showed that English phonological awareness is the only unique predictor of Arabic word reading and Arabic word reading without vowels is the only predictor of English word reading. As was discussed earlier in terms of the findings of Study 1, according to the *Central Processing Hypothesis* or *Universal Hypothesis*, reading development is facilitated by underlying cognitive processes in different languages across orthographies and can be transferred from L1 to L2. Arabic-English bilinguals showed facilitation of reading in L1 (Arabic) and L2 (English) word reading by using underlying cognitive skills which are independent from script specific mechanisms and universally applicable as was seen in both groups of Arabic-English bilinguals from Saudi Arabia and Canada.

A unique part of this study was the comparison of correlational coefficients among Urdu-English bilinguals and Arabic-English bilinguals from Saudi Arabia, Pakistan and Canada. These correlational comparisons were conducted to determine if significantly greater relationships exist among English variables tested in the study. Language groups were compared based on their place of residence: correlations among English variables of Urdu-English bilinguals from Pakistan were compared to Arabic-English bilinguals from Saudi Arabia. Overall, Urdu-English bilinguals from Pakistan showed greater relationships among English word reading, phonology, vocabulary, morphology and reading comprehension as compared to Arabic-English bilinguals from Saudi Arabia. A parallel analysis was conducted between Urdu-English and Arabic-English bilinguals from Canada, which showed greater relationships among English phonology, vocabulary, orthography and reading comprehension for the Urdu-English bilinguals. These

findings are consistent with *the Linguistic Interdependence Hypothesis* by Cummins, (1979).

According to the *Linguistic Interdependence Hypothesis*, second language development depends on first language proficiency. Moreover, positive transfer of language-related cognitive skills can occur between a first and second language, only after achieving certain thresholds in both languages. This transfer is referred to as “common underlying proficiency”, that is skills and metalinguistic knowledge acquired in one language can be accessed during the process of second language acquisition (Cummins, 1981). The *linguistic interdependence hypothesis* addresses both language-specific and language-general knowledge and skills as can be seen in the findings of the present study among Urdu-English bilinguals in Canada.

### **Study 3: A Comparison Between Urdu-English and Hindi-English Bilinguals**

#### **Research Questions for Study 3**

Based on the exploratory nature of this study, the following research questions were explored in Study 3.

1. Are there group differences between Urdu-English and Hindi-English bilinguals in Canada in terms of their performance on English measures used in the study?
2. Are variables similarly related to each other in both languages, Hindi and English?
3. Finally, are within-and-cross-linguistic predictors of Hindi and English word reading similar across languages?

#### **Design: Study 3**

This study involved cross-linguistic comparisons among Hindi-English bilinguals from Canada. The second part of this study had comparisons between Urdu-English and Hindi-English bilinguals from Canada. Hindi participants were tested on the measures of word reading, vocabulary, phonological skills and reading comprehension in Hindi. Both groups were also tested on English measures as well and the battery included the measures of word and pseudo-word reading, vocabulary, phonological and morphological awareness, orthographic choice task and reading comprehension.

#### **Participants: Study 3**

A sample of 50 Hindi-English bilinguals eight to ten-year-old children, were tested in Canada. Participants were recruited from two different International Language Schools in the region of Waterloo, Ontario, Canada. There were not any additional criteria for children to be able to participate in the study regarding the length of time attending the language school. All children in the study were from middle class and upper middle-class neighborhoods. Urdu-

English bilinguals from Canada participated in Study 1, therefore their descriptive statistics and other information can be seen in participant section of study 1 and Table 3, 4 and 5.

Demographic information was collected through a questionnaire completed by the parents of each participant. This questionnaire was designed to identify the percentage of usage of their L1, Hindi at home, their country of origin, the number of books in L1 at home, and other information about their home environment (see below).

### **Demographics: Study 3**

The key findings of the demographic questionnaire used with Hindi-English bilinguals in Canada are described in the following section. The *Demographic/ Family Language Questionnaire* was given to the parents along with the consent forms in order to determine what language(s) the parents and children speak at home. This questionnaire also obtained information about the factors that influence a child's ability to learn a second language and their verbal ability. This questionnaire was given in English and parents were offered help with translation if they needed any by the research assistants of the study. The following section explain the items being used in designing this language and demographic questionnaire.

The first part of family language questionnaire looked at the demographic information such as the child's age and grade. This part also asked for the information regarding child's record of attending school within or outside of Canada using yes/no questions. Ninety five percent of families reported that they were immigrants and had recently moved to Canada from other part of the world including India and 5% of Hindi-English bilinguals were born in Canada (citizens). The minimum time of living in Canada reported by the families was 11 months.

Within North America, 33% of families had recently moved from Edmonton (Canada), Boston,

Chicago, Seattle and Virginia and the rest of immigrant population had moved from India. Only one family reported that they moved to Canada from Dubai (Middle East).

The second part of the language questionnaire included basic information about child's oral language and literacy skills. For example, has your child ever received any extra help in any of the following areas of reading, writing, speaking or math? Parents could choose as many answers as are appropriate for their child. Forty three percent of the parents of Hindi-English bilinguals reported that their children had received extra help from tuition centers back in India in different areas of studies. Out of 43% of the group who mentioned taking extra help back in India, 21% of the children are still attending Kumon and Oxford learning centers for extra help in mathematics and English in Waterloo.

The next section of the questionnaire examined the language use in the home. Example items included what language or languages are spoken at home, what is the child's first language and what other language(s) does the child speak at home? Thirty seven percent of the families reported that Hindi is their first or home language whereas 63% of families reported that Hindi is not their first/home language. These families had some regional languages used in India as their first language such as Tamil, Gujarati, Punjabi, Marathi, Telugu and Kannada. Parents were also asked to judge their child's best language and the frequency of the child's first language use with other family members at home (parents, other siblings or grandparents if they live within the same house).

The same information was requested about the child's frequency of second language use with his/her family members at home and outside of home with friends. Forty four percent of the families reported that their children speak frequently in their L1 with other family members at home and with friends outside of home. The rest of 52% of families reported that their children

communicate in English more often as compared to their first language and 3.9% of the families did not answer this question.

The last part of this section looked at the child's frequency of watching television in his/her first and second language in two separate questions followed by the frequency of reading books in the first and second languages. Seventy six percent of the families reported that their children watch television, YouTube and use other electronic media in English and 91% of families reported that their children read only in English at homes and they do not own books in the Hindi. There were three families who did not answer to this question.

In the next section of the family language questionnaire, each parent had to provide some demographic information about themselves and their linguistic abilities. Sample questions were: what is your native language, what is your highest level of education and what is your occupation? Fifty six percent of fathers had a master's degree and were working in their field of education and 51% of mothers had undergraduate degree and were serving as homemakers. Only 17% of families reported that both parents work outside of home. Parents were also asked to judge their level of understanding, speaking, reading and writing of both their native and second language on Likert type scale ranging from 1 (being none) to 10 (being very fluent). Seventy one percent of parents reported their speaking, reading and writing ability in English as somewhat fluent (rated as 5) whereas 26% of families reported that they can fluently read, speak and write in English language and 3% of families did not answer to this question.

An additional part of the questionnaire addressed the child's exposure to his/her first language. Questions included: how many hours of the day your child receives instruction in his/her native language and the reasons why parents decided to send their child to international language school for first language instruction. Eighty seven percent of families reported that their

children receive instruction in their native language and the other 12% reported that they provide instruction to their children in English language. One parent did not answer this question. Almost 63% of the families reported that they sent their children to weekend language school, so their children could have at least some exposure to their first language or national language if Hindi was not their first language, so, their children are able to understand and communicate in their L1 when they visit their native country. The other 37% of the families reported that they send their children to language school to learn to read in Hindi because instruction in their first language (all other regional languages of sample mentioned above) is not offered in this region/area.

### **Hindi Measures**

Similar to the batteries of English and Urdu tasks, there were four different parts in this section as well; reading components, oral language skills, phonological processing and vocabulary knowledge.

**Hindi Word reading.** As was the case for the Urdu language, Hindi standardized measures were not available to administer, therefore, the primary investigator of the study created a word list by taking words from children's Hindi textbooks from the curriculum in India. The words were selected with the help of a registered Hindi teacher and a translator. This word list consisted of 50 items. These words gradually increased the level of difficulty. Hindi participants were asked to continue reading the words until the end of the list. A score of one was given for each correct word read by the participants. A raw score of 50 could be obtained in this task. Standardized residuals were used as standardized scores in data analysis. The Cronbach's alpha was .70 on this measure.

**Hindi Reading Comprehension.** Grey Oral Reading Test – 4 (Translated Hindi Version Form – A) GORT - 4: This task was administered to assess reading comprehension ability in



Hindi. This test helped to measure the four different areas of reading comprehension; oral reading rate, accuracy, fluency and comprehension. The first six stories, were translated from GORT – 4 Form – A in Hindi language to be used in Hindi testing sessions. A registered translator translated all stories. The following are the four sub-sections of this task that were assessed through this measure.

*Rate* is the amount of time taken by the participant to read a story. Time in seconds for each story was summed up at the end to determine the rate score for the measure.

*Accuracy* is the student's ability to pronounce each word in the story correctly. The total number of errors were compared to the given score range in the scoring manual. Accuracy scores for each story were summed up to calculate the total scores in this category.

*Fluency* refers to the student's rate and accuracy scores combined. Time taken by a participant on each story was added to the accuracy score in order to obtain the fluency score.

*Comprehension* refers to the appropriateness of the student's responses to questions about the content of each story read. A score of one was given for each correct response for each story and highest score on one story could be a score of five.

This test was originally designed for children and adults 6-18 years old. It had two parallel forms; Form A and Form B including 14 stories in each form. Five multiple-choice questions followed each story in both forms. The first six stories from "Form A" were taken from the GORT- 4 and translated into the Hindi language. This task took 15-20 minutes to administer, which varied from person to person according to their reading abilities. This test helped to identify the children's levels of reading comprehension and determine the strength and weaknesses of a student. The Cronbach's alpha was .73 on this measure.

**Hindi Vocabulary Knowledge.** The Expressive One Word Picture Vocabulary Test was translated into Hindi. This test was used to assess expressive vocabulary in Hindi (EOWPVT-SBE, Brownell, 2000). A total of 170 pictures of different objects and actions were shown to the participants, one picture at a time and they were asked to name the pictures in Hindi. The pictures were presented at a level of increasing difficulty. Because this measure was not a standard measure of vocabulary in the Hindi language, ceiling rules were not used. However, they were shown six pictures on a page and were asked if they know the names of the pictures. When they appeared to reach ceiling they were given five seconds to decide whether they knew the name of the picture, before they were moved to the next set of pictures. This procedure was used to avoid the frustration with this task. This task took 10 to 15 minutes to administer. Participants were assigned one point for labeling the picture correctly according to the manual (EOWPVT-SBE, Brownell, 2000). The total number of “correctly named items” were the raw scores. Raw scores were then used to calculate the standardized residuals in SPSS to use in final analyses. The Cronbach’s alpha was .78 on this measure.

**Hindi Phonological Processing. The Rapid Digit Naming in Hindi.** The rapid digit naming subtest of the Comprehensive Test of Phonological Processing was used to measure phonological awareness skills in Hindi (CTOPP; Wagner, Torgesen, & Rashotte, 1999). This task measured the speed with which an individual can name the numbers. The numbers were displayed in four rows and nine columns of six randomly selected numbers. Participants were asked to name the numbers on the top row from left to right in the Hindi language. There were 36 items in total. The score in this task is the number of seconds it took the participant to name all the numbers on form.

As mentioned earlier the Urdu-English bilinguals were participants from study 1, therefore all the details regarding Urdu measures can be seen in study 1.

**Results for Study 3: A Comparison Between Urdu-English and Hindi-English Bilinguals**

This study involved Urdu-English bilinguals from Pakistan and Hindi-English bilinguals Canada. Hindi and Urdu oral languages share many grammatical features and vocabulary, making the languages mutually intelligible. Descriptive statistics for Urdu-English bilinguals for Pakistan and Canada has been presented in the results section of first study (See Table 3 and 4, for details) therefore, descriptive statistics for only the Hindi-English bilinguals will be presented in the first portion of this study's results section. The next section describes mean comparisons conducted across languages followed by the correlational analyses among variables used in both languages and finally the results of regression analyses.

**Descriptive Statistics (Hindi-English Bilinguals in Canada)**

The following set of data was collected on Hindi-English bilinguals residing in Canada. Participants were tested on the measures of word reading, vocabulary, reading comprehension and rapid naming of digits in Hindi. They were also tested on these measures in English as well as with some additional measures such as morphological decomposition, orthographic choice and phonological awareness. All 50 participants (24 boys and 26 girls), ( $M_{age} = 9.32$ ,  $SD = .84$ ) were included in the analyses. Table 41 illustrates the means and standard deviations for each task for all of the participants. As mentioned earlier, Hindi measures were not available in standardized versions, therefore the primary investigator in conjunction with teachers of Hindi from a weekend language school created some of the Hindi measures by translating and adapting some of the measures from English. Visual inspection of the data showed no floor or ceiling effects for any of the Hindi or English measures for this group.

### **Comparisons of Gender: Study 3**

An independent samples t-test was conducted to determine gender differences in this sample. The analysis revealed no differences in terms of the performance of the participants on the Hindi and English measures. Therefore, gender was not included as a variable of interest in any further analyses.

### **Between Language Comparisons among Urdu-English and Hindi-English Bilinguals**

The mean scores on the English measures for the Hindi-English speakers ( $N = 50$ ) and the Urdu-English bilingual ( $N = 50$ ) (22 boys and 28 girls), ( $M_{\text{age}} = 8.88$ ,  $SD = .82$ ) is compared. Independent samples t-tests were conducted to compare participants' performance on English measures used in the study. Analyses revealed significant differences between Urdu and Hindi bilinguals' performance on English variables. As can be seen, Urdu bilinguals showed significant differences in English word and pseudo-word reading, phonological awareness, orthographic choice knowledge and reading comprehension as compared to the Hindi-English speakers (See Table 42).

### **Correlational Analyses (Hindi-English Bilinguals)**

Within-language associations among L1 (Hindi) variables and L2 (English) as well as cross-language relations for L1 and L2 variables (Hindi & English) were analyzed. Mainly these correlations were exploratory and used to help make the decision about which variables to include in the regressions (along with theory) and are presented in three separate sections. The first section examines all related variables for the Hindi language, the second section examines the relationships among English variables in this group and the third section examines the relationships across both languages for this group. Due to the size of correlation matrix, this particular section was divided into subsections which highlighted significant correlations.

**Relationships among L1 (Hindi) Variables.** Hindi word reading was significantly correlated with Hindi vocabulary,  $r_{(48)} = .436, p = .002$ , and reading comprehension,  $r_{(48)} = .439, p = .001$ . As expected, Hindi word reading was negatively correlated with rapid digit naming,  $r_{(48)} = -.411, p = .003$ . Hindi vocabulary was positively correlated with reading comprehension,  $r_{(48)} = .480, p < .001$ , and had a negative correlation with rapid digit naming,  $r_{(48)} = -.284, p = .046$ . Hindi reading comprehension was not correlated with rapid digit naming in Hindi. These findings are presented in the Table 43.

**Summary of Key Findings:** All the variables tested in the study were significantly correlated with each other except reading comprehension and phonological processing (RAN).

**Relationships among L2 (English) Variables.** English word reading was significantly correlated with English pseudo-word reading,  $r_{(48)} = .725, p < .001$ , vocabulary,  $r_{(48)} = .539, p < .001$ , phonological awareness,  $r_{(48)} = .429, p = .002$ , morphological decomposition,  $r_{(48)} = .353, p = .012$ , orthographic choice,  $r_{(48)} = .520, p < .001$ , and reading comprehension,  $r_{(48)} = .475, p < .001$ .

English pseudo-word reading for this particular bilingual sample was significantly correlated with English vocabulary,  $r_{(48)} = .553, p < .001$ , phonological awareness,  $r_{(48)} = .424, p = .002$ , morphological decomposition,  $r_{(48)} = .376, p = .007$  and reading comprehension,  $r_{(48)} = .530, p < .001$  and was not correlated with the English orthographic choice task. English vocabulary was significantly correlated with English phonological awareness,  $r_{(48)} = .657, p < .001$ , morphological decomposition,  $r_{(48)} = .519, p < .001$ , orthographic choice,  $r_{(48)} = .542, p < .001$ , and reading comprehension,  $r_{(48)} = .624, p < .001$ . English phonological awareness was significantly correlated with morphological decomposition,  $r_{(48)} = .571, p < .001$  and reading comprehension,  $r_{(48)} = .472, p = .001$  and was not correlated with the English orthographic

choice task. English morphological decomposition was significantly correlated with reading comprehension,  $r_{(48)} = .387, p = .006$  and was not correlated with the English orthographic choice task. The English orthographic choice task was also significantly correlated with English reading comprehension,  $r_{(48)} = .440, p = .001$ . These findings can be seen in Table 44.

**Summary of Key Findings:** Interestingly, all English variables were significantly correlated with each other in this Hindi bilingual sample with moderate to high correlations.

**Relationships among L1 (Hindi) and L2 (English).** Due to the complexity and number of variables examined, the section on cross language comparisons is divided into four further subsections, according to each construct: word reading, vocabulary, reading comprehension and RAN.

