THE IMPACT OF REFUGEE STATUS ON LANGUAGE AND COGNITIVE DEVELOPMENT: A COMPARATIVE STUDY

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LANGUAGE AND COGNITIVE ABILITIES OF BILINGUAL SYRIAN REFUGEE CHILDREN LIVING IN TURKEY: A COMPATIVE STUDY

Submitted by ÖZLEM YETER in partial fulfilment of the requirements for the degree of **Master of Science in Cognitive Science Department, Middle East Technical University** by,

Prof. Dr. Deniz Zeyrek Bozşahin
Dean, **Graduate School of Informatics**

Dr. Ceyhan Temürcü
Head of Department, **Cognitive Science Dept.**

Assist. Prof. Dr. Duygu Özge
Supervisor, **Foreign Language Education Dept., METU**

Dr. Ceyhan Temürcü
Co-Supervisor, **Cognitive Science Dept., METU**

Examining Committee Members:

Prof. Dr. Deniz Zeyrek Bozşahin
Cognitive Science Dept., METU

Assist. Prof. Dr. Duygu Özge
Foreign Language Education Dept., METU

Assoc. Prof. Dr. Nart Bedin Atalay
Psychology Dept., TOBB ETÜ

Date: 29.07.2022

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name : **Özlem Yeter**

Signature : ____________________

ABSTRACT

THE IMPACT OF REFUGEE STATUS ON LANGUAGE AND COGNITIVE DEVELOPMENT: A COMPARATIVE STUDY

Yeter, Özlem

MSc., Department of Cognitive Sciences

Supervisor: Assist. Prof. Dr. Duygu Özge

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To this day, there is no detailed information on how experiences related to forced displacement affect cognitive and linguistic development of the Syrian refugee children. To address this gap in the literature, 25 low-SES Syrian refugee children (9-year-old) were tested for their working memory (WM), inhibitory control (IC), shifting, fluid intelligence abilities as well as vocabulary abilities. Their scores were compared with two low-SES non-refugee same-age control groups: Turkish monolinguals (*N* = 20) and Arabic-Turkish bilingual minorities (*N* = 20). Syrian children lagged behind both non-refugee groups in the fluid intelligence task. They also obtained poorer WM scores than their bilingual controls. Adverse experiences and poor pre-school education had negative effects on Syrian children's cognitive development. However, no further cognitive difference between this warn-torn group and the non-refugee children was observed. On language tests, Syrian children had a smaller Turkish vocabulary size than both non-refugee controls, but they outperformed their bilingual controls in Arabic. Although Syrian children draw a more balanced bilingual profile, their L1 (Arabic) skills were poorer than the control groups' Turkish skills. Overall results suggest that although Syrian children's WM, fluid intelligence abilities and L1 development were negatively affected by the forced displacement, they were able to develop Turkish vocabulary skills and match with Turkish monolinguals on all assessed EF measures. This is the first evidence suggesting that holding bilingual status may actually have created a cognitively protective shield for disadvantaged Syrian children. This study also highlights the significance of early childhood education for cognitive development.

Keywords: Refugee Children, Bilingualism, Executive Functioning, Fluid Intelligence (Max. 5 keywords)

ÖZ

MÜLTECİ OLMA DURUMUNUN ÇOCUKLARIN DİL VE BİLİŞSEL GELİŞİME ETKİLERİ: KARŞILAŞTIRMALI BİR ÇALIŞMA

Yeter, Özlem

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Günümüze kadar zorla yerinden edilme deneyimlerinin Suriyeli çocukların dil ve bilişsel gelişimini nasıl etkilediğine dair detaylı bir bilgi bulunmamaktadır. Alanyazındaki bu boşluğu doldurmak adına, alt-SES grubundan 25 tane Suriyeli mülteci çocuğun (9 yaş grubu) çalışan bellek, ketleme, kurulum değiştirme akıcı zeka ve kelime becerileri test edildi. Suriyeli çocukların puanları mülteci olmayan aynı yaştaki iki alt-SES kontrol grubuyla karşılaştırıldı: Türkçe tek dilli (N = 20) ve Arapça-Türkçe iki dilli azınlık (N = 30) çocuklar. Suriyeli çocuklar akıcı zeka becerilerinde her iki kontrol grubunun da gerisinde kaldı. Ayrıca iki dilli yaşıtlarından daha düşük işleyen bellek skoruna ulaştılar. Olumsuz yaşantıların ve zayıf okul öncesi eğitiminin Suriyeli çocukların bilişsel gelişimini olumsuz etkilediği gözlendi. Ancak, savaş mağduru çocuklar ile mülteci olmayan gruplar arasında diğer bilişsel beceriler bakımından bir fark görülmedi. Dil testlerinde Suriyeli çocuklar mülteci olmayan iki gruptan da daha dar bir Türkçe kelime haznesine sahipken, Arapça kelime haznesi bakımından iki dilli kontrol grubundan daha iyi bir performans sergiledi. Suriyeli çocuklar daha dengeli bir iki dillilik profile sergilemesine ragmen anadillerindeki (Arapça) performansları diğer iki grubun Türkçe performansından daha zayıftı. Genel olarak sonuçlar Suriyeli mülteci çocukların çalışan bellek, akıcı zeka ve anadillerinin zorla yerinden edilme deneyimlerinden olumsuz etkilenmesine rağmen Türkçe kelime becerileri geliştirebildiğini ve anadili Türkçe olan tekdilli çocuklarla tüm yürütücü işlev testlerinde bezer performans sergilediğini göstermektedir. Bu sonuç, Suriyeli dezavantajlı çocuklar için ikidilliliğin bilişsel bir koruyucu kalkan görevi gördüğünün ilk kanıtı niteliğindedir. Bu çalışma, ayrıca erken dönem çocukluk eğitiminin bilişsel gelişim üzerindeki önemini de vurgulamaktadır.

Anahtar Sözcükler: Mülteci Çocuklar, İki Dillilik, Yönetici İşlevler, Akıcı Zeka

(En fazla 5 anahtar kelime)

To the Innocence of Children

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ASAM	Association for Solidarity with Asylum Seekers and Migrants
BCST	Berg's Card Sorting Task
CHILDES	The Child Language Data Exchange System
CPM	Coloured Progressive Matrices
IC	Inhibitory Control
TIFALDI	Turkish Expressive and Receptive Language Test
PTSD	Post-Traumatic Stress Disorder
WCST	Wisconsin Card Sorting Test
WM	Working Memory

CHAPTER 1

INTRODUCTION

The Syrian war broke out in 2011, and caused has more than five million people to seek refuge outside the country. In the more than ten years since the war started, Turkey has absorbed more than 3.7 million displaced Syrian refugees, including 1.7 million children (UNHCR, 2021; UNICEF, 2021). Experiences such as witnessing violence, making dangerous journeys, interrupted schooling, camp life, poverty, discrimination, language and cultural differences may all challenge and stress the refugees (Hadfield, Ostrowski, & Ungar, 2017; Montgomery & Foldspang, 2008; Tucker, Stolk, Baker, Valibhoy, & Kaplan, 2015; UN, 2014; UNHCR, 2014). These traumatic experiences and high level of stress may affect mental health development negatively. (Attanayake et al., 2009; for a review see Bick & Nelson, 2016; Ehntholt & Yule, 2006; Elbert et al., 2009; Eruyar, Maltby, & Vostanis, 2020; Henley & Robinson, 2011; Pinto Wiese & Burhorst, 2007; Tinghög et al., 2017).

The first detailed data regarding the mental health of Syrian children was collected from refugee camps in Turkey, where children showed high levels of depression, post-traumatic stress disorder (PTSD), and aggression although 20% of them reported no experiences of war (Özer, Şirin, & Oppedal, 2016). Observation of PTSD symptoms in refugees who did not actually witness war shows how simply being a refugee may affect mental health and psychological well-being (see also Çeri & Özer, 2018; Sarmini, Topçu, & Scharbrodt, 2020; Özkan & Çakmak, 2021; Ünver, Çeri, Fındık, & Arman, 2021).

In the context of war as a cause of trauma, the children might be too young to recall the traumatic events or might be born after the resettlement to the host country (i.e., Turkey in our context). However, even if the children themselves were not directly exposed to war or did not witness violence, the distress of caregivers may affect the children negatively due to decreased quality and quantity of nutrition and care provided to them (De Bellis, 2005; Eruyar, Maltby, & Vostanis, 2018; Gredebäck et al., 2021; Rizkalla et al., 2020; Weinstein, Fucetola, & Mollica, 2001). This relationship might help us understand why children with no war experiences in Özer et al.'s (2016) study exhibited PTSD symptoms.

Significant evidence from several countries also documents the effects that war and displacement have on refugee children's educational development (Gagné, Janus, Milbrath, Gadermann, & Guhn, 2018; Kim, Brown, Tubbs Dolan, Sheridan, & Aber, 2020; Wilkinson, 2002). Moreover, about half of the refugee children have no access to schooling (UNHCR, 2018), and those who go to school are 5 times more likely to drop out (UNICEF, 2017). In line with these statistics, Turkish Ministry of National Education (MoNE, 2022) reports that only 34.34 % of the pre-school aged refugee children go to the kindergarten in Turkey, and language barrier, discrimination, high rates of child labour are the main reasons for the dropout rate (MoNE, 2022). These statistics are worth mentioning, because children with more schooling has greater potential to have better cognitive abilities (Brod, Bunge, & Shing, 2017; Souza-Talarico, Caramelli, Nitrini, & Chaves, 2007; Cliffordson & Gustafsson, 2008). Given the low rates of schooling among the school-aged refugees, they may lag behind their non-refugee peers not only on academic, but also cognitive development.

Extensive neuroimaging research has also shown that adverse experiences cause a decreased volume and activation in the prefrontal cortex (PFC) region, which is also the home for higher order cognitive abilities (Braver et al., 2001; Casey et al., 1995; De Bellis et al., 1999; Mehnert et al., 2013; Rauch et al., 2003; Richert, Carrion, Karchemskiy, & Reiss, 2006; for a review see Shaw, Dupree, & Neigh, 2020). Further studies investigated the effects of trauma on cognitive development, and presented that traumatic experiences, depression, stress and PTSD have a negative effect on cognitive functioning (e.g., Ainamani, Elbert, Olema, & Hecker, 2017; Beers & De Bellis, 2002; Pechtel & Pizzagalli, 2011; Vasterling, Constans, Brailey, & Sutker, 1998; cf., Augusti & Melinder, 2013; Cohodes, Chen, Lieberman, & Bush, 2020). The magnitude of harm on cognitive functioning is greater for the individuals who were exposed to these negative experiences at their early childhood than those who were distressed at later ages (Dunn, Nishimi, Powers, & Bradley, 2017; Enlow, Egeland, Blood, Wright, & Wright, 2012; McCutcheon et al., 2010).

While the effects of displacement on mental health is quite clear, its impact on cognitive development is not so well established. Of course, we know that children’s cognitive development is linked to traumatic experiences, poor access to education, displacement, and family separation (Henley & Robinson, 2011; Kaplan et al., 2016), and so we would expect displaced children to show similar difficulties. However, in fact, the extant evidence does not quite match up to this particular picture.

Recently, a study tested Syrian refugee adolescents’ working memory (WM) and inhibitory control (IC) abilities compared to their Jordanian non-refugee peers and found no differences between the groups on these EF abilities (Chen et al., 2019). Being first to systematically evaluate the effect of displacement trauma on cognitive development, this study surprisingly revealed that poverty was a better predictor of cognitive development than exposure to trauma. Carrying this association one step further, Scharpf, Mueller and Hecker (2022) found that higher levels of traumatic experiences were associated with better cognitive flexibility, and greater PTSD symptoms were associated with better WM in the study they conducted on 7 – 15 year-old Burundian refugees. Scharpf and colleagues (2022) explain this unexpected finding by suggesting that the adolescents with higher EF have a better observation and reflection abilities that lead them to report more traumatic experiences (Zelazo, 2015).

The reason for the surprising resilience of executive functioning, for instance in Chen et al.'s (2019) study, of displaced adolescents could be their arrival age. The age of Syrian refugees ranged between 12 and 18 at the time of testing, and they had been in Jordon for about 2.97 years (*SD* = 0.98), that is, they were about 9 – 15 years old at the time of arrival. A study by Evans and Kim (2007) has shown that exposure to poverty in the early childhood, rather than early puberty, causes greater stress dysfunction. Indeed, typically developing children undergo remarkable changes and become cognitively mature in their cognitive and social skills, including the development of strong executive function skills allowing them to avoid distraction, control their emotions, and focus on tasks, as well as strong social and theory of mind skills facilitating interactions with others in early years of their lives (Cahan, Davis, & Staub, 2001; Carlson, 2005; Kostandov, Farber, Cheremushkin, Petrenko, & Ashkinazi, 2011; Grolnick & Farkas, 2002; Macdonald, Beauchamp, Crigan, & Anderson, 2014; Mehnert et al., 2013), especially between the ages of 3 and 8 (for a review, see Kievit, 2020). Thus, it might be argued that the children in Chen et al. (2019) had progressed in their neural and cognitive development and built better coping strategies prior to testing since they had passed a critical window for cognitive development (Woodburn et al., 2021).

For many displaced children, it is imperative to acquire a new community language; however, this was not the case for the refugees tested in Chen and colleagues' (2019) study for they spoke the same language (i.e., Arabic) as the non-refugee children they were compared to. Absence of the challenge caused by an unfamiliar language might have eased their adaption process and educational experiences (Birman, Trickett, & Vinokurov, 2002; MacNevin, 2012; Miller, 2009). One might predict that the challenges brought by being a refugee become more visible or adverse in an environment where the child has to receive education in a new community language (Tsimpli et al., 2020a). Along with the social adaptation difficulties brought by language barrier, being immersed in a medium of instruction that is different from one's mother tongue may not allow the refugees to meet their academic potential (Cahan, Davis, & Staub, 2001; Frumkin, 2013; Ibragimova & Tarasova, 2018; Tunga, Engin, & Çağıltay, 2020), which in turn may cause delays in cognitive development (Parisi et al., 2012).