Hindi word reading was significantly correlated with English word reading,  $r_{(48)} = .438, p = .001$ , pseudo-word reading,  $r_{(48)} = .446, p = .001$ , phonological awareness,  $r_{(48)} = .307, p = .030$  and reading comprehension,  $r_{(48)} = .320, p = .023$ . Hindi word reading was not correlated with English vocabulary, orthographic choice task and morphological decomposition.

Hindi vocabulary was significantly correlated with English word reading,  $r_{(48)} = .340, p = .016$ , pseudo-word reading,  $r_{(48)} = .424, p = .002$ , vocabulary,  $r_{(48)} = .437, p = .002$ , phonological awareness,  $r_{(48)} = .467, p = .001$ , morphological decomposition,  $r_{(48)} = .460, p = .001$ , the orthographic choice task,  $r_{(48)} = .470, p = .001$ , and reading comprehension,  $r_{(48)} = .466, p = .001$ . Hindi reading comprehension was only correlated with English reading comprehension,  $r_{(48)} = .306, p < .001$ . Hindi rapid digit naming was negatively correlated with English word reading,  $r_{(48)} = -.453, p = .001$ , pseudo-word reading,  $r_{(48)} = -.464, p = .001$  and reading comprehension,  $r_{(48)} = -.332, p = .019$ . Hindi RAN was not correlated with English

vocabulary, phonological awareness, orthographic choice task and morphological decomposition. All presented findings can be seen in Table 45.

**Summary of the Key Findings:** Surprisingly, Hindi vocabulary and word reading were positively correlated with English variables, with Hindi vocabulary being positively correlated with all of the English measures. Hindi phonological awareness (RAN) was negatively correlated with several of the English variables.

**Comparisons of Correlations among Urdu-English and Hindi-English Bilinguals from Canada.** A correlation coefficient comparison was conducted between for correlations for the two bilingual groups to determine if the groups differed on the level of significant correlations on English variables. Because English measures were the only measures that were similar across language groups, only L2 measures were included in these analyses. Both Urdu-English and Hindi-English bilinguals from Canada were included in this comparison. This comparison was conducted based on the Pearson  $r$  value taken from correlation matrix (Table 7 from study 1 and Table 44 from study3) and divided by total number of participants in each group to compute  $z$ -score.  $P$ -values were computed from obtained  $z$ -scores for each English variable (See table 46 for details). Analyses revealed that Urdu-English bilinguals had significantly greater relationships among English phonology, vocabulary, orthography and morphology as compared to Hindi-English bilinguals.

### **Regression Analyses**

To explore the significant predictors of word reading in Hindi and English for this particular sample, hierarchical regression analyses were conducted and are presented in the next section.



**Within Language Variables Related to (L1) Hindi Word Reading.** To explore significant predictors of Hindi word reading, a two-step hierarchical regression analysis was conducted. Hindi vocabulary and rapid digit naming were entered in each step of analysis. The total variance explained for Hindi word reading was  $R^2 = .280$ ,  $F_{(2, 47)} = 9.14$ ,  $p < .001$  (See Table 47). Hindi vocabulary and RAN were uniquely related to Hindi word reading,  $\beta = .347$ ,  $t_{(47)} = 2.69$ ,  $p = .010$  and  $\beta = -.313$ ,  $t_{(47)} = -2.42$ ,  $p = .019$ .

**Within Language Variables Related to (L2) English Word Reading.** To explore significant predictors of English word reading, a hierarchical regression analysis was conducted. All the steps from previous regression analyses were followed for this particular analysis. A four-step hierarchical regression analysis included following variables on each step: English morphological decomposition, phonological awareness, orthographic choice, vocabulary and pseudo-word reading. The total variance explained for English word reading was  $R^2 = .311$ ,  $F_{(4, 45)} = 5.08$ ,  $p = .002$  (See Table 48). English vocabulary was the only variable uniquely related to English word reading,  $\beta = .423$ ,  $t_{(45)} = 2.49$ ,  $p = .017$ .

**Cross-Linguistic Variables Related to (L1) Hindi Word Reading.** To explore cross-linguistic predictors of Hindi word reading, English morphological decomposition, orthographic choice, vocabulary, phonological awareness and word reading were entered on each step of 5-step hierarchical regression analysis. The total variance explained for Hindi word reading was  $R^2 = .228$ ,  $F_{(5, 44)} = 2.59$ ,  $p = .038$  (See Table 49). English word reading was the only variable uniquely related to Hindi word reading,  $\beta = .434$ ,  $t_{(44)} = 2.71$ ,  $p = .009$ .

**Cross-Linguistic Variables Related to (L2) English Word Reading.** To explore cross-linguistic predictors of English word reading, Hindi variables were entered in a step-wise hierarchical analysis in the following steps: Hindi vocabulary, word reading and rapid digit

naming. The total variance explained for English word reading was  $R^2 = .298$ ,  $F_{(3, 46)} = 6.507$ ,  $p = .001$  (See Table 50). Hindi rapid digit naming was the only variable uniquely related to English word reading,  $\beta = -.310$ ,  $t_{(46)} = -2.26$ ,  $p = .028$ .

### **Summary of Regression Analyses (Urdu-English Bilinguals in Canada)**

These analyses are presented in detail in the results section of study 1, therefore this section only discusses the key findings.

**Within Language Variables Related to (L1) Urdu Word Reading.** A hierarchical regression analysis was conducted to explore significant predictors of Urdu word reading with vowels. Variables were entered for each step in this order; orthographic choice, phonological awareness, morphological awareness, vocabulary and word reading without vowels. Urdu word reading was entered as dependent measure. Urdu morphological awareness was related to Urdu word reading in the first step but Urdu word reading without vowels was the only variable uniquely related to Urdu word reading in final step (see Table 16).

**Within Language Variables Related to (L2) English Word Reading.** A hierarchical regression analysis was conducted to explore significant predictors of English word reading. English morphological awareness, orthographic choice, phonological awareness and vocabulary were entered for each step. None of the variables were significantly related to English word reading, although other variables were related in previous steps (see Table 17).

**Cross-Linguistic Variables Related to (L1) Urdu Word Reading.** To explore cross-linguistic predictors of Urdu word reading, English orthographic choice, vocabulary, phonological awareness, morphological awareness, word and pseudo-word reading were entered in each step of 6-step hierarchical regression analysis. English word reading was the only variable uniquely related to Urdu word reading (see Table 18).

**Cross-Linguistic Variables Related to (L2) English Word Reading.** To explore cross-linguistic predictors of English word reading, Urdu orthographic choice, morphological awareness, vocabulary, word reading without vowels, word reading with vowels and phonological awareness were entered for each step. Urdu word reading with and without vowels were uniquely related to English word reading (see Table 19). However, Urdu word reading with vowels was positively related to English word reading, while Urdu word reading without vowels was negatively related to English word reading. Urdu phonological awareness was also related to English word reading.

**Discussion Study 3: A Comparison between Urdu-English and Hindi-English Bilinguals**

This study compared language and reading abilities of Hindi-English and Urdu-English bilinguals from Canada. Urdu-English bilinguals' performance was compared to Hindi-English bilinguals because Urdu and Hindi are two similar oral languages with similar linguistic typology. However, they do not share their scripts and writing systems as Urdu is an alphabetical language and Hindi is written in Devanagari script called an abugida orthography. These two language groups differ in terms of their first language acquisition. Urdu-English bilinguals come from one linguistic background where Urdu is mainly their home language whereas Hindi-English bilinguals speak Hindi and other regional languages in their homes. They only learn to speak Hindi and, in some cases, learn to read Hindi if they live and attend school in capital of India (Delhi) or if they live in any other part of the world. Also, Urdu-English bilinguals become fluent Urdu readers acquiring basic reading skills by the end of second grade because of the lower number of letters in the Urdu alphabet. In contrast, Hindi-English bilinguals are expected to have mastered learning the Hindi alphabet by the end of sixth grade because of the enormous number of syllables/symbols in Hindi alphabet (200 to 500).

Aside from cross-linguistic comparisons between Urdu-English and Hindi-English bilinguals, performance on variables was also compared for Hindi-English and Urdu-English bilinguals. The main purpose of these comparisons was to explore the processes that bilingual and multilingual children learn about the script of a language when the script they learned to read their first language differs substantially (Hindi-an alpha-syllabary script versus English-alphabetical script). Hindi-English bilinguals were tested on the measures of Hindi word reading, phonology (RAN), vocabulary and reading comprehension. They were also tested on English

measures of word and pseudo-word reading, vocabulary, phonology, orthography, morphology and reading comprehension. The English testing battery was consistent across language groups.

The first part of the study compared performance of Urdu-English and Hindi-English bilinguals on English measures in Canada. Overall, the groups differed in few variables. However, the Urdu-English bilinguals performed better on some English variables tested in the study and had significant differences. When compared language groups go to same schools and have similar medium of instruction at school. These differences occurred because most of the Hindi-English bilinguals were recent immigrants, whereas, Urdu-English bilinguals were mainly Canadian citizens (born in Canada) and had Urdu as their first or home language. Also, almost half of the Hindi-English sample spoke other languages in addition to Hindi. They were learning to read and speak Hindi as their second or third language at weekend language schools as one of their native languages because not all of the Indian languages are offered to learn at these weekend language schools. These children had one of several languages, specifically Punjabi, Tamil, Marathi or other south-Indian regional languages, as their first or home language.

The next part of the study explored significant cross-linguistic relationships among Hindi-English bilinguals. English word and pseudo-word reading were correlated with Hindi word reading, vocabulary and phonological awareness (RAN). English phonology, orthography and reading comprehension were also correlated with Hindi word reading and vocabulary and negatively correlated with Hindi phonology (RAN). According to Muter et al., (2004) the key precursor to word reading in an alphabetical language is phonological awareness and this includes a range of linguistic subcomponents from syllables, to onsets and rimes to phonemes. Conversely, Gottardo, Pasquarella, Chen and Ramirez (2016) suggested that the size of phonological units that are related to reading might be related to specific language or learner's

first language. The findings of this study show that relationships across and within-languages for phonological awareness and word reading.

The novel part of this study was to conduct comparisons between correlations for Urdu-English and Hindi-English bilinguals on within language L2 (English) variables. The purpose of these comparisons was to examine if there was a greater relationship among variables between both language groups. This analysis showed that Urdu-English bilinguals had significantly greater relationships among English word and pseudo-word reading, vocabulary and morphology as compared to Hindi-English bilinguals.

Within-language and cross-linguistic hierarchical regression analyses revealed that Hindi vocabulary and phonology (RAN) are the only predictors of Hindi word reading and English word reading predicts Hindi word reading. These findings suggest that reading skills are transferable from one language to another regardless of which script is being learned first. To explore within and cross-linguistic predictors of English word reading among these Hindi-English bilinguals, analyses showed that English vocabulary is the unique predictor of English word reading and Hindi phonological awareness (RAN) is the only unique predictor of English word reading.

Many studies in the past had promoted phonology and vocabulary as strong predictors of word reading in different languages (de Jong & der Leij, 1999; Georgiou, Parrila, & Papadopoulos, 2008; Holopainen, et al., 2001; Muter, et al., 2004; Parrila, et al., 2004; Wagner & Torgesen, 1987). The findings of this study suggest that this facilitation of phonological awareness and vocabulary for word reading is not limited to alphabetic languages but also works for languages written in alpha-syllabary also called as abugida orthography. Shum, Ho, Siegel and Au (2016) used *linguistic interdependence hypothesis* to determine cross-linguistic

relationships between Chinese and English bilinguals (languages that are completely different in terms of their written form as English is an alphabetic language whereas Chinese is a character-based language). Cummins, (1979) suggested that second language development depends on first language proficiency, but only when intensive exposure to the L2 occurs. According to that hypothesis positive transfer of language-related cognitive skills can occur between a first and second language, only after achieving certain thresholds in both languages. This transfer is referred to as “common underlying proficiency (CUP)”, that is skills and metalinguistic knowledge acquired in one language can be accessed during the process of second language acquisition (Cummins, 1981). The *linguistic interdependence hypothesis* addresses both language-specific and language-general knowledge and skills as can be seen here in the findings of this study. Although many of the Hindi-English speakers were recent immigrants, possibly without extensive English experience, they were learning to speak and read English in an immersion setting. Learning to speak and read the societal language, even for a shorter length of time, might be enough to facilitate a threshold of language exposure and learning.

Consistent with the above suggestions that cognitive skills and the role of similarities and differences between the two orthographies transfer between first and second languages, it was interesting to explore how this process works for children who are bilinguals and learn to read two different languages (L1, Hindi-alpha-syllabary and L2, English-alphabetical) and the fact that some cognitive abilities are common to all languages and scripts and others are more language-script-specific (Shum et al., 2016). Further findings and relationships to linguistic models and theories are discussed in the main discussion section.

### **Analyses Based on Research Questions Using Data from the Whole Sample**

Some of the research questions involved comparisons across multiple groups. Therefore, these comparisons are examined in this section. All groups of participants have been described in previous studies. This section of the study answers the research questions asked with regards to the whole sample. Each question is discussed in the same order as had been mentioned in the introduction section of the study.

**Research Question 1:** Are there within-and across-language differences between the bilingual groups of these three languages (Hindi, Urdu, and Arabic) in terms of their language learning patterns? More precisely, how does learning to speak a language prior to learning to read it influence language acquisition in terms of performance and variables related to reading? These comparisons were conducted for Urdu-English speakers and Arabic-English speakers in Canada and in countries where Urdu and Arabic were majority languages, Pakistan and Saudi Arabia, respectively. As described earlier in the literature review, in different parts of the world bilinguals learn their second language differently than bilingual children in North America. Usually, in developing countries children first are taught to read their second language (mostly English) and then they cover the spoken component of the language in higher grade levels. Language teaching patterns followed in North America emphasize oral language skills first and then written language skills. Therefore, it is important to understand how the order of learning affects these bilingual groups who learn their second languages in completely opposite ways. To answer this research question, a set of linear regression analyses was conducted in each language group. For all language groups, variables of reading and oral language skills were used but entered in two different orders.



Regression analyses on bilingual groups from Pakistan and Saudi Arabia were conducted by entering the English measure of word reading as independent variable and vocabulary as dependent to determine whether learning to read second language predicts their performance on oral language skills. The order of entering the variables was opposite for Urdu-English and Arabic-English bilinguals in Canada. As mentioned earlier these language groups learn to speak English prior to learning to read, therefore English vocabulary was entered as independent measure and word reading as dependent measure in the regression analyses.

The first regression analysis conducted on Urdu-English bilinguals from Pakistan revealed that English word reading is a significant predictor of English vocabulary,  $R^2 = .765$ ,  $F_{(1, 72)} = 234.64$ ,  $P < .001$ ,  $\beta = .875$ ,  $t_{(72)} = 15.31$ ,  $p < .001$ . The other direction of the same analysis in which English vocabulary was entered as independent variable and word reading as dependent variable for Urdu-English bilinguals from Canada revealed that English word reading was a significant predictor of English vocabulary for this particular group of bilinguals,  $R^2 = .531$ ,  $F_{(1, 48)} = 54.45$ ,  $P < .001$ ,  $\beta = .729$ ,  $t_{(48)} = 7.37$ ,  $p < .001$  (see Table 51).

The next set of regression analysis was conducted on Arabic-English bilinguals from Saudi Arabia and Canada. The first analysis revealed that English word reading is a significant predictor of English vocabulary,  $R^2 = .556$ ,  $F_{(1, 38)} = 47.64$ ,  $P < .001$ ,  $\beta = .746$ ,  $t_{(38)} = 6.90$ ,  $p < .001$  for Arabic-English bilinguals in Saudi Arabia. The other direction of same analysis in which English vocabulary was entered as independent variable and word reading as dependent variable for Arabic-English bilinguals from Canada revealed that English word reading was a significant predictor of English vocabulary for this particular group of bilinguals,  $R^2 = .283$ ,  $F_{(1, 38)} = 15.00$ ,  $P < .001$ ,  $\beta = .532$ ,  $t_{(38)} = 3.87$ ,  $p < .001$  (see Table 52).

**Summary of the Key Findings:** Overall, findings suggest that order of learning a language to read and oral language skills facilitate results in reciprocal relations across variables.

**Research Question 1a:** Are linguistic sub-skills (e.g., morphology, phonology, vocabulary) in English similarly related to each other and with word reading for each group?

To answer this research question, correlational analyses were conducted for each language group (Urdu-English, Arabic-English and Hindi-English bilinguals) to determine significant correlations between the measures of English word reading, vocabulary, phonology and morphology. The first correlational analysis revealed significant relationships between all four variables (see Table 53)

The second correlational analysis conducted with the same set of variables on Arabic-English bilinguals revealed significant relationships among all four variables (see Table 54).

The last correlational analysis conducted on Hindi-English bilinguals in Canada to determine relationships among English word reading, phonology, vocabulary and morphology revealed significant relationships among all four variables (see Table 55).

**Summary of the Key Findings:** All three analyses revealed that relationships among the variables of English word reading, vocabulary, phonology and morphology are consistent across all three languages (Urdu, Arabic and Hindi).