Challenging as it is to learn a new language for these disadvantaged children, some research has shown that learning a second language may enhance cognitive abilities (e.g., Bialystok & Craik, 2010; Bialystok, 2017; Kavé, Eyal, Shorek, & Cohen-Mansfield, 2008). Traditionally, it was posited that bilingual brains deactivate the non-target language to speak in the target language (e.g., Macnamara & Kushnir, 1971). However, both behavioural and neuroimaging studies later have shown that both languages of bilinguals are simultaneously activated regardless of what language they are using (Colomé, 2001; Marian & Spivey, 2003; Spivey & Marian, 1999; Thierry & Yan, 2007). This discovery suggests that the bilingual brain might have a system that allows the bilinguals to be able to speak in one language despite the activation of the other language at the same time. This led the researchers to investigate whether this constant language control could offer any advantages in domain general mechanisms.

Some of the studies investigating the relationship between bilingualism and non-linguistic abilities favoured bilingual advantage in WM (Asadollahpour, Baghban, Mirbalochzehi, Naderifar, & Tahmasebi, 2015; Blom, Küntay, Messer, Verhagen, & Leseman, 2014), shifting (Bialystok & Viswanathan, 2009; Prior & Macwhinney, 2010), IC (see Bialystok, Craik, Green, & Gollan, 2009, for a review; Blumenfeld & Marian, 2013) and fluid intelligence (Daller & Ongun, 2018; Sadighi & Yamini, 2011; Yousefi, Soleymani, & Ghazanfariyanpour, 2018). However, not all researchers' were able conclude the same (e.g., Antón, Carreiras, & Duñabeitia, 2019; for e review, see Paap, Johnson, & Sawi, 2015). Not being able to find a difference between monolingual and bilingual college students, Paap, Anders-Jefferson, Mason, Alvarado and Zimiga (2018) pointed to the paucity of studies finding a bilingual advantage and suggested that bilingualism might be a task-specific language processing system.

Overall, although whether being a bilingual offers advantages or not remains controversial (Grote, Scott, & Gilger, 2021; Daubert & Ramani, 2019; cf., Nichols, Wild, Stojanoski, Battista, & Owen, 2020; Paap & Greenberg, 2013; Samuel, Roehr-Brackin, Pak, & Kim, 2018), it remains a tantalising possibility that second language learning could provide children with a "protective factor" that enhances skills that are known to be important in later life.

Thus, it is important to understand how development proceeds in displaced children who have to learn new languages, and who arrive in a new country at a younger age. For instance, does immersive education in a Turkish language school promote strong Turkish language development and compensate for the cognitive damage caused by displacement? Or does the detrimental effect of war experiences outweigh the advantages that may be offered by bilingualism? To answer this question, we focus on Syrian refugee children who were displaced from their countries to a country with a different language (i.e., Turkish rather than Arabic) at the mean age of 4;5, where periods of social, linguistic and cognitive development are still in progress (Bates et al., 1994; Huizinga & Van Der Molen, 2007; Luciana & Nelson, 2002; Rothbart, 1989;Sameroff & Haith, 1996; Wellman, Cross, & Watson, 2010). We investigate their cognitive abilities and language competence both in their heritage and the majority language. We compare their development to two other groups of children: Non-refugee Turkish monolinguals and non-refugee children from Turkey's Antakya region, who are Turkish – Arabic bilinguals. In both cases, these groups had a low-SES profile.

The findings will provide an initial evidence base for clinical scientists, educators, and policy makers in the way of creating more effective curriculums, or educational policies. The results will also enable us to test theoretical claims about how bilingualism affects cognitive control abilities and how exposure to a new language influence cognition in the context of refugee status. The research thus sets the stage for both social impact, on the 1.2 million refugee children in Turkey, and for scientific impact in the study of bilingual development.

Data presented here is very precious for including two very rare populations: Antakian bilinguals and bilingual Syrian refugees speaking the same language pairs. Although school-age children are encouraged and obliged to go to school, some children are unable to attend the school for not being registered in the city they live in and some have to work to contribute to family finances (Mutlu, Kırımsoy, & Antakyalıoğlu, 2016). The Syrian refugee children who are both enrolled in schools and can speak Turkish is small in number for not all the refugee children are able to enrol into Turkish state schools (Sirin & Rogers-Sirin, 2015). Regarding the non-refugee Arabic-Turkish bilingual group in the present study, fewer families teach Arabic to their children and the number of Arabic speakers in Hatay region decreases with every younger generation (Yıldırım, 2020). Speakers of Arabic in the region are usually the middle aged and older individuals since fewer families transmit the heritage language to the following generation. Moreover, both samples are comparable since they come from similar SES and cultural background. For these reasons, the non-refugee groups in our study constitute a very valuable and a reliable comparison group for the refugee children.

Cross-linguistic similarities and differences may affect the language learning process (e.g., easier language learning process when language pairs are similar) (Ringbom, 2006). However, the bilingual groups in the current study do not match only on the languages they speak (i.e., Arabic vs Turkish), but also on the dialect of the same language (i.e., Levantine dialect of Arabic). One other criticism to bilingual advantage/disadvantage stems from the discrepancy caused by imperfectly matched sample groups. The methods of the current study address this problem by recruiting the participants who match on age, mother education and spoken languages.

Having an understanding of linguistic abilities of children with dual language background and factors playing a role in the development of these abilities will provide us with the means to optimize their learning environment. The results will also enable us to test theoretical claims about how bilingualism affects cognitive control abilities.

The aims and the significance of the present study have been introduced in the present chapter. In the second chapter, the literature review focusing on the fluid intelligence, executive functions assessed in the current study (namely, working memory, shifting ability and inhibitory control), Theory of Mind and language abilities (on vocabulary and narrative aspects) will be covered along with their relation to war traumas, social and educational background and bilingualism. It will end with the statement of the hypotheses of the present study. In the third chapter, methodology of the current study will be explained in detail with the description of the sample and the tasks.

CHAPTER 2

LITERATURE REVIEW

This chapter aims to introduce the effect of bilingualism, early childhood stress and trauma, and individual differences on cognitive and linguistic abilities. The possible relationships between these variables are discussed in the light of previous research on them. This chapter ends with the statement of research questions and the hypotheses of the present study.

2.1. Cognitive Abilities in Bilingualism

Executive function (EF) is an umbrella term used to refer to cognitive processes including working memory, inhibitory control and shifting ability that are responsible for purposeful, goal-oriented activity enabling physical, cognitive and emotional self-control (Corbett et al., 2009; Lezak, 1995; Pennington & Ozonoff, 1996). EFs, measured both in childhood and later years, predicts life achievements, academic success, occupation, physical and mental health, social development (Batty, Deary, & Gottfredson, 2007; Fong & Iarocci, 2020; Strenze, 2007). A growing body of research has also demonstrated that EFs are essential for the individuals’ social adaptation (Romero-López, Pichardo, Ingoglia, & Justicia, 2018), self-regulation (González, Fuentes, Carranza, & Estévez, 2001), mental health (Penadés et al., 2007; Taylor Tavares et al., 2007), physical health (Will Crescioni et al., 2011; Miller, Barnes, & Beaver, 2011) and academic achievement (De Franchis et al., 2017; Sasser et al., 2015). Some findings even suggest that EF performances contribute similar (Brydges, Reid, Fox, & Anderson, 2012) or even higher unique variance than IQ scores as implications for learning (Cain et al., 2004; Tsubomi & Watanabe, 2017).

For decades, many researchers have studied the relationship between EFs and bilingualism; however, they have failed to meet on common grounds up until now (Adesope, Lavin, Thompson, & Ungerleider, 2010; Hilchey & Klein, 2011; Poarch & Krott, 2019). Cox et al. (2016) likens the intertwined relationship between bilingualism and cognitive abilities to “which came first, chicken or egg?” dilemma; does bilingualism come with cognitive advantages or differences in cognitive functioning allow some to become bilinguals? The cryptic relationship between bilingualism and EF is understandable, when we consider that there is no definition of “bilingualism” that is agreed on and shared by all researchers. Bloomfield (1933) defines bilingualism as having “native-like” control over two languages, while to Oestreicher, (1974:9) it is “complete mastery of two different languages without interference between the two linguistic process”. According to Brice and Brice (2009), it is “the ability to speak, read and/or write in more than one language with varying degrees of proficiency”. In definition of Grosjean (2010) it is having sufficient competence of two languages in daily use. Grojean’s (2010) definition of bilingualism as “communicative competence” is adopted in this study since the systematic input starts only after schooling, and language learning process is born out of the need for communication for the Syrian refugees – the focus group of this study.

Bilingualism has not only been defined in different ways but also been classified under different categories mainly depending on the onset age of acquisition (AoA) and order of acquisition (e.g., early vs late bilingualism, simultaneous vs sequential bilingualism). Acquisition of two languages from birth till puberty is referred to as “early bilingualism”. Usually, the development of one language starts later than the other one in refugee populations, which makes them sequential bilinguals (Ray-Subramanian, 2011; Tabors, 1997). Their exposure to majority language (i.e., language spoken by the majority of the population in a region or a country) starts on the arrival to host country. Thus, the age they were at when they arrived in the resettled country is taken as their AoA in this study (Montrul, 2008). As for the minorities, the language they speak at home differs from the majority language of the country, while both the heritage language and the majority language may be used in a mixture at the minority house, allowing children to become simultaneous bilinguals from birth.

Traditionally, it was assumed that coexistence of two distinct sets of lexicon and syntax drained mental energy and confused bilinguals, which later negatively affected their psychological and intellectual abilities (e.g., Fernandez & Nielsen, 1986; Jones & Stewart, 1951; Saer, 1923). However, the tests used in the past studies suggesting a monolingual superiority over bilinguals were either not standardised or the groups were not truly matched for their demographic backgrounds (Peal & Lambert, 1962). It was later posited that the bilinguals can activate the target language and deactivate the non-target one in monolingual context (e.g., Macnamara & Kushnir, 1971). However, the following studies rebutted this claim and evidenced that both languages of bilinguals, regardless of the one being used at the time of speaking, are simultaneously active (Colomé, 2001; De Groot et al., 2000; Dijkstra et al., 1999; Daan Hermans et al., 1998; Van Hell & Dijkstra, 2002). This simultaneous activation may create a competition between the languages in the bilingual brain (Marian & Spivey, 2003a) and challenging this competition in daily social contexts may bring advantages on cognitive abilities (Bialystok, 1999; Bialystok et al., 2004; Bialystok et al., 2006; Bialystok et al., 2008; Pereira et al., 2007; for a review, Adesope et al., 2010; cf., Kousaie & Phillips, 2012; Nichols et al., 2020; Paap et al., 2015; Paap et al., 2017; Paap et al., 2018).

Some researchers stated that the divergent findings in the literature are unsurprising and expected as both EFs and bilingualism are complex structures consisting of varying levels (Valian, 2015; Yang et al., 2016). Indeed, there is no one technique for the assessment of neither the language nor the cognitive abilities (Poarch & Krott, 2019). Moreover, given that the sample sizes and subject profiles are not the same across the studies, the discrepancy in the literature is inevitable (von Bastian, Souza, & Gade, 2016). Thus, it is vital to take the assessment methods, subjects’ level of proficiency in both languages and the age of acquisition into account while interpreting the results.

The following subsections present findings from studies investigating the effect of bilingualism on cognitive abilities (i.e., fluid intelligence, abstract reasoning, working memory, shifting ability, inhibitory control, and theory of mind) and language skills (i.e., receptive and expressive vocabulary, and production and comprehension of narratives) tested in this study in detail.

2.1.1. Working Memory

Working memory (WM) is a component of short-term memory (STM). Although the information is stored for a short period of time both in STM and WM, WM deals with the manipulation of information while processing a complex cognitive task (Baddeley & Hitch, 1974). In his book, Goldstein (2011) highlights the importance of WM in everyday functioning. For example, to able to calculate 22 multiplied by 15 without using pencil and paper, we have to multiply 2 by 5 and store the product 10 to later proceed for the following calculation steps. To be able to take notes during a seminar for instance, we have to listen to the speaker and keep their words in mind as we keep writing. Storing or processing the information alone would not be enough to complete these tasks correctly; simultaneous inclusion of both systems is required for these mental activities to be carried out.

Some studies report that bilinguals exhibit more efficient WM abilities than monolinguals (Antón et al., 2019; Asadollahpour et al., 2015; Mehrani & Zabihi, 2017; Tsimpli et al., 2020) In Morales, Calvo and Bialystok (2013)'s study, bilinguals aged 5 – 7 outperformed monolinguals, and this advantage was more evident when the WM tasks contained other EF demands. A similar pattern was also observed for early (before the age of 4) sequential bilinguals too (Barbosa, Jiang, & Nicoladis, 2019). Blom et al. (2014) compared monolingual speakers of Dutch with sequential bilinguals of Turkish and Dutch, and found that despite the fact that the bilingual children come from a lower socioeconomic status (SES), they did not differ from the monolingual group on WM. This finding of no group effect on WM actually could be interpreted as an indicator of bilingual advantage taking into consideration that the bilingual group comes from a low SES profile. This interpretation was confirmed when WM gains were observed for bilingual children after the groups were controlled for SES and vocabulary measures.

Nonetheless, bilinguals did not always exhibit a better performance than monolinguals on WM tasks (Bialystok et al., 2008; Engel de Abreu, 2011; Namazi & Thordardottir, 2010). Differing levels of proficiency and balance between the language pairs may be the reasons for such a nuance (Swanson, Kong, & Petcu, 2018). Investigating this factor, Blom et al. (2014) observed that the bilingual children's language proficiency was a predictor of their WM performance (c.f., Gutiérrez-Clellen et al., 2004). Adding on this, Vejnovic, Milin and Zdravkovic (2010) suggested that effect of early language acquisition positively affects the WM. Active language use is considered to be another significant factor. For instance, in the context of Italian bilinguals, despite having less years of schooling, highly active bilinguals had better WM scores than less active bilinguals with longer schooling (Garraffa, Obregon, & Sorace, 2017). This suggests that active language use can compensate for the effects of lower educational background.

2.1.2. Inhibitory Control

Inhibitory control (IC) refers to the ability “to control one’s attention, behaviour, thoughts, and/or emotions to override a strong internal predisposition or external lure, and instead do what’s more appropriate or needed.” (Diamond, 2013, p. 137). As two languages are simultaneously active in bilingual brains , bilinguals’ ability to inhibit and control their languages and whether this ability offers advantages or not have long been discussed and investigated (for reviews see Kroll et al., 2014; Kroll et al., 2015).