**Research Question 1b:** Are the variables related to reading similar for all language groups?

To answer this research question sets of hierarchical regressions were conducted for each language group to determine the significant predictors of English word reading. Based on the literature, the measure of oral language skills and phonology are the main predictors of reading in most of the languages and orthographies. To answer this research question three separate

regression analyses were conducted on each language (Urdu, Arabic and Hindi) to determine whether English vocabulary and phonology predict English word reading. The first analysis conducted on Urdu-English bilinguals revealed that English vocabulary and phonology are significant predictors of English word reading,  $R^2 = .662$ ,  $F_{(2, 121)} = 121.66$ ,  $P < .001$ ,  $\beta = .681$ ,  $t_{(121)} = 9.16$ ,  $p < .001$ ,  $\beta = .178$ ,  $t_{(121)} = 2.39$ ,  $p = .018$  (see Table 56).

The second analysis conducted on Arabic-English bilinguals revealed that only English vocabulary was a significant predictor of English word reading,  $R^2 = .665$ ,  $F_{(2, 77)} = 76.44$ ,  $P < .001$ ,  $\beta = .754$ ,  $t_{(77)} = 10.45$  (see Table 57).

The last analysis conducted on Hindi-English bilinguals revealed that only English vocabulary was a significant predictor of English word reading,  $R^2 = .301$ ,  $F_{(2, 47)} = 10.097$ ,  $P < .001$ ,  $\beta = .453$ ,  $t_{(47)} = 2.80$ ,  $p = .007$  (see Table 58).

**Summary of Key Findings:** Overall, out of all three language groups it was only Urdu-English bilinguals who had English vocabulary and phonology as significant predictors of English word reading. For other two language groups (Arabic-English and Hindi-English bilinguals) it was only English vocabulary, which predicted English word reading.

**Research Question 2:** Are there group differences in Urdu-English and Hindi-English bilinguals in terms of their morphological and phonological awareness and relations between these skills and reading skills?

As mentioned earlier in the literature review, Urdu and Hindi languages share their linguistic roots (oral language) with each other. However, it is important to reveal group differences if there are any to determine what language component plays the most important role in predicting reading skills in these languages. To answer this research question, three groups were included in a one-way ANOVA. Groups were divided based on the languages and place of

residence (Urdu-English bilinguals from Pakistan and Canada and Hindi-English bilinguals from Canada). The variables used in this analysis were English morphology, phonology and word reading. Between group analysis revealed significant differences among all three variables tested in the model, word reading,  $F_{(2, 173)} = 754.27, p < .001$ , phonology,  $F_{(2, 173)} = 526.78, p < .001$  and morphology,  $F_{(2, 173)} = 9211.14, p < .001$ . Visual inspection of mean comparisons revealed that Urdu-English bilinguals from Canada performed better ( $M = 72.68, SD = 9.86$ ) on English word reading as compared to Urdu-English bilinguals from Pakistan ( $M = 23.28, SD = 5.60$ ) and Hindi-English bilinguals in Canada ( $M = 68.72, SD = 9.10$ ). Findings were slightly different for other two measures tested in the model. Urdu-English bilinguals from Pakistan performed better on the measures of morphology and phonology as compared to Urdu-English and Hindi-English bilinguals from Canada (see Table 59).

Although findings of the current study did not match with the findings of a study conducted by Rao and colleagues (2011) on the same language groups, Hindi and Urdu bilinguals, Rao and colleagues (2011) examined the role of orthographic depth in shaping visual word recognition among Urdu-English and Hindi-English university students. The results of the study showed greater naming speed and accuracy for the Hindi items than the Urdu items (Rao et al., 2011). These results suggest the benefits of reading a shallower orthography with more “available” or orthographic units such as Hindi as compared to Urdu. Perhaps these differences occurred because study conducted by Rao and colleagues (2011) tested young adults who were university students as compared to the current study where participants were young children and had not fully developed orthographic knowledge required to read Hindi.

**Research Question 2a:** Do Arabic-English and Urdu-English bilinguals perform differently on orthographic measures based on their country of residence, specifically North

America or their native countries? Are relations between orthographic processing and reading similar for the children in different locations?

Based on the fact that Urdu and Arabic languages share their script with each other and Urdu speakers learn to read Arabic as their other language for religious requirements it was interesting to examine their orthographic knowledge. Additionally, both Arabic and Urdu are considered as shallow orthographies when written with vowels and deep orthographies when written without vowels. Both language groups learned English as their second language, which has deep and inconsistent orthography. A study conducted by Seymour and colleagues (2003) found that readers of deep and inconsistent orthographies showed slower progress as compared to shallow and consistent orthographies. These differences were also discussed by Zeigler and Goswami (2005) in the *Psycholinguistic Grain Size Theory* (PGST). Therefore, the point of interest for this specific study was to explore how bilinguals who learn a mix of deep and shallow orthographies as their first language perform on their second language that is an inconsistent and deep orthography. It was expected that Urdu-English bilinguals would have stronger understanding of the orthographic skills because they are exposed to the orthographic rules of two different, but similar languages as compared to Arabic speakers who do not gain this experience. This question was answered by conducting an independent sample t-test between both language groups and their performance on the measure of English orthography. Another group difference was determined by another independent sample t-test to reveal group differences based on the bilingual conditions: bilinguals living in Pakistan or Saudi Arabia and bilinguals living in Canada.

The first independent samples t-test conducted between Urdu-English and Arabic-English bilinguals revealed that significant differences between both language groups. Urdu-English

bilinguals ( $M = 24.01$ ,  $SD = 3.50$ ) performed better on English orthographic choice task as compared to Arabic-English bilinguals ( $M = 12.74$ ,  $SD = 1.85$ ),  $t_{(204)} = 41.06$ ,  $p < .001$ . Another independent samples t-test was conducted between these two language groups but across countries. The first mean comparison revealed that Urdu-English bilinguals from Canada performed better on English orthographic choice task ( $M = 26.36$ ,  $SD = 3.51$ ) as compared to Arabic-English bilinguals from Canada ( $M = 13.30$ ,  $SD = 1.63$ ),  $t_{(88)} = 37.72$ ,  $p < .001$ . Results of the last comparisons were consistent with the previous two analyses with Urdu-English bilinguals from Pakistan performing better ( $M = 22.46$ ,  $SD = 2.49$ ) on English orthographic choice task as compared to Arabic-English bilinguals from Saudi Arabia ( $M = 12.18$ ,  $SD = 1.90$ ),  $t_{(114)} = 38.76$ ,  $p < .001$  (see Table 60).

A set of linear regression analyses was conducted as the last step of answering this research question to determine whether English orthographic knowledge is a significant predictor of English reading skills in both language groups, Urdu-English and Arabic-English speakers. Regression analysis conducted on Urdu-English bilinguals revealed that English orthographic choice knowledge is a significant predictor of English word reading,  $R^2 = .158$ ,  $F_{(1, 124)} = 23.29$ ,  $P < .001$ ,  $\beta = .431$ ,  $t_{(124)} = 4.82$ ,  $p < .001$ . The next analysis was conducted on Arabic-English bilinguals and results were consistent as were found with Urdu-English bilinguals  $R^2 = .192$ ,  $F_{(1, 78)} = 18.48$ ,  $P < .001$ ,  $\beta = .438$ ,  $t_{(78)} = 4.30$ ,  $p < .001$  (see Table 61).

### General Discussion

These studies explored the language and literacy skills of bilingual and multilingual children in North America and comparable groups in their native countries. The children spoke Urdu, Arabic or Hindi as their first language and learned to read and speak English as their second language. This study was further divided into three sub-sections based on the comparisons conducted between language groups. The first study compared Urdu-English bilinguals from Pakistan and Canada. The second study involved comparisons between Arabic-English bilinguals from Saudi Arabia and Canada and cross-linguistic comparisons between Urdu-English and Arabic-English bilinguals from Pakistan, Saudi Arabia and Canada. The last study compared Urdu-English bilinguals and Hindi-English bilinguals from Canada. Given the novelty of the groups assessed, exploratory analyses within the studies compared two of the three language groups but additionally there were some research questions, which included data from all three studies.

Three research questions were addressed across the studies: First exploration was initiated for within-and-cross-linguistic differences between the bilingual groups of these three languages (Urdu, Arabic and Hindi) in terms of their language learning patterns. More precisely, how learning to speak a language prior to learning to read it influences language acquisition in terms of speed of acquisition and variables related to reading. Second, linguistic subskills (morphology, phonology and vocabulary) were examined to determine whether they were similarly related to each other for each language group. Morphology was expected to be more highly related to Arabic reading. For Urdu and Hindi, phonological processing was more likely to be related to reading. Third, group differences in Urdu and Hindi speakers in terms of their morphological and phonological awareness and relations between these skills and reading skills

were explored. Finally, Arabic and Urdu bilinguals were compared to assess whether they perform differently on orthographic measures based on their country of residence, specifically North America or their native countries.

### **The Role of Language in Learning to Read**

Around the world, many children learn to read English as a foreign or second language. Research has examined strategies that apply to second or foreign language achievement (Bremner, 1998; Oxford & Ehrman, 1995; Oxford, 1989; Park, 1997; Wharton, 2000). Research conducted on bilinguals suggests that all language learners use a variety of learning strategies sometimes consciously and at other times automatically (Hong-Nam & Leavell, 2006). Based on the previous findings this study aimed to explore within- and cross-linguistic differences between bilingual groups of three languages (Urdu-English, Arabic-English and Hindi-English) in terms of their language learning patterns. More precisely, how does learning to speak a language prior to learning to read it influence language acquisition in terms of speed of acquisition and variables related to reading? These comparisons were conducted for Urdu-English speakers and Arabic-English speakers in Canada and in countries where Urdu and Arabic were majority languages, Pakistan and Saudi Arabia, respectively. An additional group included Hindi-English speakers in Canada were included. These languages were selected based on differences in the depth of the orthography as well the script used.

The largest language group tested in this study was Urdu-English bilinguals from Pakistan and Canada. Urdu is considered to be a classic example of digraphia: a linguistic situation in which different scripts are used to write the same language (Ahmad, 2011). Urdu orthography inherits some characteristics from Arabic such as the optional use of diacritic marks: a glyph added to a letter (Cardona & Jain, 2007). In Urdu, short vowels are not considered letters



on their own instead they are applied above or below a consonant by using appropriate diacritics and the primary orthographic structure of Urdu is similar to Arabic (Humayoun, & Hammarstrom, 2006). On the other hand, English (L2 of this bilingual group) is considered a deep orthographic language with more complex grapheme-phoneme correspondence and more irregularities in its writing system. Urdu-English bilinguals from Pakistan and Canada differed from each other in terms of the processes they used in learning to read and speak English as their L2. For example, Urdu-English bilinguals from Pakistan performed noticeably higher on Urdu variables as compared to English variables tested in the study. On the other hand, Urdu-English bilinguals from Canada performed better on English variables as compared to Urdu variables tested in the study. Urdu-English bilinguals from Pakistan learn to read English prior to learning to speak at schools at the age of eight or nine (Grade 4 to 5). Whereas, Urdu-English bilinguals in Canada learn to speak Urdu and English simultaneously in their homes and learn to read English prior to learning to read Urdu in their schools at the age of five. In addition to learning spoken Urdu, Muslim children from Pakistan learn to read Arabic script. As the language of the Quran, Arabic is also widely used throughout the Muslim world and attached to the Muslim community. Therefore, it was expected that bilingual children who get more exposure to their L1 (Urdu) and Arabic as another language with similar scripts would achieve a higher level of oral language and reading skills as compared to the bilinguals who only learned L1 and L2 with limited exposure in foreign context (Arabic-English bilinguals in Canada). Based on the previous findings of Seymour and colleagues (2003) who demonstrated that readers of shallow and consistent orthographies show faster progress in reading acquisition than beginning readers of deep and inconsistent orthographies, it is convincing to conclude that language learners (Urdu-English bilinguals) who experience learning their first and an additional language (Urdu and

Arabic) with both deep and shallow orthographies tend to show better performance on their second language (English), which is written in a deep and inconsistent orthography.

The second set of language groups in this study included Arabic-English bilinguals from Saudi Arabia and Canada. Arabic-English bilinguals from Saudi Arabia follow the same patterns of learning to read and speak English as Urdu-English bilinguals from Pakistan. The patterns of learning to read and speak English in Canada are also similar for Arabic-English and Urdu-English bilinguals in Canada as they all attend similar public schools. The Arabic language is ranked sixth among languages used in North America (Statistics United States of America, 2011). Semitic languages use consonantal roots to mark the core meaning, and then add vowels additional consonants to create derived words that are related to the root meaning. Vowelled Arabic script is considered to be a consistent letter-sound alphabetical system. As described earlier Arabic and Urdu scripts have many similarities (Abu- Rabia, 2001; Bauer, 1996) and both languages are written in a shallow orthography when written with vowels and in deep orthographic scripts, when written without vowels (Abu-Rabia & Siegel, 2003; Frost et, al., 1987). Because Urdu is not a Semitic language, the script and its representation of vowelized and un-vowelized forms do not necessarily match the morphology of the language.

The third language group tested in this study was Hindi-English bilinguals from Canada. Hindi-English bilinguals were not tested in their native country (India) due to scheduling issues. Hindi is written with the Devanāgarī script. Hindi orthography has elements of an alphabetic script and a syllabary, resulting in it usually being characterized as an alpha-syllabic script, or an abugida orthography (Nag, 2011). As stated earlier, Hindi and Urdu are essentially dialects of the same language despite their differential association with the regions of India and Pakistan. Similar to Urdu, Hindi, especially colloquial Hindi, is influenced by English vocabulary.

Knowing that Urdu and Hindi share many features with each other it is reasonable to say that Hindi and Urdu are different versions of the same language. Alpha-syllabic orthographies, such as Hindi, represent speech at two levels, the syllabic level and the phonemic level (Salomon, 2000) consistent with the explanation of the *Psycholinguistic Grain Size Theory*. According to PGST children who learn to read consistent orthographies rely mainly on grapheme-phoneme recoding strategies because the relationship between grapheme-phonemes is straightforward (Ziegler & Goswami, 2005). It is also suggested that beginning readers acquire the knowledge of correspondence between graphic symbols and units of sounds in the process of learning to read their specific language.

### **The Role of Context in Language Learning**

Many children learn to read English prior to or at the same time as learning to speak English, often becoming better at decoding than speaking English (Asfaha, Beckman, Kurvers & Kroon, 2009; Dubeck, Jukes & Okello, 2012). As was described earlier in the literature review, in different parts of the world bilinguals learn their second language in very different contexts as compared to bilingual children in North America. In some developing countries children are taught to read their second language (mostly English) prior to learning to speak the language. Then they learn to master the spoken component of the language in higher grade levels. Language teaching patterns followed in North America emphasize oral language skills first and then written language skills. Therefore, the results must be understood in terms of how the order of learning affects these bilingual groups who learn their second languages in different ways. To answer the research question whether variables related to oral language skills and word reading are related to each other in all languages tested in the study, a set of linear regression analyses was conducted in each language group. For all language groups variables of reading and oral

language skills were entered in two different orders. Findings of the first analysis conducted on Urdu-English bilinguals from Pakistan revealed that English word reading is a significant predictor of English vocabulary. The same analysis for Urdu-English bilinguals from Canada revealed that English word reading is a significant predictor of English vocabulary. The same set of regression analyses was conducted on Arabic-English bilinguals from Saudi Arabia and Canada. Results showed similar findings for both groups with English word reading as a significant predictor of English vocabulary among Arabic-English bilinguals in Saudi Arabia and English vocabulary as a significant predictor of English word reading among Arabic-English bilinguals in Canada. Overall, findings of all languages show similar English variables predicting English reading across language groups. More precisely, the order of learning to read and speak a language does not seem to affect variables related to overall second language acquisition. These findings are consistent with previous studies that examined reading development of bilingual children, but extend this research to children learning English in other countries. Previous findings suggest that language and literacy skills are related to each other and that first language (L1) and second language (L2) skills can influence each other (Chang, 2013; Jiang, 2004; Koda, 1996). Although, none of the above studies conducted comparisons across cultures to determine the effects of order of acquisition (oral or written first) on learning to read second language and the present study makes this unique contribution. Other studies conducted on Spanish-English speakers suggested that bilinguals who have good language and literacy skills in Spanish tend to have strong skills in English, their L2 (Durgunoglu, Nagy & Hancin-Bhatt, 1993; Gottardo, 2002; Lindsey, Manis & Bailey, 2003).

Cook (2003) examined relations between oral proficiency in the L1 and L2 in an attempt to build theoretical models of bilingualism. He suggested that because both languages are in one

‘mind’, they must interact in bilinguals. However, the degree and direction of overlap has never been explained in theories of second language acquisition. For example, Cook (2003) suggested that L1 and L2 relations are bidirectional and has provided evidence of L2 influences on the L1 in highly skilled users of each language (also see Chow, McBride-Chang, & Burgess, 2005). The present study explored the functionality of these variables related to reading and developing oral language skills in English in two directions across cultures. The findings of this particular research question also suggest that variables of word reading and vocabulary facilitate each other in the process of second language acquisition when both L1 and L2 are alphabetical languages (Urdu versus English and Arabic versus English). Moreover, learning to read prior to learning to speak in any context does not appear to cause any delay or deficiency in literacy and language development among young children as was seen in both language groups across countries (Urdu-English bilinguals from Pakistan and Canada and Arabic-English bilinguals from Saudi Arabia and Canada). This claim could not be examined for languages that are not alphabetical such as Hindi language (characterized as an alpha-syllabic script or abugida orthography) because Hindi-English bilinguals from India were not compared with Hindi-English bilinguals in Canada, even though these bilinguals follow the same second language learning pattern as the other two language groups, it was not possible to conduct comparisons.

### **Common Linguistic Subskills for all three Language Groups (Urdu, Arabic and Hindi)**

The present study explored whether linguistic subskills (morphology, phonology and vocabulary) are similarly related to each other for each language group. It was expected that morphology would be highly related to Arabic word reading among Arabic-English bilinguals. Alternately, phonological processing was expected to be highly related in Urdu and Hindi reading for Urdu-English and Hindi-English bilinguals. The findings of this research question

showed that all three linguistic subskills in English (morphology, phonology and vocabulary) are strongly related to each other and to English word reading as well in all three language groups, Urdu, Arabic and Hindi speakers. One theory of word reading, the *dual-route model* by Coltheart (1978) suggests that the process of word reading involves two different routes, direct or indirect. The *indirect route* of word reading depends on individual letter recognition and reconstruction of the phonology of the word through its spelling. Also, this process depends on faster word reading as compared to direct route of word reading that is basically accessing the mental lexicons for vocabulary to read the sight words. The application of this model was questioned by researchers in relation to different languages and orthographies (Bar-Kochva & Breznitz, 2014). Therefore, one of the purposes of the present study was also to explore whether this model is applicable on different language groups with different writing systems and scripts. Consistent with the above mentioned criticism on *Dual Route Model* by Bar-Kochva and Breznitz (2014) the findings of this study suggest that this model is only applicable in some language groups. In particular, among the groups studied here this process of learning to read in English where there is a different first language with different writing systems, such as Urdu and English in this case. Urdu-English bilinguals showed that phonology was a significant predictor of word reading but this was not the case among Arabic-English and Hindi-English bilinguals.

These findings are also consistent with the *orthographic depth hypothesis (ODH)* (Katz & Frost, 1992), which suggests that readers use reading strategies in different orthographies. More precisely, current findings fit with the framework of weak ODH, which explains phonology as the main predictor of word reading in word specific orthography. This study tested three languages, Urdu, Arabic and Hindi, that are similar or different based on the specific writing systems used, two with the same script (Urdu and Arabic) and one with Akshara or

alpha-syllables (Hindi). In reading, phonology is needed for the pronunciation of printed words not only from pre-lexical letter-phonology correspondences, but also from lexical phonology (Perfetti, 2002). The weak ODH suggests visual orthographic addressing of the lexicon as the next stage of word reading after mastering the links between the orthography and phonology. Koda (2005) suggested that this process is only strongly related to shallow orthographies, consistent and applicable in this case on Arabic (alphabetic) and Hindi (alpha-syllabic) languages among Arabic-English and Hindi-English bilinguals who read words by using the strategies mentioned in weak ODH. Although all three languages tested in the study are written in shallow orthographies, Urdu and Arabic, the L1s of Urdu-English and Arabic-English bilinguals, are somewhat more consistent and shallow orthographies when written with vowels (type of script used in this study) and are based on assembled phonological patterns of reading and differing from English (L2), an opaque orthography.

### **Variables Related to Word Reading Among Urdu-English, Arabic-English and Hindi-English Bilinguals**

The present study also explored whether vocabulary and phonological awareness are related to word reading in all three language groups. The first analysis conducted on Urdu-English bilinguals revealed that English vocabulary and phonology were significant predictors of English word reading. The second analysis conducted on Arabic-English bilinguals showed that only English vocabulary was the significant predictor of English word reading and the last analysis conducted on Hindi-English bilinguals showed consistent findings as only English vocabulary was the significant predictor of English word reading. A general aspect of learning to read is making effective links between the sounds and symbols in a language (the pattern followed in learning to read English, Urdu, Arabic and Hindi). This is required because it helps

in establishing and patterns of sounds and symbols that represent a word. Also, both accuracy and fluency of mappings are important for skilled reading in all languages (Nag & Snowling, 2013). For example, other studies that showed the role of rapid digit naming as the predictor of reading across languages (Ding, Richman, Yang, & Guo, 2010; Nag & Snowling, 2012; Puolakanaho et al., 2008; Ziegler et al., 2010). Rapid naming is considered to be related to the speed of visual and phonological processing. However, individual differences on this task that predict reading skills across different orthographies cannot be ignored. Accordingly, these differences suggest that variables associated with RAN are also associated with cross-modal mappings and are only a language general phenomenon (Puolakanaho et al., 2008). People who are poor at rapid naming tasks are at high risk of reading failure and that both language-specific and language-general cognitive demands of learning to read differ across scripts in terms of the challenges faced by language learners (Nag & Snowling, 2013). Findings of the current study were consistent but only among Urdu-English bilinguals, which showed English phonological awareness strongly predicted English word reading. Although these bilinguals were not tested specifically on RAN but another measure of phonological awareness (elision-phoneme deletion task) showed that mastering skills in phonemic awareness facilitated word reading. However, rapid naming in Hindi speakers was related with Hindi variables (word reading and vocabulary) but was not related with reading comprehension. These findings are equivocal in terms of the suggestions of de Jong and van der Leij (1999), Holopainen, et al (2001), Mutter, Hulme, Snowling and Stevenson (2004) that three factors of phonological processing (phonological awareness, phonological short-term memory and RAN) predict the rate of reading acquisition in almost all alphabetic languages that vary in orthographic consistency.



### **Group Differences in Urdu-English and Hindi-English Bilinguals and Variables Related to Their Reading Skills**

The present study also explored whether English morphological and phonological awareness equally predicted English word reading among Urdu-English and Hindi-English bilinguals. It was mentioned earlier in the literature review that Urdu and Hindi languages share their linguistic roots (oral language) with each other. More precisely, the focus of this study was to highlight whether languages that only differ in (scripts) writing systems but not orally have similar predictors of reading in terms of their native languages and their second language English. Three groups were included in this analysis based on the participants' first language and place of residence. The first group included Urdu-English bilinguals from Pakistan, the second group was Urdu-English bilinguals from Canada and the last group included in the analysis was Hindi-English bilinguals from Canada. Participants' performance on English word reading, morphology and phonology was compared and showed differences among all three language groups. Urdu-English bilinguals from Canada performed better on the measure of English word reading as compared to the other two groups. Urdu-English bilinguals from Pakistan performed better on the measures of phonology and morphology as compared to the other two groups.

According to the extant literature, the first step in learning to read an alphabetic language is to learn how graphemes map onto phonemes. Sometimes children with different background languages but in same learning environment follow similar rules and instructions while learning to read their L2 (Bitan & Karni, 2003, 2004; Bitan, Manor, Morocz, & Karni, 2005; Brooks & Miller, 1979; Farrington-Flint Wood, Canobi, & Faulkner, 2004; Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; Van Orden, Stone & Pennington, 1990; Walton, 1995; Walton, Walton, & Felton, 2001). As was discussed earlier, Urdu-English and Hindi-English bilinguals

from Canada attended similar public schools with same medium of instruction and curriculum, therefore, their performance on measures of reading and language was expected to be similar. These two language groups were instructed to learn to read English with explicit instruction in classrooms in terms of letter-to-sound correspondences at their early literacy levels. On the other hand, the third compared group (Urdu-English bilinguals from Pakistan) learn these literacy skills with implicit instruction given at their schools. These findings are consistent with the suggestions of Bitan and Karni (2003) that the use of linguistic rules or regularities differs by age and instruction in different languages in different learning environments.

The importance and relationship of all phonological processes to second language acquisition are not clearly defined, but phonetic coding skills have been related to second language acquisition and were strong predictor (Skehan, 1991). It is clear that learning a second language involves learning new grapheme-phoneme correspondences and rules that influence decoding speed and accuracy (Bitan & Karni, 2003, 2004; Bitan et al., 2005; Brooks & Miller, 1979). These details are interesting in light of our findings with Urdu-English and Hindi-English bilinguals from Canada who receive explicit instruction for English literacy. However, their performance was lower on the measures of phonology and morphology as compared to Urdu-English bilinguals from Pakistan. Based on the fact that these Urdu-English bilinguals from Pakistan are not introduced with individual letter-sound correspondence, they were administered this (elision-task) slightly differently. The instructions asked children to omit a letter sound instead of deleting a phoneme on each item of phonological awareness task. These children had been taught the concept of letters making “sounds”. Even the teachers struggled with the concept of letter-sound. An example is say “CUP”, now say cup without saying the letter “C” instead of other group administration, say “CUP” without saying “Ka”. Both ways of administering the task

provided the same results but might have altered the underlying task. Moreover, having close to equal performance of Urdu-English and Hindi-English bilinguals on the measure of phonology and morphology is not a surprise finding in this case as mentioned earlier that these two languages have similar grammatical structures and vocabulary.

### **Differences between Urdu-English and Arabic-English Bilinguals across Countries**

The present study also examined whether Arabic-English and Urdu-English bilinguals performed differently on orthographic measures based on their country of residence, specifically North America or their native countries. More specifically, are relations between orthographic processing and reading similar for the children in different locations? Based on the fact that Urdu and Arabic languages share their script with each other and Urdu speakers learn to read Arabic as their additional language for religious requirements, it was interesting to examine their orthographic knowledge. It was expected that Urdu-English bilinguals would have stronger understanding of the orthographic skills because they are exposed to the orthography of two different, but similarly represented languages as compared to Arabic speakers who do not gain this experience. Findings showed that Urdu-English bilinguals performed better on the English orthographic choice task as compared to Arabic-English bilinguals. In another set of analysis between these two language groups but across countries Urdu-English bilinguals from Canada performed better on English orthographic choice task as compared to Arabic-English bilinguals from Canada. Results of the last comparisons showed that Urdu-English bilinguals from Pakistan performed better on English orthographic choice task as compared to Arabic-English bilinguals from Saudi Arabia. These findings suggest that Urdu-English bilinguals benefit from learning to read another language (Arabic-similar script to their L1) and use extra exposure of script and language in second language acquisition. Another point of interest was to determine whether

English orthographic knowledge was a significant predictor of English reading skills in both language groups (Urdu-English and Arabic-English). Results showed that English orthographic choice knowledge was related to English word reading for Urdu-English and Arabic-English bilinguals.

Seidenberg and McClelland (1989) suggested in the *connectionist model* that the process of learning to read words depends on establishing mappings among phonology, orthography and semantics. However, processes related to learning to read an orthography are also dependent on whether it is an alphabetic or non-alphabetic writing system and the consistency of sound-symbol mappings (Katz & Frost, 1992; Perfetti & Harris, 2013; Share, 2014). In this case, both bilingual groups (Urdu-English and Arabic-English bilinguals) read L1s with similar alphabetic and consistent orthographies and were learning to read English (an alphabetic and inconsistent written language) as their L2. It was suggested that for different writing systems, script-specific differences in relation to typological features will affect reading development (Share, 2014), which is consistent with the findings of this study. Yet, exposure to script and its effect on second language acquisition was not studied and explained. Findings of the current study add to the literature on language learning context and the type exposure to a particular language. Specifically, the more a learner is exposed to reading a specific alphabetic script in one language the more you refine your skills and transfer them in learning to read a similar alphabetic script. Perhaps, that can be introduced and named as “*Script Similarity Hypothesis*” or “*The Script Effect*” where language learners are taking advantage of having to read two languages in one script and transferring their knowledge and stronger skills in learning to read another language compared to a group of bilinguals who does not experience this. The *script effect* found in this study among Urdu-English bilinguals can also be tested among other language learners such as

Farsi-English bilinguals who also learn to read in Arabic as another language after learning to read in Farsi. Like Urdu, Farsi also shares its script and vocabulary with Arabic, and Farsi speakers and also learn to read Arabic for their religious purposes.

### **Key Findings for all three Language Groups in Relation to Theory**

The following part of this discussion section explains the common themes and findings from all three studies across languages in relation to the previously discussed models and theories of language learning in different context.

As mentioned in the literature review, bidirectional cross-linguistic relationships between languages with different linguistic typologies and orthographic systems provide the opportunity to examine language-specific and language-general mechanisms. Although the literature provides us with cross-linguistic relationships found for languages with similar orthographies or linguistic typologies (e.g., the Roman alphabet), it was still unclear whether language-general mechanisms influence the relationships across typologically different orthographies. For example, [reading an alphabetic script versus an alpha-syllabary (a segmental writing system in which consonant–vowel sequences are written as a unit based on a consonant letter, and vowel notation is secondary)] can have an impact on alphabetic literacy. Additionally, researchers argue that Akshara in Hindi, represent speech at two levels, the syllabic level and the phonemic level (Bae & Joshi, 2017; Salomon, 2000). Comparing Urdu-English and Hindi-English bilinguals' performance on their L2 (English) in study 3 gave us an opportunity to solve this puzzle faced by the researchers in field of bilingualism in predicting second language acquisition. Findings suggest that a language-general mechanism is used by Urdu-English bilinguals in Canada in learning to read English as their L2 helps them to be better readers as compared to Hindi-English bilinguals. For instance, learning to read in an alphabetic language with consistent grapheme-

phoneme correspondence is a language general mechanism and applicable across languages (i.e. Urdu-English bilinguals). In contrast, Hindi-English bilinguals use more language-specific mechanisms to read their L1 and L2, therefore, showing a smaller effect of L1 performance on their L2.

The literature suggests that when young children begin the process of learning to read, they learn the code used by their language to represent speech and how the symbols map onto speech. Hulme et al., (2003) suggested that the key precursor to word reading in an alphabetic language is phonological awareness. Many researchers accept the notion that phonological awareness includes a range of linguistic subcomponents from syllables, to onsets and rimes to phonemes (Anthony & Lonigan, 2004; Stanovich, 1990). The size of the phonological unit that is most highly related to reading might be related to the specific language or might be related to the learner's L1 (Gottardo, Pasquarella, Chen & Ramirez, 2016; Ziegler & Goswami, 2005; Jimenez, 1997). The present findings are consistent with this theory. For example, phonemic awareness is related to reading a shallow alphabetic orthography such as Spanish. In this case, L1 phonological awareness was only related to English word reading among Urdu-English bilinguals and Hindi-English bilinguals in Canada. This relationship was not found in any other language group. Even in an irregular language such as English this relationship between phonemes and graphemes is usually systematic (e.g., the symbol L is usually pronounced /l/) (Ehri, 2011; Share, 1995).

Previous research in the area of reading development had assumed that the models of reading development are generalizable across languages (e.g., Frith, 1985; Marsh, Friedman, Welch, & Desberg, 1981). These models have not been tested systematically in all languages across cultures, specifically non-European languages. The present studies extended this research

by comparing readers across cultures and contexts across languages and within the same language. These comparisons showed some interesting findings. For instance, cross-linguistic comparisons conducted on Urdu-English bilinguals from Canada showed positive correlations between Urdu and English variables, which were consistent with Cummins' *Linguistic Interdependence hypothesis* (1981) that L1 reading and L2 proficiency influences L2 reading. On the other hand, cross-linguistic comparisons conducted on Urdu-English bilinguals from Pakistan showed negative correlations between all Urdu and English variables tested in the study. These findings contrasted with Cummins (1981) hypothesis and showed that L1 reading and L2 proficiency does not always influence L2 reading. Perhaps these findings can be explained by two different types of bilinguals, additive and subtractive as both groups (Urdu-English bilinguals from Pakistan and Canada) were learning to read in two completely different situations and learning environments. The differences in patterns of findings across groups suggests that context is important in the processes involved in language development and that theories must be tested across contexts.

Usually bilinguals are defined as either simultaneous or sequential bilinguals, learning both languages at the same time or after the other. Another classification described in Gottardo and Grant (2008) is additive and subtractive bilinguals. According to their definitions, elective bilinguals learn another language in a formal setting, usually as an additional course credit at school, while continuing to use their L1 most of the time as Urdu-English bilinguals do in Pakistan. These additive bilinguals learn their L2 in addition to an L1 that remains their dominant language. On the other hand, subtractive bilinguals learn their L2 because they are required to attend school in the societal, majority languages, as Urdu-English bilinguals do in Canada. Most of these bilinguals are either new immigrants or second-generation immigrants

trying to learn a societal language. For these bilinguals, L1 skills usually decrease because their L2 becomes their dominant language. Surprisingly, this trend was not found in Arabic-English bilinguals from Saudi Arabia and Canada.

Another purpose of this research was to determine the differences among language learners who have different first languages, either alphabetic or alpha-syllabic, and either inconsistent or consistent, while learning to read same second language, English. The process of learning to read that Hindi-English and Urdu-English bilinguals follow to learn their L1 and L2 might be different because they have their L1s written in completely distinct writing systems. Examining L1 skills in these groups was the most difficult part of these comparisons especially when children from the same age group differed in their L1 skill levels in both language groups. More precisely, Urdu-English bilinguals were able to recognize all letters used in Urdu alphabet whereas Hindi-English bilinguals had not achieved the highest level of recognizing all symbols/Akshara used in Hindi script as they are not expected to achieve these levels until grade level 5 or 6.