Discovery of parallel activation has become a base for the proceeding studies. Taking into consideration that both language repertoires are active at the same time (Starreveld, Groot, Rossark, & Hell, 2014), to be able to control this activation and use one language at a time, bilingual speakers must control their languages by supressing/inhibiting the non-target language and focusing on the intended language (Rodriguez-Fornells et al., 2002). This mechanism can be explained by Inhibitory Control Model (Abutalebi & Green, 2007; Green, 1998), which relies on individuals’ ability to execute the target task by inhibiting other competitor tasks and stimuli. Individuals need this skill to complete both complex and simple daily tasks too. However, daily actions usually have stereotyped sequences within the equifinal alternatives, while this process is more complex for language production (Green & Abutalebi, 2013).

Considering the evidence for parallel language activation in bilinguals (e.g., Costa et al., 2000; De Groot et al., 2000; Thierry & Yan, 2007), more effort would be required of bilinguals to have good control over their both languages in addition to the cognitive control needed for daily tasks and language production (Green & Abutalebi, 2013). Jones et al. (2012) showed that there is a greater brain activation in functional magnetic resonance imaging (fMRI) for picture naming and reading aloud tasks in the native language of bilinguals relative to monolinguals. Greater activation being observable even in the tasks conducted in the native language of bilinguals suggests that bilinguals need to negotiate the activity of their languages by trying to suppress even the weaker language (Jones et al., 2012; Whitford & Luk, 2019).

Based on the dual activation hypothesis, it is possible to say that having to run two language systems, trying to decide which language to use and picking the relevant vocabulary by taking the interlocutor into account (e.g., what language does the interlocutor speak?) at the time of speaking may indeed require a higher mental agility and a stronger cognitive control. Research in which both young bilinguals (e.g., Bialystok, 1999; 2010; Bialystok et al., 2005; Qu et al., 2016) and older bilinguals (Bartolotti & Marian, 2012; Bialystok et al., 2004; Bialystok et al., 2005; Bialystok et al., 2008; Prior & Macwhinney, 2010) perform better and faster (Abreu et al., 2012) than the monolinguals in IC tasks gives countenance to this proposition. For example, Catalan-Spanish bilingual young adults, who were proficient and educated in both languages were faster and better than Spanish monolinguals at conflict resolution (Costa et al., 2008).

Although the findings of the work cited in the previous paragraph support the bilingual IC advantage, some studies fail to replicate the same results (Morton & Harper, 2007; for a review see Hilchey & Klein, 2011). Analysing the data from previous studies that conclude a bilingual advantage on IC, Paap and colleguages (2014) stated that the consistent findings in favour of bilingualism were absent for IC and an advantage was observable only in small sample sizes. Namazi and Thordardottir (2010) found no difference between the monolinguals' and bilinguals' performances on the Simon Task. They discuss that the reason for their findings being at odds with the bilingual advantage hypothesis is due to their highly homogenous simultaneous balanced bilingual participant profile. They add that the bilinguals (around age 5) on their study were exposed to two languages on a regular basis from birth, so the language control process was highly automatic and did not recruit controlled attention, whereas previous studies either examine sequential bilinguals or the bilingual sample in their study failed to form a homogeneous group (Namazi & Thordardottir, 2010).

In contrast to Namazi and Thordardottir (2010), it has been suggested that bilinguals with higher L2 proficiency have greater IC capacity, which makes it possible for them to become proficient in L2. Young bilingual adults who are proficient in their both languages are both faster and more accurate in IC tasks than the less-proficient bilinguals (Carlson & Meltzoff, 2008; Singh & Mishra, 2012; Thanissery et al., 2020). These might be because it requires more effort for proficient bilinguals to control their two languages. In other words, language proficiency increases the level of activation of both languages (Blumenfeld & Marian, 2007), and greater inhibition would be expected of them to control the languages. Early bilinguals who use their both languages actively showed smaller interference, while late and less proficient bilinguals performed similar to monolinguals in Luk et al. (2011) (see also Khodos and Moskovsky, 2020).

One cause for the inconsistencies in the literature has been suggested to be differing language contexts of tested bilinguals (Hartanto & Yang, 2016), which might also be the case in the present study. Adaptive control hypothesis (ACH; Green and Abutalebi, 2013) argues that bilinguals' language control process is shaped by their language contexts. Specifically, using one language at home and the other one at school/work/neighbourhood, etc. (i.e., single-language context) or switching between the languages depending on the interlocutor (i.e., dual-language context) or mixing two languages within an utterance (i.e., dense code-switching) would modulate the levels of control (Green & Abutalebi, 2013). Some studies observed the differences between switch cost and reaction time (RT) among bilinguals who differ in their language contexts, and lent support to ACH (e.g., Hartanto & Yang, 2016, Lai & O'Brien, 2020; Treffers-Daller et al., 2020). Conversely, Hofweber, Marinis and Treffers-Daller (2016) presented that dense-code switchers show a training effect and hold an advantage in IC because dense code-switching enhances conflict-monitoring.

2.1.3. Shifting Ability

Shifting ability, also referred to as *mental flexibility*, *cognitive shifting*, *mental set shifting*, *task switching/shifting*, and *attention switching/shifting*, is defined by Scott (1962) as “the readiness with which the person's concept system changes selectively in response to appropriate environmental stimuli; it is assessed by inviting the subject to expand the groups he has created on the original sorting task” or simply, it is the ability to shift between two or more than two competing mind-sets (Davidson, Amso, Anderson, & Diamond, 2006; Yeniad et al., 2014). Shifting ability is associated with children’s learning practices; thus, it is an important skill for school readiness (Vitiello, Greenfield, Munis, & George, 2011).

Several fMRI studies show that basal ganglia, dorsolateral PFC, and posterior parietal cortices are activated during the task-switching activities that require mental flexibility (e.g., Leber et al., 2008; Quiñones-Camacho et al., 2019). Some studies found engagement of the same regions during the language switch task performance of bilinguals too (Hernandez, Martinez, & Kohnert, 2000; Hernandez, Dapretto, Mazziotta, & Bookheimer, 2001). Bilinguals often mix or switch between their two languages based on the conditions of the context and the interlocutor (Heredia & Altarriba, 2001).

Can these interlingual switching habits of bilinguals expand further and offer them any advantages in non-linguistic shifting tasks? Garbin and colleagues' (2010) study answer this question positively: bilinguals in their study were observed to outperform the control groups in nonverbal shifting activities (see also Barac & Bialystok, 2012; Bialystok, 1999; Bialystok & Martin, 2004; Bialystok & Shapero, 2005; Carlson & Meltzoff, 2008; Karslı & Karakelle, 2018; Prior & Gollan, 2011). Several other findings suggested that the ability to shift between languages confers benefits on non-linguistic shifting tasks as well (Declerck et al., 2017; Gross & Kaushanskaya, 2016; Prior & Macwhinney, 2010). Nonetheless, some other studies found either weak or no bilingual advantage for non-verbal shifting task performance (Antón et al., 2014; Antón et al., 2019; Czapka & Festman, 2021; Haft et al., 2019; Prior & Gollan, 2013).