As was described in the literature review, research on learning to read an alpha-syllabic language is in the initial stages, with most recent research on learning to read alpha-syllabaries being conducted in India (Nag & Perfetti, 2014). This research highlighted the importance of orthography-specific investigations in the reading science. Because phonemes are represented as modifications to the base form of Akshara, a larger number of symbols/Akshara must be learned to read this alpha-syllabic language, specifically Hindi. The third study of this research has tried to add to the literature by comparing Urdu-English and Hindi-English bilinguals from Canada. The performance of these two language groups was only compared on English measures as those were the only consistent measures used across groups. Overall, Urdu-English bilinguals did



better on English measures as compared to Hindi-English bilinguals, but most differences were small. The fact that almost 95% of the Hindi-English bilinguals were first generation immigrants to Canada as compared to Urdu-English bilinguals who were Canadian born might have influenced group performance. Also, 63% of the Hindi-English bilinguals spoke additional languages but had received formal education in Hindi in India as could be seen in their performance on Hindi and English measures. These bilinguals performed relatively better on Hindi measures as compared to English language measures. When searching for predictors of English word reading for Hindi-English bilinguals, it was found that RAN is related to English word reading. One of the L1 phonological processing factor out of three is considered to be RAN which in this case facilitates L2 word reading for these Hindi-English bilinguals suggesting the powerful relationship of phonological processing and reading across languages (Gottardo, Yan, Siegel & Wade-Wooley, 2001).

For language learners, following the rules of letter-by-letter correspondences can result in frequent errors in reading English as compared to following the rule of recognizing larger orthographic patterns such as rimes which promotes higher word reading accuracy. The case is slightly different when language learners learn to read a consistent orthography (i.e., German language). Accordingly, for language learners, this skill is not only required for word recognition in inconsistent orthography, but also in consistent orthographies (Brennan & Booth, 2015). In alphabetic orthographies, word recognition is usually facilitated by quick and accurate identification of larger patterns. The influence of grain size in second language learners (Bitan & Karni, 2003, 2004; Bitan et al., 2005; Brooks & Miller, 1979) does not explain how instruction about grain size helps with rime patterns. The role of phonological awareness in second language acquisition or learning a new orthography is ambiguous. The findings of this study tried to

examine one piece of the puzzle that phonological awareness in terms of its effect on second language acquisition when languages differ in terms of orthography and their consistency as was seen in this case of Hindi-English bilinguals. Although, these findings cannot be generalized to all alpha-syllabic versus alphabetical languages because Hindi-English bilinguals from India were not tested in this study, these results can be a good starting point for future researchers.

### **Does First Language Help in Learning Second Language**

The fact that bilingualism and multilingualism are common in Canada was important in terms of determining whether first language proficiency is helpful in second language acquisition especially when bilinguals have completely different linguistic backgrounds. Bilingualism in North America is not treated as it is in other parts of the world. In North America, bilingual children learn to speak and read English as a requirement at school, where the medium of instruction and communication is mainly English. Also, the supplementary resources available through weekend language learning schools do not provide in depth and systematic curriculum, which can provide explicit L1 learning. In contrast, bilingual children in other parts of the world learn to speak and read English as just another subject (course credit) at school and in many cases, English is not their second language but an additional language beyond a second language. Previous studies showed that in some situations young children begin school literate in their first language and display unbalanced biliteracy skills in their early years at school (Shum, Ho, Siegel, & Au, 2016). Consequently, it is hard for educators to determine if specific bilingual children are at risk for reading difficulties. Another challenge for educators is deciding whether children should be assessed in their first or second language. According to Shum and colleagues (2016) some cognitive abilities are common to all languages and scripts and other are more language-script-specific (also see Geva & Siegel, 2000). This particular research tried to address

these concerns of whether these transferable skills are language-general or language-specific by comparing bilingual children's performance across both languages they knew. However, findings of this study provided mixed results that first language proficiency helps second language acquisition only in some contexts or across some languages. These outcomes suggest that some skills are transferable from one language to another in some languages however, many skills are language-specific. Further longitudinal research is required to separate transferrable skills from nontransferable in all writing systems across languages and cultures used in this study.

Overall, among all three language groups, Urdu-English bilinguals from Pakistan and Canada performed better on almost all of the English measures except reading comprehension as compared to Arabic-English and Hindi-English bilinguals in similar contexts. These particular findings were not surprising findings. Their performance on English variables was expected based on the fact that this bilingual group has the most exposure to all languages they learn in their environment regardless of living in Pakistan or in Canada. An additional benefit is that this language group, shares its L1 script with Arabic language, its oral language with Hindi language and borrows vocabulary from Arabic, Farsi and English. One language (Urdu) comprised of various qualities and components taken from other languages such as script, vocabulary and linguistic typology suggests that it is a benefit for Urdu-English bilinguals learning their L2.

### **Limitations**

This study was unique as researchers have not compared the specific language groups tested in this study across countries in different language learning contexts. There were many limitations, which could not be avoided. The biggest limitation of this study across Urdu and Hindi languages was the lack of availability of standardized measures in Urdu and Hindi languages. Despite the fact that the primary investigator of the study translated or adapted many

English standardized measures in Urdu and Hindi languages, there were some flaws in the measures of reading comprehension, orthographic choice task and morphological awareness that require further work. Translating English measures into the Urdu and Hindi languages was the biggest challenge in this study. The structure of the Urdu and Hindi languages made translation difficult. The word choices required for translating the reading comprehension task was one of the difficult tasks of this study.

In any cross-linguistic study, it is a typically challenging task to translate the vocabulary measure, which was faced here in translating the vocabulary test into Urdu and Hindi languages. The expressive measure of vocabulary used in this study among both language groups measured their total vocabulary in each language. Many pictures in the picture vocabulary test were cognates in the Urdu, Hindi and English languages. In addition, many pictures were hard to translate in the Urdu and Hindi languages because the concepts do not exist or are very unfamiliar in Urdu and Hindi vocabulary such as the picture of “Racoon” and “Mermaid”. This challenge could be minimized if there was a standardized test available in the Urdu language. Also, if responses on such items which happened to be cognates in both Urdu and Hindi languages were omitted from final total scores, findings might differ in terms of having vocabulary as a predictor of reading skills. An alternative of this problem can be testing these particular language groups on the measure of language specific productive vocabulary as compared to testing on knowledge of vocabulary items that could be common across languages.

Another limitation of the study was the lack of variability among bilinguals tested in Canada in terms of age related performance in their L1 literacy. Some of the older children were attending weekend language schools for shorter time period as compared to some younger children and the total number of language learners was small. Therefore, children of different

ages attend weekend language classes in the same classroom with same levels. This educational constraint limits their second language acquisition and does not provide age related variability.

Despite efforts, the language experiences across language groups were not identical. Hindi-English bilinguals from Canada were the smallest group of bilinguals tested in this study. Specifically, the majority of the Hindi-English bilinguals from Canada were first generation immigrants with more exposure to Hindi as compared to other two language groups tested in the study (Urdu-English and Arabic-English bilinguals). Unfortunately, Hindi-English bilinguals could not be included in the study for cross-cultural comparisons.

This research was not a longitudinal study, which may be an important limitation. These children were tested at only one point in time which allowed for assessment of relations among variables across languages. In addition, it would be interesting to examine the development of differences over the period that could show improvement for these children in their L1 proficiency at a certain age or after a certain time in language school. A longitudinal design could also answer the question of: what happens after the completion of one school year at a language school? Do these children achieve a higher level of oral proficiency and reading skills in their L1? We also could not control the effect of time in language schools for all three language groups in Canada because of the small sample size of Urdu, Arabic and Hindi speaking children who go to these weekend language schools to learn to read their L1. Exposure to a language is an important variable in bilingual studies and a longitudinal approach will allow answering this issue.

### **Future Research**

The development of the assessment tools in Urdu and Hindi languages was an important contribution to the study. Although further work needs to be done, considering the fact that there

are no standardized tests available in Urdu and Hindi languages translating already existing tasks from English to Urdu and Hindi language is considered as the biggest contribution of the study. The most reliable and successful Urdu measures created for this study were Urdu word reading with and without vowels, vocabulary, phonological processing and morphology, while reading comprehension was reliable for one of the groups. All four Hindi measures, Hindi word reading, vocabulary, phonological awareness and reading comprehension proved to be reliable and successful on this particular sample of Hindi-English bilinguals. Further work needs to be done to create reliable language tasks that measure Urdu orthographic processing and reading comprehension as well as finding ways to train teachers in the administration of phonological awareness measures and the conceptual understanding of this measure.

Also, the significant differences found between Urdu-English and Arabic-English bilinguals from Pakistan, Saudi Arabia and Canada showed that these children learn to read and speak languages in different context and atmosphere. Also, the teachers, who were used as research assistants in Pakistan to test children on Urdu and English measures, were not able to understand the instructions for administering each task due to the teaching methods used in Pakistan. For example, teachers asked the children to omit the letter from the elision task in English phonological processing task when they had to ask the children to omit the sound (phoneme) of the given word. The concept of a phoneme as a key unit in reading was unfamiliar to them. Organizing professional development workshops for teachers based on teaching by providing explicit literacy instruction prior to testing children at different grade levels would provide some interesting findings. The expansion of this study through an intervention across countries could also be helpful for language learners in order to maintain their mother tongue as their heritage in another linguistic culture.

### Conclusion

To summarize the major findings briefly: learning to read a language prior to learning to speak does not affect the relationships among L2 variables in language learners. L2 variables related to oral language and reading skills facilitate each other in the process of second language acquisition. Overall, the same linguistic subskills, word reading, vocabulary, phonology and morphology are related to each other among all three language groups, Urdu, Arabic and Hindi in English (their L2). Although all subskills are related to each other in all three language groups English phonological awareness predicts English word reading in Urdu-English and Hindi-English bilinguals. However, Urdu-English bilinguals had stronger metalinguistic skills as compared to Hindi-English bilinguals. Additionally, Urdu-English bilinguals showed better performance on many English variables compared to the Arabic-English bilinguals, when English language learning context was held constant. These group differences might be related to the Urdu speakers learning two languages, Urdu and Arabic, with one common script. Finally, the language learning context and the L1 are both related to L2 reading acquisition. The key findings suggest modifications to the *Linguistic Interdependence Hypothesis* (Cummins, 1987) that the more a learner is exposed to reading a specific alphabetic script in one language the more he refines his skills and transfers them in learning to read a similar alphabetic script, was mentioned as “*Script Similarity Hypothesis*” or “*The Script Effect*” where language learners take advantage of having to read two languages in one script and transferring their knowledge and stronger skills in learning to read another language compared to a group of bilinguals who does not experience this. The most important contribution of this study was its unique findings which would help future researchers to understand the language groups used in the study in relation to theories and models of reading acquisition presented in past. These findings are also able to

challenge the theories developed using only the North American context of language learning such as *Linguistic Interdependence Theory* by Cummins (1981) and its applicability to other linguistic contexts (Share, 2008).

Overall, research conducted on bilingual children across languages and cultures is important for understanding the process of language learning in immigrant populations and the challenges that they face in L2 acquisition. The findings of these studies can help the immigrant parents to preserve their children's heritage language for their future generations while encouraging the acquisition of the necessary skills for integration into their new country.



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**Tables**

Table 1: Languages used in the study

	Grain Size	Type of script	Linguistic Roots
English	Alphabetic	Roman	Saxon Celtic
Urdu	Alphabetic	Nastaliq	Arabic, Farsi and Turkish
Arabic	Alphabetic	Perso-Arabic script	Aramaic, Hebrew, Ugaritic and Phoenician
Hindi	Alphasyllable	Devanagari	Sanskrit

Table 2: Examples of letters and word (the book) in each language used in this study

	Individual letters	Words
English	A, b, c, d, z	Book
Urdu	ا ب پ و ی	کتاب
Arabic	ا ب ت و ي	کتاب
Hindi	अ आ इ ई उ ऊ	किताब

Table 3: Descriptive statistics: Performance of Urdu bilinguals in Pakistan on English and Urdu variables (raw scores)

	N	Total no. of items	Mean	SD
Urdu word reading with vowels	76	30	22.51	6.35
Urdu word reading without vowels	76	30	19.71	4.79
Urdu vocabulary	74	170	47.23	12.87
Urdu phonological awareness task	76	10	7.07	1.94
Urdu morphological awareness task	76	10	6.07	1.42
Urdu orthographic choice task	76	10	7.37	1.57
Urdu reading comprehension	76	15	10.13	1.43
English word reading	76	106	67.67	11.05
English pseudo-word reading	76	45	23.28	5.60
English vocabulary	76	170	54.80	21.83
English phonological awareness task	76	20	10.68	3.06
English morphological awareness task	76	28	16.80	3.40
English orthographic choice task	76	30	22.46	2.49
English reading comprehension	76	43	9.70	1.88

Table 4: Descriptive statistics: Performance of Urdu bilinguals in Canada on English and Urdu variables (raw scores)

	N	Total no of items	Mean	SD
Urdu word reading with vowels	50	30	11.14	2.30
Urdu word reading without vowels	50	30	9.34	1.93
Urdu vocabulary	50	170	20.52	5.00
Urdu phonological awareness task	50	10	5.22	1.05
Urdu morphological awareness task	50	10	1.78	1.14
Urdu orthographic choice task	50	10	6.56	1.64
Urdu reading comprehension	50	15	11.76	1.33
English word reading	50	106	72.68	9.86
English pseudo-word reading	50	45	28.72	5.44
English vocabulary	50	170	81.16	15.59
English phonological awareness task	50	20	13.24	4.53
English morphological awareness task	50	28	13.16	5.38
English orthographic choice task	50	30	26.36	3.51
English reading comprehension	50	43	11.54	2.59

Table 5: Mean comparisons among Urdu-English bilinguals across countries (Pakistan and Canada)

Construct	Country	N	Mean	SD	t-value & sig.
Urdu words with vowels	Canada	50	11.14	2.30	-12.12***
	Pakistan	76	22.51	6.35	
Urdu words without vowels	Canada	50	9.34	1.93	-14.53***
	Pakistan	76	19.71	4.79	
Urdu vocabulary	Canada	50	20.52	5.00	-13.96***
	Pakistan	76	47.23	12.87	
Urdu phonology	Canada	50	5.22	1.05	-6.12***
	Pakistan	76	7.07	1.94	
Urdu morphology	Canada	50	1.78	1.14	-17.78***
	Pakistan	76	6.07	1.42	
Urdu orthography	Canada	50	6.56	1.64	-2.77
	Pakistan	76	7.37	1.57	
Urdu reading comprehension	Canada	50	11.76	1.33	6.40***
	Pakistan	76	10.13	1.43	
English word reading	Canada	50	72.68	9.86	2.75
	Pakistan	76	67.37	11.05	
English pseudo-word reading	Canada	50	28.72	5.44	5.39***
	Pakistan	76	23.28	5.60	
English vocabulary	Canada	50	81.16	15.59	7.35***
	Pakistan	76	54.80	21.83	



English phonology	Canada	50	13.24	4.53	3.77***
	Pakistan	76	10.68	3.06	
English morphology	Canada	50	13.16	5.38	-4.65***
	Pakistan	76	16.80	3.40	
English Orthography	Canada	50	26.36	3.61	7.82***
	Pakistan	76	22.46	2.49	
English reading comprehension	Canada	50	11.54	2.59	4.61***
	Pakistan	76	9.70	1.88	

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Table 6: Within language (L1-Urdu) correlations for Urdu-English bilinguals in Pakistan

	1.WRV	2.WRWV	3.Voca	4.PA	5.MD	6.O.Ch	7.R.comp
1.Word reading with vowels	-						
2.Word reading without vowels	.744**	-					
3.Vocabulary	.830**	.701**	-				
4.Phonological awareness	.907**	.741**	.832**	-			
5.Morphological decomposition	.458**	.342**	.370**	.521**	-		
6.Orthographic choice	.772**	.693**	.723**	.792**	.304**	-	
7.Reading comprehension	.210	.089	.200	.278*	.100	.185	-

Table 7: Within language (L2-English) correlations for Urdu-English bilinguals in Pakistan

	1.WR	2.NWR	3.Voca	4.PA	5.MD	6.O.Ch	7.R.comp
1.Word reading	-						
2.Pseudo-word reading	.827**	-					
3.Vocabulary	.875**	.775**	-				
4.Phonological awareness	.605**	.679**	.649**	-			
5.Morphological decomposition	.777**	.669**	.790**	.618**	-		
6.Orthographic choice	.291*	.304**	.371**	.206	.275*	-	
7.Reading comprehension	.418**	.376**	.466**	.290*	.376**	.156	-

Table 8: Cross-linguistic (Urdu with English) relationships for Urdu-English bilinguals in Pakistan

	1.WR	2.WRWV	3.Voca	4.PA	5.MD	6.O.Ch	7.R.comp
1.English words	-.735**	-.559**	-.656**	-.687**	-.328**	-.494**	-.137
2.English pseudo-words	-.588 **	-.449**	-.510**	-.488**	-.234*	-.340**	-.003
3.English vocab	-.799**	-.602**	-.690**	-.729**	-.338**	-.625**	-.098
4.English PA	-.509**	-.427**	-.402**	-.390**	-.218	-.390**	-.109
5.English MD	.706**	-.626**	-.615**	-.648**	-.316**	-.552**	-.172
6.English OC	-.135	-.313**	-.397**	-.165	.160	-.091	-.058
7. English RC	.572**	-.242*	-.519**	-.547**	-.126	-.430**	-.246*

Note: All the rows include variables in English (L2) and columns include variables in Urdu (L1) language.