The individuals analysed under the label of “bilingual” vary in their level of proficiency and frequency of language use. For this reason, the language profiles and environments, and the switching frequency of the bilinguals and their relation to mental flexibility have also been analysed in the literature. Bilinguals with dual-language context (i.e., both languages are used with different speakers in the same context) have shown lower switching costs relative to bilinguals with single-language context (i.e., separate languages for different contexts) (Khodos, Moskovsky, & Paolini, 2021). This might be because dual-language bilinguals are trained to switch between their languages more frequently. Positive correlations were found between frequency of language-switch in daily life and cognitive shifting (Barbu et al., 2018; Barbu et al., 2020; Prior & Gollan, 2011). Besides language frequency and language context, earlier age of language acquisition and balanced bilingualism were also found to be significantly associated with better shifting abilities in non-verbal shifting tasks (Carlson & Meltzoff, 2008; Soveri et al., 2011; Vega and Fernandez, 2011; Yow & Li, 2015). Yudes et al.'s (2011) study added another dimension to this discussion, where experienced simultaneous interpreters showed better switching performance than fluent bilinguals did. Their finding suggest that experience plays a greater role than proficiency in the advancement of shifting. However, not all studies found significant effect of age of acquisition, L1 use at home (Czapka & Festman, 2021), language proficiency (Nicoladis et al., 2018; Timmermeister et al., 2020) or frequency of language use (Prior & Macwhinney, 2010) on tasks requiring shifting ability.

2.1.4. Fluid Intelligence

Traditional intelligence tests measured specific domains of cognition (e.g., mathematical, verbal, memory, etc.). The attained scores were limited to specific domains instead of general intellectual ability. Spearman (1904) proposed general intelligence theory also known as "g factor" and suggested that a basic level of g factor is needed for the success on overall performance on mental ability tests. Adding to that, Cattell (1963) suggested that general intelligence is a combination of learning the new and remembering the past experiences and it consists of two general factors: fluid and crystallised intelligence. Crystallised intelligence (*Gc*) is formed as a result of learning and recalling prior knowledge and since prior knowledge is a cumulative result of input offered by environment, it is influenced and shaped by culture and experience (Cattell, 1963). Gc can be assessed through remote associations (*What word is associated with bathtub, prize fighting, and wedding?*), esoteric analogies (*Socrates is to Aristotle as Sophocles is to* _____*?*) and vocabulary (*What is a word near in meaning to temerity?*) (Cavanaugh & Blanchard-Fields, 2010; Horn, 1982), whereas fluid intelligence (Gf) requires speed thinking, flexible reasoning, understanding and responding to any situation, especially new ones, and operating at the time of experiment or problem and is more culture-fair and is more suitable for multi-cultural/lingual contexts (Cattell, 1963; Cavanaugh & Blanchard-Fields, 2010; Horn, 1968). Puzzles, maze matrices, completion of number and letter series, figure classifications are examples of tasks that tap Gf.

Previous work illustrated positive effect of bilingualism on fluid intelligence tests for both young adults (Sadighi & Yamini, 2011) and children (Tsimpli et al., 2020), while some others showed no significant difference in fluid intelligence and abstract reasoning skills between bilingual and monolingual children (Bialystok & Shapero, 2005; Engel de Abreu et al., 2012; Morales et al., 2013; Paap & Greenberg, 2013). Adding on these findings, Bialystok et al. (2004) reported no difference between monolinguals' and bilinguals' Raven's scores neither in children or younger or older adults.

Comparison studies of monolinguals' and bilinguals' intelligence present conflicting results. Several studies analysed the relationship between intelligence and the language proficiency of bilinguals for both languages. For instance, in the study by Barik and Swain (1976) higher IQ was more observable in higher L2 achievers compared to lower L2 achievers. Daller and Ongun (2018) tested Turkish-English bilingual children who live in the UK for their vocabulary size and non-verbal intelligence, and she found a positive correlation between the children's vocabulary knowledge in both languages and their non-verbal IQ scores. Her findings also demonstrated that children whose families use more Turkish at home had higher non-verbal intelligence scores than both monolinguals and bilinguals whose parents do not use Turkish very often.

These findings indicate that dominancy of heritage language spoken at home supports the IQ.

2.1.5. Effect of Individual Differences on Cognitive Development

It would be misleading to compare participants solely by their linguistic and cognitive abilities. For the differences between the groups to be better understood, participant characteristics should be taken into account for a better interpretation of the results (Whitford & Luk, 2019). In the following sub-sections, previous research examining the effect socioeconomic background and years of education on linguistic and cognitive abilities are presented.

2.1.5.1. Socioeconomic Status and Cognitive Development

Socioeconomic status (SES), which is usually measured by the family income and maternal education level, is documented to be strongly associated with children's language and cognitive development (for a review see Whitehurst & Lonigan, 1998; Noble, Norman, & Farah, 2005). Parents are the first individuals that children open their eyes to, and they are the main source of children's linguistic input (Attig & Weinert, 2020; Sultana, Wong, & Purdy, 2020; Zimmerman et al., 2009). The quality of parent-child relationship is highly associated with household income and parental, especially maternal, education (Kong, Chen, Xue, Wang, & Liu, 2015; Rouchun, Zongkui, Shuailei, Qingqi, & Chen, 2021). Parents with higher levels of education and income provide higher quality and quantity of linguistic and cognitive input to their children: they play educative games, interact more, provide rich materials such as books and computers and afford good schools (APA, 2017; Farver, Xu, Lonigan, & Eppe, 2013; González-Betancor, López-Puig, & Cardenal, 2021; Weiland, McCoy, Grace, & Park, 2017). Therefore, children with high SES backgrounds develop better psychological (Gottfried, Gottfried, Bathurst, Guerin, & Parramore, 2014), academic (Anders, Grosse, Rossbach, Ebert, & Weinert, 2013; Kluczniok, Lehrl, Kuger, & Rossbach, 2013; Gottfried, Fleming, & Gottfried, 1998; Walker, Greenwood, Hart, & Carta, 1994), linguistic (Hart & Risley, 1995) and cognitive skills (for a review see Farah, 2017; Hackman, Farah, & Meaney, 2010; Noble, McCandliss, & Farah, 2007) compared to low-SES children.

Unfortunately, due to various reasons (e.g., language barrier, legal restrictions) many refugee families go through financial difficulties and live in poor environments in the country of resettlement (UNHCR, 2014; UN, 2014). As a result of uncertainty and adaptation period accompanied by monetary difficulties, they may develop distress and mental health problems (Gredebäck et al., 2021). These, in turn, may lead to harsh and inattentive parenting (Bryant et al., 2018). Growing in such a strain during childhood is shown to cause stress, which has detrimental effects on the brain and cognitive functioning (for a review see Blair & Raver, 2016). For the cases where parents do not suffer from mental health problems, children still may have poor access to good quality nutrition they need to grow and develop both physically and cognitively in low-SES houses (Lee & Jackson, 2017; for a review see Siddiqui, Salam, Lassi, & Das, 2020).

A large number of studies identified SES as a predictor for WM, IC and shifting of the individuals across a wide range of ages (Asadollahpour et al., 2015; Clark et al., 2013; Chevalère et al., 2022; Last, Lawson, Breiner, Steinberg, & Farah, 2018; Micalizzi, Brick, Flom, Ganiban, & Saudino, 2019; Suárez-Orozco & Suárez-Orozco, 2015; Suor, Sturge-Apple, & Skibo, 2017; Theodoraki, McGeown, Rhodes, & MacPherson, 2020). Therefore, it is highly crucial that SES is taken into consideration while studying individuals' cognitive abilities (Aartsen, Smits, van Tilburg, Knipscheer, & Deeg, 2002; Cascio, Lauharatanahirun, Lawson, Farah, & Falk, 2022).