Table 9: Within language (L1-Urdu) correlations for Urdu-English bilinguals in Canada

	1.WRV	2.WRWV	3.Voca	4.PA	5.MD	6.O.Ch	7.R.comp
1.Word reading with vowels	-						
2.Word reading without vowels	.690**	-					
3.Vocabulary	.279	.268	-				
4.Phonological awareness	.298*	.413**	.534**	-			
5.Morphological decomposition	.537**	.705**	.369**	.512**	-		
6.Orthographic choice	.173	.221	.090	.151	.337*	-	
7.Reading comprehension	.210	.246	-.152	.183	.311*	.286*	-

Table 10: Within language (L2-English) correlations for Urdu-English bilinguals in Canada

	1.WR	2.NWR	3.Voca	4.PA	5.MD	6.O.Ch	7.R.comp
1.Word reading	-						
2.Pseudo-word reading	.704**	-					
3.Vocabulary	.729**	.585**	-				
4.Phonological awareness	.705**	.584**	.809**	-			
5.Morphological decomposition	.505**	.398**	.610**	.663**	-		
6.Orthographic choice	.391**	.512***	.373**	.483**	.429**	-	
7.Reading comprehension	.586**	.466**	.629**	.740**	.519**	.527**	-

Table 11: Cross-linguistic (Urdu with English) relationships for Urdu-English bilinguals in Canada

	1.WR	2.WRWV	3.Voca	4.PA	5.MD	6.O.Ch	7.R.comp
1.English words	.303*	.146	.437**	.544**	.305*	.060	.098
2.English pseudo-words	.003	-.063	.321*	.316*	.068	.077	.081
3.English vocab	.263	.323*	.429**	.548**	.360*	-.027	.062
4.English PA	.194	.244	.581**	.517**	.371**	.072	-.038
5.English MD	.283*	.357*	.540**	.507**	.530**	.156	.059
6.English OC	-.019	-.018	.327*	.193	.005	.028	.054
7. English RC	.151	.158	.603**	.432**	.280*	.277	.056

Note: All the rows include variables in English (L2) and columns include variables in Urdu (L1) language.

Table 12: Urdu variables related to Urdu word reading among Urdu-English bilinguals in Pakistan (Total  $R^2 = .852$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1.Morphology	.194	.440**	.001	.022
2.Orthographic choice	.473	.725**	.134	1.67
3.Phonological awareness	.172	.785**	.625	5.77**
4.Vocabulary	.013	.212*	.212	2.50*



Table 13: English variables related to English word reading among Urdu-English bilinguals in Pakistan (Total  $R^2 = .783$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1.Orthographic choice	.120	.346**	.059	.987
2.Phonological awareness	.285	.551***	.026	.341
3.Morphology	.217	.607***	.178	1.88
4.Vocabulary	.161	.699***	.699	7.17***

Table 14: English variables related to Urdu word reading among Urdu-English bilinguals in Pakistan (Total  $R^2 = .667$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1. Phonological awareness	.247	-.497**	.025	.224
2. Orthographic choice	.005	-.071	.086	1.12
3. Word reading	.287	-.695**	-.190	-1.10
4. Pseudo-word reading	.003	.120	.158	1.15
5. Morphology	.043	-.336*	-.173	-1.41
6. Vocabulary	.082	-.662**	-.662	-4.06**

Table 15: Urdu variables related to English word reading among Urdu-English bilinguals in Pakistan (Total  $R^2 = .557$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1. Words without vowels	.311	-.557**	-.038	-.294
2. Morphology	.014	-.125	.063	.658
3. Phonology	.147	-.625**	-.183	-.788
4. Vocabulary	.02	.266	-.168	-1.10
5. Orthographic choice	.011	.183	.250	1.70
6. Words with vowels	.054	-.618*	-.618	-2.87*

Table 16: Urdu variables related to Urdu word reading among Urdu-English bilinguals in Canada  
(Total  $R^2 = .490$ )

Step – Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1.Orthography	.030	.173	.005	.046
2.Phonology	.075	.278	-.066	-.472
3.Morphology	.184	.524**	.086	.508
4.Vocabulary	.007	.100	.114	.888
5.Word without vowels	.194	.625**	.625	4.10**

Table 17: English variables related to English word reading among Urdu-English bilinguals in Canada (Total  $R^2 = .574$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1.Morphology	.255	.505**	-.009	-.065
2.Orthography	.037	.241	.078	.691
3.Phonology	.209	.639**	.296	1.60
4.Vocabulary	.073	.466*	.466	2.77*

Table 18: English variables related to Urdu word reading among Urdu-English bilinguals in Canada (Total  $R^2 = .227$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1.Orthography	.000	-.019	-.097	-.582
2.Vocabulary	.085	.314	.145	.574
3.Phonology	0	.019	-.167	-.642
4.Morphology	.059	.278	.248	1.34
5.Pseudo-word reading	.018	-.180	-.383	-1.87
6.Word reading	.083	.498*	.498	2.15*

Table 19: Urdu variables related to English word reading among Urdu-English bilinguals in Canada (Total  $R^2 = .402$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1.Orthography	.004	.060	-.035	-.278
2.Morphology	.091	.322*	.120	.646
3.Vocabulary	.121	.374*	.159	1.12
4.words without vowels	.01	-.146	-.398	-2.02*
5.Words with vowels	.047	.300	.336	2.03*
6.Phonology	.129	.467*	.467	3.04*

Table 20: Descriptive statistics: Performance of Arabic-English bilinguals in Saudi Arabia on English and Arabic variables (raw scores)

	N	Total no of items	Mean	SD
Arabic word reading with vowels	40	30	16.65	3.23
Arabic word reading without vowels	40	30	17.70	3.13
Arabic pseudo-word reading	40	18	13.20	2.55
Arabic vocabulary	40	170	32.60	3.82
Arabic phonological awareness task	40	10	9.25	1.87
Arabic morphological awareness task	40	10	17.50	2.75
Arabic orthographic choice task	40	10	40.22	6.67
Arabic reading comprehension	40	15	19.37	2.70
English word reading	40	106	48.73	12.24
English pseudo-word reading	40	45	20.08	6.93
English vocabulary	40	170	32.70	9.03
English phonological awareness task	40	20	14.83	4.71
English morphological awareness task	40	28	6.30	1.89
English orthographic choice task	40	45	12.18	1.90
English reading comprehension	40	43	12.03	3.16



Table 21: Descriptive statistics: Performance of Arabic-English bilinguals in Canada on English and Arabic variables (raw scores) tested in study

	N	Total no of items	Mean	SD
Arabic word reading with vowels	40	30	16.00	4.24
Arabic word reading without vowels	40	30	13.90	3.38
Arabic pseudo-word reading	40	18	12.92	3.64
Arabic vocabulary	40	170	22.63	4.99
Arabic phonological awareness task	40	10	10.52	1.79
Arabic morphological awareness task	40	10	13.95	3.28
Arabic orthographic choice task	40	10	33.23	7.54
Arabic reading comprehension	40	15	16.73	5.25
English word reading	40	106	71.38	12.21
English pseudo-word reading	40	45	29.63	6.22
English vocabulary	40	170	78.30	15.48
English phonological awareness task	40	20	17.75	1.39
English morphological awareness task	40	28	14.20	2.94
English orthographic choice task	40	45	13.30	1.63
English reading comprehension	40	43	21.98	4.00

Table 22: Mean comparisons of Arabic-English Bilinguals' performance on Arabic and English measures (raw scores) from Saudi Arabia and Canada

Construct	Country	N	Mean	SD	t-value & sig.
Arabic words with vowels	Canada	40	16.00	4.24	-.769
	Saudi	40	16.65	3.23	
Arabic words without vowels	Canada	40	13.90	3.38	-5.21***
	Saudi	40	17.70	3.13	
Arabic pseudo-words	Canada	40	12.93	3.64	-.391
	Saudi	40	13.20	2.55	
Arabic vocabulary	Canada	40	22.63	4.99	-10.02***
	Saudi	40	32.60	3.82	
Arabic phonology	Canada	40	10.53	1.79	3.10**
	Saudi	40	9.25	1.87	
Arabic morphology	Canada	40	13.95	3.28	-5.24***
	Saudi	40	17.50	2.75	
Arabic orthography	Canada	40	33.23	7.54	-4.39***
	Saudi	40	40.23	6.67	
Arabic reading comprehension	Canada	40	16.73	5.25	-2.83*
	Saudi	40	19.38	2.70	
English word reading	Canada	40	71.38	12.21	8.28***
	Saudi	40	48.73	12.24	
English pseudo-word reading	Canada	40	29.63	6.22	6.48***
	Saudi	40	20.08	6.93	

English vocabulary	Canada	40	78.30	15.48	16.08***
	Saudi	40	32.70	9.03	
English phonology	Canada	40	17.75	1.39	3.76***
	Saudi	40	14.83	4.71	
English morphology	Canada	40	14.20	2.94	14.26***
	Saudi	40	6.30	1.89	
English Orthography	Canada	40	13.30	1.63	2.83*
	Saudi	40	12.18	1.90	
English reading comprehension	Canada	40	21.98	4.00	12.33***
	Saudi	40	12.03	3.16	

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Table 23: Mean comparisons among Urdu-English and Arabic-English Bilinguals from Pakistan and Saudi Arabia on English variables

Construct	Bilinguals	N	Mean	SD	t-value & sig.
English word reading	Urdu	76	67.37	11.05	8.31***
	Arabic	40	48.73	12.24	
English pseudo-word reading	Urdu	76	23.28	5.60	2.69*
	Arabic	40	20.08	6.93	
English vocabulary	Urdu	76	54.80	21.83	6.11***
	Arabic	40	32.70	9.03	
English phonology	Urdu	76	10.68	3.06	-5.71**
	Arabic	40	14.83	4.71	
English morphology	Urdu	76	16.80	3.40	18.07***
	Arabic	40	6.30	1.89	
English orthography	Urdu	76	22.46	2.49	22.78***
	Arabic	40	12.18	1.90	
English reading comprehension	Urdu	76	9.70	1.88	-4.96**
	Arabic	40	12.03	3.16	

Table 24: Mean comparisons among Urdu-English and Arabic-English Bilinguals from Canada on English variables

Construct	Bilinguals	N	Mean	SD	t-value & sig.
English word reading	Urdu	50	72.68	9.86	.561
	Arabic	40	71.38	12.21	
English pseudo-word reading	Urdu	50	28.72	5.44	-.735
	Arabic	40	29.63	6.22	
English vocabulary	Urdu	50	81.16	15.59	.867
	Arabic	40	78.30	15.48	
English phonology	Urdu	50	13.24	4.53	-6.05***
	Arabic	40	17.75	1.39	
English morphology	Urdu	50	13.16	5.38	-1.09
	Arabic	40	14.20	2.94	
English orthography	Urdu	50	26.36	3.51	21.67***
	Arabic	40	13.30	1.63	
English reading comprehension	Urdu	50	11.54	2.59	-14.92***
	Arabic	40	21.98	4.00	

Table 25: Within language (L1-Arabic) correlations for Arabic-English bilinguals in Saudi

Arabia

	WRV	WRWV	Pseudo- words	Vocab	PA	MD	O.Ch	R.comp
1.Words vowels	-							
2.Words without vowels	.632**	-						
3.Pseudo-words	.520**	.553**	-					
4.Vocabulary	.371*	.458**	.181	-				
5.Phonology	.715**	.558**	.545**	.3582*	-			
6.Morphology	.506**	.398*	.437**	.348*	.511**	-		
7.Orthography	.713**	.631**	.522**	.296	.578**	.640**	-	
8.Read comprehension	.586**	.543**	.434**	.391*	.476**	.624**	.547**	-

Table 26: Within language (L2-English) correlations for Arabic-English bilinguals in Saudi Arabia

	1.WR	2.NWR	3.Voca	4.PA	5.MD	6.O.Ch	7.R.comp
1.Word reading	-						
2.Pseudo-word reading	.739**	-					
3.Vocabulary	.746**	.637**	-				
4.Phonological awareness	.241	.501**	.127	-			
5.Morphological decomposition	.734**	.485**	.651**	.213	-		
6.Orthographic choice	.456**	.437**	.549**	.041	.347*	-	
7.Reading comprehension	.811**	.608**	.753**	.195	.763**	.483**	-

Table 27: Cross-linguistic (Arabic with English) relationships for Arabic-English bilinguals in Saudi Arabia

	WRV	WRWV	Non-word	Vocab	PA	MD	O.Ch	R.comp
Word reading	.098	.335*	.074	.200	.020	.096	.105	.110
Pseudo-word reading	.142	.373*	.319*	.083	.099	.127	.232	.173
Vocabulary	-.108	.203	.006	.257	-.074	.102	.090	.196
Phonology	.621	.681**	.572**	.282	.446**	.345*	.613**	.538**
Morphology	.176	.365*	.014	.264	.079	.157	.118	.167
Orthography	-.222	.065	.098	.161	-.206	.149	-.003	.181
Read comp	.081	.360*	-.016	.229	.107	.078	.137	.128

Note: All the rows include variables in English (L2) and columns include variables in Arabic (L1) language.



Table 28: Within language (L1-Arabic) correlations for Arabic-English bilinguals in Canada

	WRV	WRWV	Pseudo- words	Vocab	PA	MD	O.Ch	R.comp
1. Words vowels	-							
2. Words without vowels	.641**	-						
3. Pseudo-words	.889**	.704**	-					
4. Vocabulary	.199	.410**	.193	-				
5. Phonology	.662**	.337*	.610**	.117	-			
6. Morphology	.493**	.442**	.405**	.545**	.496**	-		
7. Orthography	.619**	.575**	.608**	.632**	.409**	.644**	-	
8. Read comprehension	.219	.308	.268	.704**	.146	.567**	.720**	-

Table 29: Within language (L2-English) correlations for Arabic-English bilinguals in Canada

	1.WR	2.NWR	3.Voca	4.PA	5.MD	6.O.Ch	7.R.comp
1.Word reading	-						
2.Pseudo-word reading	.692**	-					
3.Vocabulary	.532**	.512**	-				
4.Phonological awareness	.430**	.273	.331*	-			
5.Morphological decomposition	.641**	.639**	.621**	.488**	-		
6.Orthographic choice	.184	.006	-.078	.045	.067	-	
7.Reading comprehension	.613**	.556**	.706**	.551**	.675**	.079	-

Table 30: Cross-linguistic (Arabic with English) relationships for Arabic-English bilinguals in Canada

	WRV	WRWV	Non-word	Vocab	PA	MD	O.Ch	R.comp
Word reading	.546**	.531**	.480**	.030	.463**	.258	.287	-.088
Pseudo-word	.375*	.379*	.347*	-.033	.415**	.148	.043	-.180
Vocabulary	.244	.176	.223	-.079	.360*	.315*	.054	-.009
Phonology	.525**	.413**	.487**	.174	.515**	.233	.387*	.176
Morphology	.451**	.395*	.420**	.077	.571**	.404**	.285	.115
Orthography	.195	.255	.172	-.130	-.037	-.021	.154	.114
Read comp	.493**	.329*	.364*	.041	.447**	.396*	.235	.123

Note: All the rows include variables in English (L2) and columns include variables in Arabic (L1) language

Table 31: Comparisons of Correlation Among Urdu-English from Pakistan and Arabic-English Bilinguals from Saudi Arabia based on their performance on L2 (English)

	1.WR	2.NWR	3.Voca	4.PA	5.MD	6.O.Ch	7.R.comp
1.Word reading	-						
2.Pseudo-word reading	.25	-					
3.Vocabulary	.05**	.16	-				
4.Phonological awareness	.02**	.17	.00***	-			
5.Morphological decomposition	.61	.16	.14	.01**	-		
6.Orthographic choice	.00***	.00***	0	.30	.02**	-	
7.Reading comprehension	.00***	.12	.01**	.61	.00***	.06	-

Table 32: Comparisons of Correlation Among Urdu-English and Arabic-English Bilinguals from Canada based on their performance on L2 (English)

	1.WR	2.NWR	3.Voca	4.PA	5.MD	6.O.Ch	7.R.comp
1.Word reading	-						
2.Pseudo-word reading	.91	-					
3.Vocabulary	.12	.63	-				
4.Phonological awareness	.05*	.07	.00***	-			
5.Morphological decomposition	.35	.12	.93	.23	-		
6.Orthographic choice	.30	.01**	.03**	.02**	.07	-	
7.Reading comprehension	.84	.57	.52	.13	.26	.02**	-

Table 33: Arabic variables related to Arabic word reading among Arabic-English bilinguals in Saudi Arabia (Total  $R^2 = .663$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1.Morphology	.256	.506**	-.026	-.184
2.Pseudo-word reading	.11	.370*	.030	.222
3.Vocabulary	.039	.210	.045	.377
4.Un-vowelized word read	.092	.405*	.144	.942
5.Orthography	.086	.460*	.382	2.38*
6.Phonology	.08	.393**	.393	2.80*

Table 34: English variables related to English word reading among Arabic-English bilinguals in Saudi Arabia (Total  $R^2 = .676$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig
1.Orthography	.208	.456**	.077	.664
2.Phonology	.049	.223	.097	.985
3.Vocabulary	.325	.687***	.424	2.97**
4.Morphology	.094	.411**	.411	3.19**

Table 35: English variables related to Arabic word reading among Arabic-English bilinguals in Saudi Arabia (Total  $R^2 = .512$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1. Word reading	.010	.098	.206	.824
2. Pseudo-word reading	.01	.153	-.208	-.923
3. Morphology	.028	.249	.210	1.09
4. Vocabulary	.125	-.559*	-.247	-1.18
5. Orthography	.05	-.271	-.190	-1.28
6. Phonology	.289	.670**	.670	4.42**



Table 36: Arabic variables predicting English word reading among Arabic-English bilinguals in Saudi Arabia (Total  $R^2 = .173$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig	Final $\beta$	Final t-value & Sig
1. Words with vowels	.010	.098	-.022	-.078
2. Pseudo-word reading	0	.081	-.073	-.341
3. Vocabulary	.032	.190	.069	.360
4. Morphology	0	.015	.103	.461
5. Orthographic choice	.001	.054	-.130	-.471
6. Phonology	.015	-.189	-.220	-.885
7. Words without vowels	.115	.522*	.522	2.11*

Table 37: Arabic variables related to Arabic word reading among Arabic-English bilinguals in Canada (Total  $R^2 = .705$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1.Morphology	.243	.493**	.019	.139
2.Vocabulary	.007	-.098	-.260	-1.99
3.Orthography	.229	.696***	.390	2.61*
4.Words without vowels	.123	.432**	.382	3.30**
5.Phonology	.103	.394**	.394	3.43**

Table 38: English variables related to English word reading among Arabic-English bilinguals in Canada (Total  $R^2 = .484$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1.Morphology	.411	.641***	.409	2.42*
2.Vocabulary	.029	.218	.244	1.55
3.Phonology	.016	.145	.141	1.01
4.Orthography	.028	.169	.169	1.37

Table 39: English variables related to Arabic word reading among Arabic-English bilinguals in Canada (Total  $R^2 = .427$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1.Pseudo-word reading	.141	.375*	.031	.152
2.Morphology	.075	.357	.109	.522
3.Orthography	.029	.172	.095	.681
4.Vocabulary	.002	-.059	-.141	-.800
5.Word reading	.092	.471*	.362	1.72
6.Phonology	.088	.350*	.350	2.24*

Table 40: Arabic variables predicting English word reading among Arabic-English bilinguals in Canada (Total  $R^2 = .448$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1.Orthography	.083	.287	.002	.009
2.Morphology	.009	.125	-.075	-.379
3.Vocabulary	.05	-.297	-.200	-1.02
4.Pseudo-word reading	.107	.436*	-.410	-1.24
5.Word with vowels	.058	.563	.433	1.36
6.Phonology	.016	.183	.299	1.56
7.Words without vowels	.125	.555*	.555	2.68*

Table 41: Descriptive statistics: Performance of Hindi-English bilinguals on Hindi and English variables (raw scores) tested in the study

	N	Total no of items	Mean	SD
Hindi word reading	50	30	22.22	4.80
Hindi vocabulary	50	170	31.88	7.75
Hindi reading comprehension	50	30	13.50	1.91
Hindi RAN	50	-	22.00	2.18
English word reading	50	106	68.72	9.10
English pseudo-word reading	50	45	22.42	5.51
English vocabulary	76	170	77.14	11.46
English phonological awareness task	50	20	11.06	2.99
English morphological awareness task	50	28	12.72	4.59
English orthographic choice task	50	30	20.56	7.11
English reading comprehension	50	43	12.68	2.71

Table 42: Mean comparisons between Urdu-English and Hindi-English Bilinguals from Canada

Construct	Language	N	Mean	SD	t-value & sig.
English word reading	Urdu	50	72.68	9.86	2.08*
	Hindi	50	68.72	9.10	
English pseudo-word reading	Urdu	50	28.72	5.44	5.74**
	Hindi	50	22.42	5.51	
English vocabulary	Urdu	50	81.16	15.59	1.46
	Hindi	50	77.14	11.46	
English phonology	Urdu	50	13.24	4.53	2.83*
	Hindi	50	11.06	2.99	
English morphology	Urdu	50	13.16	5.38	.439
	Hindi	50	12.72	4.59	
English orthography	Urdu	50	26.36	3.51	1.99*
	Hindi	50	25.08	2.86	
English reading comprehension	Urdu	50	11.54	2.59	-2.14*
	Hindi	50	12.68	2.71	

Table 43: Within language (L1-Hindi) correlations for Hindi-English bilinguals

	Word read	Vocab	Read comp	RAN
1.Word reading	-			
2.Vocabulary	.436**	-		
3.Reading comprehension	.439**	.480**	-	
4.RAN	-.411**	-.284*	-.083	-



Table 44: Within language (L2-English) correlations for Hindi-English bilinguals

	1.WR	2.NWR	3.Voca	4.PA	5.MD	6.O.Ch	7.R.comp
1.Word reading	-						
2.Pseudo-word reading	.725**	-					
3.Vocabulary	.539**	.553**	-				
4.Phonological awareness	.429**	.424**	.657**	-			
5.Morphological decomposition	.353**	.376**	.519**	.571**	-		
6.Orthographic choice	.520**	.127	.542**	.136	-.141	-	
7.Reading comprehension	.475**	.530**	.624**	.472*	.387**	.440**	-

Table 45: Cross-linguistic (Hindi with English) relationships for Hindi-English bilinguals

	1.WR	2.Vocab	3.Rcomp	4.RAN
1.English words	.438**	.340*	.032	-.453**
2.English pseudo-words	.446**	.424**	.161	-.464**
3.English vocab	.206	.437**	.121	-.250*
4.English PA	.307*	.467**	.179	-.175
5.English MD	.192	.460**	.234	-.006
6.English OC	.192	.470**	.015	-.221
7. English RC	.320*	.466**	.306*	-.332*

Note: All the rows include variables in English (L2) and columns include variables in Hindi (L1) language.

Table 46: Comparisons of Correlation Among Urdu-English And Hindi-English Bilinguals from Canada based on their performance on L2 (English)

	1.WR	2.NWR	3.Voca	4.PA	5.MD	6.O.Ch	7.R.comp
1.Word reading	-						
2.Pseudo-word reading	.20	-					
3.Vocabulary	.00***	.04*	-				
4.Phonological awareness	.24	.06	.94	-			
5.Morphological decomposition	.00***	.04*	.01**	.72	-		
6.Orthographic choice	.42	.03**	.29	.05*	.00***	-	
7.Reading comprehension	.72	.34	.27	.29	.95	.12	-

Table 47: Hindi variables related to Hindi word reading among Hindi-English bilinguals in Canada (Total  $R^2 = .280$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1.Vocabulary	.190	.436**		3.35**
1.Vocabulary			.347	2.69*
2.Phonology (RAN)	.09	-.313*	-.313	-2.42*

Table 48: English variables related to English word reading among Hindi-English bilinguals in Canada (Total  $R^2 = .311$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1.Morphology	.353	.353**	.060	.390
2.Phonological awareness	.095	.337*	.071	.391
3.Orthography	.017	.140	.101	.724
4.Vocabulary	.093	.423**	.423	2.49*

Table 49: English variables related to Hindi word reading among Hindi-English bilinguals in Canada (Total  $R^2 = .228$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1. Morphology	.037	.192	-.005	-.032
2. Orthographic choice	.019	.145	.022	.149
3. Vocabulary	.008	.110	-.192	-.990
4. Phonology	.034	.271	.240	1.23
5. Word reading	.13	.434**	.434	2.71*

Table 50: Hindi variables predicting English word reading among Hindi-English bilinguals in Canada (Total  $R^2 = .298$ )

Step - Variables	$\Delta R^2$	$\beta$ for step & Sig.	Final $\beta$	Final t-value & Sig.
1.Vocabulary	.115	.340*	.143	1.03
2.Word reading	.104	.358*	.248	1.70
3.RAN	.079	-.310*	-.310	-2.26*

Table 51: Predictors of English word reading and vocabulary for Urdu-English bilinguals from Pakistan and Canada

Language groups	Variables	$\beta$	Std. error	df	t-value and sig.
Urdu-English (Pakistan)	Word reading	.875	.114	72	15.31***
Urdu-English (Canada)	Vocabulary	.729	.063	48	7.37***



Table 52: Predictors of English word reading and vocabulary for Arabic-English bilinguals from Saudi Arabia and Canada

Language groups	Variables	$\beta$	Std. error	df	t-value and sig.
Arabic-English (Saudi Arabia)	Word reading	.746	.080	38	6.90***
Arabic-English (Canada)	Vocabulary	.532	.108	38	3.87***

Table 53: Relationships among English word reading, vocabulary, phonology and morphology in Urdu-English bilinguals

	Word read	Vocabulary	Phonology	Morphology
Word reading	-			
Vocabulary	.808**	-		
Phonology	.657**	.710**	-	
Morphology	.463**	.299**	.440**	-

Table 54: Relationships among English word reading, vocabulary, phonology and morphology in Arabic-English bilinguals

	Word read	Vocabulary	Phonology	Morphology
Word reading	-			
Vocabulary	.807**	-		
Phonology	.436**	.407**	-	
Morphology	.836**	.905**	.443**	-

Table 55: Relationships among English word reading, vocabulary, phonology and morphology in Hindi-English bilinguals

	Word read	Vocabulary	Phonology	Morphology
Word reading	-			
Vocabulary	.539**	-		
Phonology	.429**	.657**	-	
Morphology	.353*	.519**	.571**	-

Table 56: English vocabulary and phonology predicting English word reading among Urdu-English bilinguals

	$\beta$	Std. error	df	t-value and sig.
Vocabulary	.681	.034	121	9.16***
Phonology	.178	.205	121	2.39**

Table 57: English vocabulary predicting English word reading among Arabic-English bilinguals

	$\beta$	Std. error	df	t-value and sig.
Vocabulary	.754	.046	77	10.45***
Phonology	.129	.321	77	1.78

Table 58: English vocabulary predicting English word reading among Hindi-English bilinguals

	$\beta$	Std. error	df	t-value and sig.
Vocabulary	.453	.128	47	2.80*
Phonology	.131	.492	47	.809

Table 59: Mean comparisons comparing performance on English word reading, phonology and morphology among Urdu-English and Hindi-English bilinguals

Construct	Country	Language	N	Mean	SD
English word reading	Pakistan	Urdu	76	23.28	5.60
	Canada	Urdu	50	72.68	9.86
	Canada	Hindi	50	68.72	9.10
English phonology	Pakistan	Urdu	76	16.80	3.40
	Canada	Urdu	50	13.24	4.53
	Canada	Hindi	50	11.06	2.99
English morphology	Pakistan	Urdu	76	33.59	3.20
	Canada	Urdu	50	13.16	5.38
	Canada	Hindi	50	12.72	4.59



Table 60: Mean comparisons comparing performance on English orthographic choice task among Urdu-English and Arabic-English bilinguals from Pakistan, Saudi Arabia and Canada

Construct	Country	Language	N	Mean	SD	t-value & sig.
English orthography		Urdu	126	24.01	3.50	26.52***
		Arabic	80	12.74	1.85	
English orthography	Pakistan	Urdu	76	22.46	2.49	22.78***
	Saudi Arabia	Arabic	40	12.18	1.90	
English orthography	Canada	Urdu	50	26.36	3.51	21.67***
	Canada	Arabic	40	13.30	1.63	

Table 61: English orthography predicting English word reading in Urdu-English and Arabic-English bilinguals

Language groups	Variables	$\beta$	Std. error	df	t-value and sig.
Urdu-English	Orthography	.398	.256	124	4.82***
Arabic-English	Orthography	.438	.915	78	4.30***

## Appendices

### Appendix A: Urdu Measures

#### Word Reading with Vowels

سردی	ہیران	ایک ساتھ
سبزیان	براعزام	درد
انگلی	چرہنا	ٹوکری
پیسانی	انفرادی	پردے
کتای	ہکمران	گھنے
الماری	ساہرا	میز
تاریک	تکھتاسیاه	کیلندر
پینسل	چیل	بوٹل
گھر	چاول	کمپیوٹر
روسنی	پنکھا	بازار

## GORT - 4 FORM - A

## STORY 1

دیکھو بابا - بابا آئے - ہم کھیلنا چاہتے ہیں - ما! کیا آپ بھی کھیلوگی؟ ہم یہاں کھیل سکتے ہیں۔

## QUESTIONS: STORY 1

س: ۱: کہانی میں کون بات کر رہا ہے؟

ا۔ ایک کتا                      ب۔ باپ

ج۔ بچہ                              د۔ ماں

س: ۲: ابھی ابھی کون گھر آیا؟

ا۔ ایک بچی                      ب۔ ایک لڑکا

ج۔ ماں                                د۔ باپ

س: ۳: باپ کیا کرنا چاہتا تھا؟

ا۔ ماں سے بات                      ب۔ کھیلنا

ج۔ کام کرنا                        د۔ دیکھنا

س: ۴: بچے کھیلنے کے لئے کس کو بولتے ہیں؟

ا۔ باپ                                ب۔ کھلاڑی

ج۔ ماں                                د۔ ایک لڑکا

س: ۵: اس کہانی کے لئے بہترین نام کیا ہو سکتا ہے؟

ا۔ بابا کام کر رہے ہیں              ب۔ ماں کام کر رہی ہیں

ج۔ بابا کے لئے انتظار              د۔ فیملی کے ساتھ مزہ

## FORM - A STORY - 2

ہماری بلی مہی چھت پر بیٹھنا پسند کرتی ہے۔ مہی گھر سے اونچے درخت پر جاتی ہے۔ پھر چھت پر چھلا لگاتی ہے۔ وہ وہاں بیٹھ کر پرندوں کو دیکھتی ہے۔ لیکن ہمیشہ کھانے کے وقت واپس نیچے آ جاتی ہے۔

## QUESTIONS - STORY:2

س ۱: کہانی میں بلی کہاں بیٹھتی ہے؟

۱۔ گھر کے ساتھ      ب۔ گھر کے اوپر

۲۔ درخت میں      د۔ آگ کے پاس

س ۲: کہانی میں بلی ----

۱۔ پرندوں کو دیکھتی ہے      ب۔ پرندے کھاتی ہے

۲۔ درخت کے نیچے سوتی ہے      د۔ نیچے نہیں آ سکتی

س ۳: مہی کو سب سے زیادہ کیا پسند ہے؟

۱۔ درخت      ب۔ گھاس

۲۔ چھت      د۔ بستر

س ۴: اس میں سے کیا کہانی میں نہیں ہوا؟

۱۔ چھت سے نیچے دیکھنے کے لئے بہت کچھ ہے      ب۔ مہی کو چھت پر بہت مزہ آتا ہے

۲۔ چھت پر رن ہے      د۔ کبھی کبھی مہی چھت پر سو جاتی ہے

س ۵: آپ کو کیا لگتا ہے مہی کو چھت پر بیٹھنا کیوں پسند ہے؟

۱۔ وہاں ٹھنڈ ہے      ب۔ وہاں کھانا ملنا آسان ہے

۲۔ وہاں بیٹھنا محفوظ ہے      د۔ یہ ایک اچھا مذاق ہے

## FORM - A STORY - 3

ایک آدمی گاڑی سے باہر آیا۔ اس کے ہاتھ میں ایک ڈبہ تھا۔ ایک چھوٹی بچی اس سے ملنے بھاگتی ہے۔ بیٹوہا، وہ کہتی ہے۔ کیا آپ کے پاس میرے لئے تھنڈے؟ ابا کہتے ہیں یہ ایک اٹھی بچی کے لئے ہے۔ لوی ہنستی ہے اور کہتی ہے، میں اچھی بچی ہوں۔

## QUESTIONS - STORY - 3:

س ۱: آدمی کے ہاتھ میں کیا تھا؟

ا۔ ایک چھوٹی گاڑی

ب۔ ایک خوبصورت کھلونا

ج۔ ایک چھوٹی بچی

د۔ ایک تھنڈ

س ۲: آدمی سے ملنے کے لئے کون بھاگا؟

ا۔ ایک چھوٹی لوی

ب۔ ایک بڑی لوی

ج۔ ایک بڑا کتا

د۔ ایک چھوٹا کتا

س ۳: آدمی ڈبے کے ساتھ کیا کرنا چاہتا تھا؟

ا۔ اس میں کچھ رکھنا چاہتا تھا

ب۔ چھوٹی لوی کو دکھانا چاہتا تھا

ج۔ اپنی چھوٹی بیٹی کو دینا چاہتا تھا

د۔ کسی کے لئے رکھنا چاہتا تھا

س ۴: آپ کو کیا لگتا ہے ابا اپنی بیٹی کو کیوں تھنڈ دینا چاہتے تھے؟

ا۔ کیوں کہ وہ اچھے بچے ہیں

ب۔ کیوں کہ اس کو کچھ برانا چاہتے تھے

ج۔ کیوں کہ وہ اس سے سب سے زیادہ پیار کرتے تھے

د۔ اس کو خوش کرنے کے لئے

س ۵: لوی کو کیسا لگا جب اس نے تھنڈ دیکھا

ا۔ برا

ب۔ خوش

ج۔ مزاحیہ

د۔ شرمیلی

## FORM - A STORY - 4

صبح سکول جانے کا وقت ہو گیا تھا۔ بچوں نے بستر ٹھیک کیا اور تیار ہوئے۔ ایک بچے نے کہا مجھے میرے لال جوڑے نہیں مل رہے۔ اماں نے کہا تو پھر آج تمہیں براون والے جوڑے پہننے پر مجبور ہوں گے۔  
 دوسرے بچے نے کہا مجھے میری نئی کتاب نہیں مل رہی۔ اماں نے کہا وہ میں نے کل رات کوفرش پر پڑی دیکھی تھی۔ جب بچے تیار ہوئے تو انہوں نے اماں کی گاڑی کی چابیاں ڈھونڈنے میں مدد کی۔ اماں نے  
 سب کو بیکار کر کے خدا حافظ کیا۔