Richer and healthier nutrition promotes neurocognitive development (Liu & Raine, 2017). Fluid intelligence, specifically, is vulnerable to malnutrition and household income is a determinant of food accessibility (Huang et al., 2021; Lynn, 1990). Wachs and McCabe (2001) also showed that mothers with higher education were making healthier dietary choices, and thus, children with more educated mothers had better nutrition intake. This was also the case for the pregnant women; more educated mothers had more nutritional knowledge (Abdul Manaf et al., 2014; Cheng, Dibley, Zhang, Zeng, & Yan, 2009).

When the relationship between SES and EFs is investigated in trauma context, some studies found SES to be even a stronger predictor for cognitive abilities than trauma itself (Chen et al., 2019; Lambert et al., 2016; Sheridan et al., 2017). Assari (2020) proposes that SES might even have a healing effect on the after effects of trauma. As for the SES and EF relationship in bilingual context, Abreu et al (2012) tested 40 young immigrant children challenged by poverty, and compared them against 40 matched monolingual children (both groups living in Europe) for their language and cognitive abilities. Based on the evidence on the adverse effects of low-SES on cognitive development in the literature, we would expect bilingual children to outperform their monolingual peers with higher SES. However, even though the bilinguals in Abreu and friends' (2012) study scored lower in vocabulary tests, they were able to outperform the monolingual participants in IC tasks. Engel de Abreu et al. (2012) attribute the success of the children with lower SES to their bilingual profile and suggest that bilingualism might "provide protection against the adverse cognitive effects that are associated with poverty".

2.1.5.2. Role of Schooling in Cognitive Development

School is the first place children step their foot out of their houses, where they interact with their peers and get involved in intellectually demanding activities. Children have to follow some set of rules, take responsibilities, build new friendships, and complete the assigned tasks at school. They also get involved in intellectually and cognitively demanding activities by attending lessons, and supressing and inhibiting the distractors surrounding them to be fully engaged (Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008). Thus, those who attend school participate in more intellectual and cognitively demanding activities compared to those who do not go to school (Parisi et al., 2012). As a result, more years of schooling leads to an enhanced intellectual, linguistic and cognitive development (Albert et al., 1995; Boocock, 1995; Tickell, 2011; Kim, 2015), such that it may even offer benefits for low-SES children (Heckman, 2006).

Several studies suggested that the individuals with higher years of formal education perform better on WM tasks (Ainamani et al., 2017; Chen et al., 2019; Reis, Guerreiro, & Petersson, 2003) even at an old age, suggesting that duration of education has a long-term effect on WM (Souza-Talarico, Caramelli, Nitrini, & Chaves, 2007). The enhancing effect of schooling was also observed for IC (McKay, Wijeakumar, Rafetseder, & Shing, 2021), and shifting too (Yeniad et al., 2014; cf., Lowe, 1999).

Fluid intelligence, developing with brain maturation, differs from the EF components as there is a common argument that it is a more robust hereditary ability and less dependent on schooling (Baltes, Staudinger, & Lindenberger, 1999; Gray & Thompson, 2004; Valentin Kvist & Gustafsson, 2008). However, Jaeggi, Buschkuehl, Jonides and Perrig (2008) showed that merits gained from WM trainings can be transferred to fluid intelligence. Although Jaeggi et al.'s (2008) study seems promising for especially educational settings (Sternberg, 2008), Watrin, Hülür and Wilhelm (2022) failed to replicate the same outcomes even after 2 years of WM training.

Schooling is usually interrupted in conflict affected areas during the war (Ahmadzadeh et al., 2014), and for this reason, refugee children who are resettled in a host country are likely to have less knowledge and skills than expected for the grade level their age falls into (Dryden-Peterson, 2015). As a result, they attend to grades lower than their age. In these age-heterogeneous classes, refugee children try to adjust to a new culture and learn the language of the host country while trying to catch up with their peers in the school (Jimerson & Ferguson, 2007). This could be overwhelming for the students. For instance, being over-age by 2 or more years was found to be associated with dropping out with students in Malawi (Sunny et al., 2017), and similarly, children in Mozambique who were over-age at school entry had weaker school performance, higher rates of drop-out and retention (i.e., grade repetition) (Wils, 2004).

An age-homogeneous class is characterised by the children of same age studying in the same grade level in the school. Children who study in an age-heterogeneous class (i.e., with peers of different age groups) may feel left out and experience social isolation. Besides educational outcomes, higher or lower age for grade is an indicator cognitive abilities. Challenging and enriched learning environments boost EF in children (Diamond & Lee, 2011); however, students in grades lower than their age receive education that targets to improve skills that are below their cognitive capacity. Syrian refugee children who attend to a grade with peers younger than them (i.e., higher age-for-grade) in Lebanon showing poorer performance on the WM task and having slower IC reaction time is a supporting evidence for detrimental effects of higher age-for-grade (Kim et al., 2020).

2.3. How do Trauma and Stress Affect Cognitive Development?

Even today, wars affect millions of people and forces them to seek asylum outside their countries. War-related traumatic experiences include loss of or separation from family members or friends, experiencing or witnessing violence, destruction of home, shelling, rape, torture, death threats, bombings, kidnapping, poverty, and displacement. Individuals may develop PTSD and mental health problems after detrimental experiences during wars and conflicts, which in the end may exceed their ability to cope with its effects (Hasanovic, 2011; Sack, Clarke, & Seeley, 1996; Ibrahim & Hassan, 2017; Smith, Perrin, Yule, Hacam, & Stuvland, 2002). Impacts of such experiences in childhood persist well into adulthood and lead to higher chances of financial strain (Henry, Fulco, & Merrick, 2018; Sansone, Leung, & Wiederman, 2012), involvement in crime (Widom & White, 1997), problems in social relations (Horwitz, Widom, McLaughlin, & White, 2001; Luntz, Barbara K., Widom, 1994; Schilling, Aseltine, & Gore, 2007), and poorer physical health (Beilharz et al., 2020; Shonkoff et al., 2012; Widom & White, 1997).

The aftermath of war remains to be stressful even after resettlement in a new country as, in fact; it is the beginning of another challenging journey. In this journey in the host country, refugee children encounter several problems that may cause excessive stress on the refugee children: poverty, unhygienic house conditions, social integration difficulties, language barrier, discrimination (Flores, Tschann, Dimas, Pasch, & de Groat, 2010; Cutler, 2016; Hadfield et al., 2017; Şafak-Ayvazoğlu, Kunuroglu, & Yağmur, 2021; Tummala-Narra & Claudius, 2013; UNHCR, 2018). At some cases, children may be too young to recall the traumatic events and thus may not be direct subjects of the trauma; however, the existing stress, depression and anxiety of the parents may decrease their level of attentivity, availability and social support to meet the needs of the child (Rizkalla et al., 2020).