## QUESTIONS - STORY - 4:

س: ۱: اماں نے کیا کھویا؟

ا۔ کتاب  
 ب۔ جوڑے

ج۔ توٹی  
 د۔ چابی

س: ۲: اس کہانی کا بہترین نام کیا ہو سکتا ہے؟

ا۔ گمشدہ جوڑے  
 ب۔ ایک اچھا دن

ج۔ ایک نئے دن کا آغاز  
 د۔ سکول کی تیاری

س: ۳: کیا اس کہانی میں سے نہیں ہے؟

ا۔ بچوں نے ناشتے میں اڈے کھائے  
 ب۔ اماں نے بچوں کو سونے کے لئے بولا

ج۔ اماں نے نئی قمیض پہنی  
 د۔ بچے کھانا باڑھنا بھول گئے

س: ۴: آج کو کیا لگا کہانی میں فعلی کو کیسا لگا؟

ا۔ جلدی میں  
 ب۔ برا

ج۔ خوش  
 د۔ خوش قسمت

س: ۵: آپ دن کے کس حصے کو کیسے بیان کریں گے؟

ا۔ جلدی میں  
 ب۔ خاموش

د۔ مصروف

ج۔ مزیدار



## FORM - A STORY - 5

ایک پرندہ پانی کی تلاش میں اڑھ رہا تھا۔ کچھ فاصلے کے بعد وہ دو گھنٹے پیسا ہو گیا۔ اسے میں اس کا ایک کاپی کا برتن دکھائی دیا۔ اور وہ وہاں گیا پانی پینے کے لئے۔ لیکن برتن میں پانی بہت کم تھا۔ اس کو لگا وہ پیاس سے مر جائے گا۔ اسے میں اس کا ایک ترکیب آئی۔ اس نے نکل کر جمع کئے اور پانی میں ڈالنا شروع کر دئے۔ ایسے میں پانی اوپر آگیا اور پرندہ پانی پی کر اڑھ گیا۔

## QUESTIONS - STORY - 5:

س: ۱: پرندہ پانی کیوں نہیں پی سکا؟

ا۔ برتن میں پانی بہت کم تھا

ب۔ برتن میں سراخ تھا

ج۔ پانی کا ذائقہ خراب تھا

د۔ پانی بہت گندا تھا

س: ۲: کہانی میں پرندہ۔۔۔۔۔؟

ا۔ چلا سکا تھا

ب۔ تھکا ہوا تھا

ج۔ بھوکا تھا

د۔ بیوقوف تھا

س: ۳: کہانی کا کیا نتیجہ نکلتا ہے؟

ا۔ برادقت ہمیشہ نہیں رہتا

ب۔ امید غصے سے بہتر ہے

ج۔ دماغ جیسے کاراستہ ہے

د۔ ہر کسی کا اچھا مزاق پسند ہوتا ہے

س: ۴: پرندے کو کہا لگا جب وہ پانی پانی سکا؟

ا۔ حیران

ب۔ پریشان

ج۔ گھبرایا

د۔ امید

س: ۵: جب پرندہ پانی پینے کے قریب تھا تو؟

ا۔ سب کام سے تھکا ہوا تھا

ب۔ اپنی ترکیب پر فخر

ج۔ اپنے سفر سے تھکا ہوا

د۔ وقت ذائع کرنے پر ناراض

## FORM - A STORY - 6

پارک کے قریب ایک خالی میدان میں لوگ بہت مدت سے کام کر رہے تھے۔ بہت مارے لڑکے میدان کی صفائی کر رہے تھے۔ انہوں نے سوچی ٹانھیں، گتے اور گندا اٹھایا۔ کچھ لوگوں نے گھاس کاٹی۔ پھر سب لوگوں نے اٹل چلایا۔ پھر سب کے والدین آگئے۔ انہوں نے کچھ چھولے لگائے۔ اوپر ایک لکڑی کی کشتی درخت کے پاس رکھی۔ پھر انہوں نے ایک مطلوبہ پاڑ لگائی۔ اب بچوں کے پاس ایک محفوظ میدان تھا جہاں سب کھیل سکتے تھے۔ جس توہانے میں سب نے مدد کی تھی۔

## QUESTIONS - STORY - 6:

س: ۱: کہانی میں لڑکے کیا کر رہے تھے؟

- ۱۔ چھولے لگا رہے تھے  
 ۲۔ پاڑ لگا رہے تھے  
 ۳۔ باڑ لگا رہے تھے  
 ۴۔ باڑکس نے لگائی؟

۱۔ والدین نے  
 ۲۔ لڑکیوں نے  
 ۳۔ لڑکوں نے  
 ۴۔ پڑوسیوں نے

س: ۳: کہانی کا بہترین نام؟

- ۱۔ ایک نیا کھیل کا میدان  
 ۲۔ خالی میدان  
 ۳۔ کھیل کا میدان کیسے بناتے ہیں  
 ۴۔ میدان میں پارٹی

س: ۴: کون سا جملہ کہانی سے نہیں ملتا؟

- ۱۔ دوپہر میں سب کھانے کے لئے رکے  
 ۲۔ لوگوں نے کام کا مزایا  
 ۳۔ لوگوں نے سارا دن کام کیا  
 ۴۔ جب لوگوں نے سب کام کر لیا تو ان کو پیسے ملے

س: ۵: لوگوں کو کیسا لگا جب انہوں نے سب کام ختم کر لیا؟

- ۱۔ ناامید  
 ۲۔ خوش

د۔ پریشان

ج۔ تیران

### Urdu Phonological Awareness Task

Deleting Sound (phoneme)	Items	
ب	بازار	۱
ا	کتاب	۲
ھ	دھول	۳
ت	ستارا	۴
ھ	بھاری	۵
ا	گندا	۶
ل	لاری	۷
د	دانت	۸
ی	جنگلی	۹
م	جامن	۱۰

## Urdu Orthographic Choice Task

Option 1	Option 2	Option 3	
مہل	محل	مہل	۱
کطاب	کتاب	قتاب	۲
اکل	اقل	عقل	۳
مایوص	معیوس	مایوس	۳
طامیر	تعمیر	تامیر	۵
فیکر	فکر	فقر	۶
موقمل	مقمل	مکمل	۷
کلم	کلم	قلم	۸
اینہ	عاینہ	اینہ	۹
ظلم	ظولم	زلم	۱۰

**Urdu Morphological Awareness Task**

دار	۱
بیت	۲
گاہ	۳
ا باد	۳
کوٹ	۵
پورہ	۶
نگر	۷
ستان	۸
کدہ	۹
خانہ	۱۰

**Appendix B: Hindi Measures****Hindi Word Reading**

1.बिल्ली

2.हम

3.नहीं

4.तथा

5.हाँ

6.किताब

7.मदद

8.फिर

9.उन्हें

10.पहर

11.लकड़ी

12.पुरुषों

13.बच्चा

14.नया

15.रुकें

16.काम

17.छलांग

18.उपवास

19.ठीक

20.दूध

21.गुम हो गया

22.खोज

23.कागज़

24.खुला

25.मेहरबान

26.जूते

27.पैसे

28.महान

29.पिता

30.नदी

31.अंतरिक्ष



32.कम

33.बाएं

34.लोग

35.लहर की

36.बच्चा

37.बलवान

38.भीड़

39.बेहतर

40.के भीतर

41.विमान

42.सुंदर

43.ख्याति प्राप्त

44.बजट

45.न्याय

46.सुबह

47.व्यापार

48.गुणवत्ता

49.गिरावट

50.तत्त्वों

## Hindi Reading Comprehension

## Story 1

पिता देखें। पिता यहाँ है। हम खेलना चाहते हैं। आप खेल सकते हैं? आप माँ खेल सकते हैं? हम यहाँ खेल सकते हैं।

प्रश्न:

1. इस कहानी में कौन बात कर रहा है?

ए एक कुत्ते

बी पिता

सी एक बच्चे

डी मदर

2. जो सिर्फ घर आ गया है?

ए एक बिल्ली

बी एक लड़का

सी माँ

डी पिता

3. क्या पिता क्या करना चाहते हैं?

मां को ए टॉक

बी प्ले

सी काम

डी देखो

4. जो बच्चों को उनके साथ खेलने के लिए पूछा?

ए एक पिता

बी एक खिलाड़ी

सी माँ

डी एक लड़का

5. इस कहानी के लिए सबसे अच्छा नाम क्या है?

ए पिताजी काम कर रहा है

बी मदर बात कर रही है

सी पिता के लिए खोज

डी परिवार मज़ा

## Story 2

हमारी बिल्ली मिमी छत पर बैठने के लिए पसंद करती है। मिमी घर से लंबा पेड़ के ऊपर चला जाता है। फिर वह छत पर कूदता है। वह बैठता है और पक्षियों पर लग रहा है। लेकिन वह हमेशा नीचे आता है, जब इसे खाने के लिए समय है।

प्रश्न:

1. कहानी में बिल्ली बैठा है

ए सभा द्वारा

घर के ऊपर बी पर

सी एक पेड़ में

डी आग से

2. कहानी में बिल्ली

ए पक्षियों देखना पसंद करता है

बी पक्षियों के खाने

पेड़ के नीचे सी नींद

डी नीचे नहीं मिल सकता

3. मिमी अच्छी पसंद करती है क्या करता है?

ए पेड़

बी घास

सी छत

डी बिस्तर

4. कहानी में क्या जाना नहीं है?

बेशक इसमें छत से देखने के लिए कई बातें हैं

बी मिमी छत पर मज़ा है

सी छत पर बर्फ नहीं है

डी कभी कभी मिमी छत पर सोता

5. यदि आप ऐसा क्यों सोचते मिमी छत पर बैठने के लिए पसंद करती है?

ए यह अच्छा है

बी यह भोजन खोजने के लिए आसान है

सी यह सुरक्षित महसूस करता है

डी यह एक अच्छा मजाक है

## Story 3

एक आदमी कार से बाहर हो गया। वह अपने हाथ के नीचे एक सुंदर बॉक्स था। एक छोटी सी लड़की उससे मिलने के लिए घर से भाग गया। हैलो पिता, उसने कहा। आप मेरे लिए एक आश्चर्य है? पिता ने कहा, मैं एक अच्छी लड़की के लिए कुछ है। महिला हँसे, मैं बहुत अच्छा कर रहा हूँ।

प्रश्न:

1. आदमी पकड़े क्या था?

ए एक छोटी कार  
बी एक सुंदर खिलौना  
सी एक छोटी सी लड़की  
डी ए उपस्थित

2. कौन आदमी से मिलने के लिए भाग गया?

ए एक छोटी सी लड़की  
बी एक बड़ी लड़की  
सी एक बड़ा कुत्ता  
डी एक छोटे कुत्ते

3. क्या बॉक्स के साथ क्या करने के लिए आदमी योजना है?

ए उस में कुछ रखें  
बी छोटी लड़की को दिखाओ  
सी यह उसकी छोटी लड़की के लिए दें  
डी किसी के लिए इसे सहेजें

4. क्या आप ऐसा क्यों सोचते हैं पिता उसकी छोटी लड़की एक आश्चर्य देना चाहता था?

उसे दिखाने के लिए कि वह एक अच्छे पिता है ए  
बी क्योंकि वह कुछ बुरा उसे बताना था  
सी क्योंकि वह उसके परिवार में किसी और से अधिक पसंद आया  
डी उसे खुश करने के लिए और अच्छा महसूस करने के लिए

5. आप कैसे लगता है कि महिला महसूस किया जब वह आश्चर्य देखा?

ए क्षमा  
बी उत्साहित  
सी अजीब बात है  
डी शर्मीला

## Story 4

इसे पाने के लिए और स्कूल जाने के लिए समय था। बच्चों को अपने बिस्तर बना दिया और कपड़े पहने। एक बच्चे ने कहा, मैं अपने लाल जूते नहीं मिल सकता है। माँ ने कहा, तो आप के बजाय भूरे रंग के लोगों को पहनना होगा। अन्य बच्चे ने कहा, मैं अपनी ब्लू बुक खो दिया है। पिता ने कहा, मैं कल रात फर्श पर देखा था। बच्चों पर पिछले तैयार थे, वे पिता कार की चाबियाँ के लिए लग रही मदद की। माँ उन सब को अलविदा चूमा और कहा, एक अच्छा दिन है।

प्रश्न:

1. क्या पिता को खो दिया था?

ए पुस्तकें

बी जूते

सी हैट

डी कुंजी

2. इस कहानी के लिए सबसे अच्छा नाम क्या है?

ए जूते गायब

बी एक अच्छा दिन

सी एक नए दिन के लिए तैयार हो रही है

डी स्कूल के लिए जा रहे

3. क्या इस कहानी में फिट नहीं करता है?

ए बच्चों के नाशते के लिए अंडे खा लिया

बी मदर बच्चों के बिस्तर के लिए तैयार हो जाओ के लिए कहा

सी पिता एक नीले रंग की शर्ट पहनी थी

डी बच्चों को लगभग एक लंच पैक करने के लिए भूल गया

4. आप कैसे लगता है कि इस कहानी में परिवार महसूस किया?

ए जल्दबाजी

बी क्षमा

सी मुबारक

डी लक्की

5. क्या काम आप दिन के इस समय का वर्णन करने के लिए प्रयोग करेंगे?

एक तेज़

बी चुप

सी रोमांचक

डी व्यस्त

## Story 5

एक ब्लू जे एक अंग पानी की तलाश पर बैठा था। सिर्फ एक महान दूरी प्रवाहित करने के बाद, वह बहुत प्यास लगी थी। उस पल में, वह जमीन पर एक पानी जार हाजिर करने के लिए हुआ है, तो वह नीचे उड़ गए और जार से एक पेय पाने की कोशिश की। लेकिन वहाँ जार में इतना कम पानी है कि वह पीने के लिए असमर्थ था। बस के रूप में वह महसूस किया है कि वह निश्चित रूप से प्यास से मर जाएगा, एक विचार उसके अटक गया। जे पत्थरों के ढेर को इकट्ठा किया और उन्हें जार में छोड़ने लगे। छोटे से छोटे, गुलाब जल और आखिरी में जे उसकी भरने पी सकता।

प्रश्न

1. क्यों जे पानी नहीं पी सकता है?

ए पानी जार में बहुत कम था

बी जार एक रिसाव था

सी पानी बुरा चखा

डी पानी भी गंदा था

2. इस कहानी में Jay है?

एक चतुर

बी थक गये

सी भूख

डी बेवकूफ

इस कहानी में मुख्य विचार 3. क्या है?

ए एक बुरी स्थिति एक लंबे समय तक रहता है कभी नहीं

बी आशा है कि क्रोध की तुलना में बेहतर है

सी दिमाग अक्सर अस्तित्व के लिए महत्वपूर्ण हैं

डी हर कोई एक अच्छा मजाक पसंद करती है

4. आप कैसे लगता है कि जे महसूस किया जब वह पीने के लिए असमर्थ था?

ए हैरान

बी हैरान

सी चिंतित

डी उम्मीद

5. जब जे अंत में पानी तक पहुँचने में सक्षम था, वह शायद था?

ए सभी को कड़ी मेहनत से थक

बी उसके विचार पर गर्व है

सी उसकी यात्रा से विश्राम

डी इतना समय बर्बाद कर के बारे में गुस्सा

## Story 6

पार्क के पास एक खाली बहुत पर, कई लोगों को काम पर मेहनत कर रहे थे। कई लड़कों को बहुत दूर की सफाई कर रहे थे। वे पुराने बोर्ड, कचरा, और सूखी शाखाओं कि जमीन को कवर उठाया। दूसरों लंबा मातम में कटौती और उन्हें दूर किया। तब सभी लड़कियों चिकनी जमीन उठाया। अंत में, माता पिता के एक समूह पहुंचे। वे कुछ झूलों और एक झूला डाल दिया, और एक पेड़ के बगल में एक पुरानी लकड़ी की नाव रखा। तब वे सब बहुत चारों ओर एक मजबूत बाड़ का निर्माण किया। अब बच्चों को एक सुरक्षित खेल का मैदान है कि पड़ोस में हर किसी को बनाने में मदद की थी।

प्रश्न:

1. इस कहानी कर में लड़कों में क्या कर रहे थे?

ए झूलों लाना

बी पत्तियों raking

सी बिल्डिंग एक बाड़

डी बहुत समाशोधन

2. कौन बाड़ बनाया?

ए माता पिता

बी लड़कियों

सी लड़कों

डी पड़ोसियों

3. इस कहानी के लिए सबसे अच्छा नाम क्या है?

ए नया खेल का मैदान

बी कैसे एक खेल का मैदान बनाने के लिए

सी खाली बहुत

खेल के मैदान पर डी एक पार्टी

4. कौन सा वाक्य कहानी फिट नहीं करता है?

ए दोपहर हर कोई एक लंच ब्रेक के लिए बंद कर दिया

बी लोगों को पूरे दिन काम किया

सी लोगों को काम का आनंद लिया

डी जब वे खत्म हो रहे थे, लोगों की मदद करने के लिए भुगतान किया गया

5. तुम्हें क्या लगता है जब वे खत्म हो गए थे लोग महसूस किया?

ए निराश

बी खुश

सी बहलाते

डी क्रॉ