Cumulative effect of both pre- and post-migration experiences challenge the developing brain, cause a decrease in the volume of hippocampus, and affect PFC area negatively (Bick & Nelson, 2016; Campbell & MacQueen, 2004; De Bellis et al., 1999; Richert, Carrion, Karchemskiy, & Reiss, 2006; for a review see Smith, 2005). These regions host higher-order functions (Miller & Wallis, 2009; Moriguchi & Hiraki, 2009; Moriguchi & Hiraki, 2013). This suggests that harm in PFC for instance, may be reflected on the cognitive development of the individuals negatively (Ainamani, Elbert, Olema, & Hecker, 2017; Beers & De Bellis, 2002; De Bellis, Keshavan, Spencer, & Hall, 2000; Vasterling, Constans, Brailey, & Sutker, 1998; Ewing-Cobbs, Prasad, Landry, Kramer, & DeLeon, 2004; Otte et al., 2015).

In their study where they measured EFs of 10-year-old children, DePrince, Weinzierl and Combs (2009) showed that children who were exposed to traumatic experiences performed poorly on their WM and IC abilities regardless of type of trauma even after controlling for SES. Their findings were parallel to several other findings evidencing the relationship between adverse experiences and impoverished WM and IC (Blanchette & Caparos, 2016; Majer, Nater, Lin, Capuron, & Reeves, 2010; Marshall et al., 2016; Schweizer & Dalgleish, 2011; Vasterling et al., 1998). Though not consistent, (DePrince et al., 2009; Dolan et al., 2012; Zakzanis, Leach, & Kaplan, 1998), a similar pattern was observed also for shifting ability (Pang et al., 2014; Pang, 2015; Simmons, Strigo, Matthews, Paulus, & Stein, 2009; Tuula Ilonen, Kirsi-marja Leinonen, 2000) and performance intelligence tasks (Barrera-Valencia, Calderón-Delgado, Trejos-Castillo, & O'Boyle, 2017; Vasterling et al., 2002).

Furthermore, Gabrys, Dixon, and Anisman (2017) could find no association between trauma and shifting ability for university students who reported having experienced trauma at the age of 6 and older, while the ones reporting adverse experiences prior to age of 5 had more difficulty in shifting task. This study underscores that the age of exposure to adverse experiences at a developmentally earlier stage might bear more severe cognitive outcomes than at later stages (see also, Knyazev & Slobodskaya, 2003; Loman & Gunnar, 2010; Sack et al., 1996; Skowron, Cipriano-Essel, Gatzke-Kopp, Teti, & Ammerman, 2014).

2.4. Language Abilities

2.4.1. Vocabulary Knowledge

Vocabulary knowledge is one of the essentials in a language that enables children to comprehend and produce sentences (Dong, Tang, Chow, Wang, & Dong, 2020; Lervåg & Aukrust, 2010; Ouellette, 2006). Past research suggests that lexical knowledge also predicts children's grammar development (Bates & Goodman, 1999) and literacy skills (Tabors, Páez, & López, 2003; Wilsenach, 2015). Vocabulary size is also a predictor of both language development, investigation of which provides the researchers with some insight as to children's development (Koenig, Arunachalam, & Saudino, 2020; Lyytinen, Eklund, & Lyytinen, 2005; Whitehurst & Lonigan, 1998; for a review see, Rescorla, 2011).

Monolinguals and bilinguals have been compared for their vocabulary knowledge by many researchers. In series of studies, young monolingual children obtained higher scores than bilinguals on both receptive (Bialystok & Shapero, 2005; Martin-Rhee & Bialystok, 2008; Morales et al., 2013) and expressive (Carlson & Meltzoff, 2008; Gross et al., 2014; Hemsley et al., 2010) vocabulary tests. The monolingual college students in the study conducted by Bialystok and colleagues (2008) performed significantly better in English vocabulary tasks than their bilingual counterparts who were educated in English, but speak another language at home. In the 3-year longitudinal study they conducted with 6 year-olds, Pascale and de Abreu (2011) observed that monolingual children outperformed simultaneous bilingual children in the expressive vocabulary test in the majority language. These findings, as well as other parallel findings (Abreu et al., 2012; Bialystok & Feng, 2009; Bialystok & Luk, 2012; Portocarrero et al., 2007) might be surprising after the aforementioned bilingual advantages in various cognitive domains; however, it has been suggested that the monolinguals might be surpassing bilinguals owing to a larger family input in their L1 (Leseman, 2000) and enhancement of this input by the social circle and school (Dixon et al., 2012; Lin & Johnson, 2016), whereas bilinguals have to distribute their learning time across the two languages (Bialystok, Luk, Peets, & Yang, 2010). Distribution of the time results in distribution also in the vocabulary size across the languages (Oller, Pearson, & Cobo-Lewis, 2007). Another suggestion is that bilinguals may be suffering from the conflict and competition between the representations coming from two languages (Dann Hermans et al., 1998; Gollan et al., 2005) which might be stemming from bilingual processing cost (Gollan, Fennema-Notestine, Montoya, & Jernigan, 2007).

With the majority of the findings converging on monolingual advantage in vocabulary capacity, the focus of the research has been drawn on the roles of different avenues affecting the vocabulary capacity of bilinguals. Children with consistent exposure to a language show advantages in that language (Hammer et al., 2012; Mancilla-Martinez & Lesaux, 2011). In other words, language development is in direct proportion to language input (V. C. M. Gathercole & Thomas, 2009). As home is the first source available to the children, the language (i.e., heritage or majority language) spoken at home plays a crucial role in the vocabulary development (Umbel, Pearson, Fernandez, & Oller, 1992). For instance, Turkish-English bilingual children who live in the UK and whose parents use more Turkish at home had greater vocabulary size in Turkish than the children whose parents do not use Turkish as often as them (Ongun, 2018). Similarly, Turkish-Swedish and German-Swedish bilingual children whose parents and siblings spoke only or mainly in the home language, had significantly higher scores in expressive vocabulary in their heritage language (Bohnacker, Lindgren, & Öztekin, 2016). 6-7 year-old French-English bilinguals who were reported to use both languages equally on daily basis, matched monolingual speakers of English receptive vocabulary test and they had similar scores on their two languages (Morton & Harper, 2007).

Other studies also present similar findings, suggesting that use of heritage language at home has a positive effect on maintenance of the heredity language vocabulary, whereas the use of community language at home decreases the vocabulary size in heredity language (De Houwer, 2007; Dixon et al., 2012; Scheffner Hammer et al., 2008). Considering the amount of the time school age children spend their days in the classrooms, school is another major source of language input after home. Usually, the language of instruction is different from the one spoken at home for minorities, immigrants and refugees. Schooling plays an important role in the development of L2 vocabulary (Schwartz & Katzir, 2012). When the formal language is different from the one spoken at home, a shift of language dominancy from home language to school language can be observed (Kohnert & Bates, 2002). That is, children obtain higher vocabulary scores in majority language, but perform significantly lower in their home language after exposure to immersed in the majority language (Fillmore, 1991; Gibson et al., 2012; Hammer et al., 2008; Kan & Kohnert, 2005; Oller et al., 2007) and this difference between the languages become more evident as the systematic L2 exposure at school increases (Kohnert & Bates, 2002). Thus, Duursma and colleguages' (2007) highlight that the use of majority language at home is not required for the proficiency of children in that language, but the vocabulary development of ethnic language is dependent on home support.

The age of arrival and the length of residence in the host country is another determinant of community language vocabulary for the sequential bilinguals who are born in a country other than the one where community language is spoken (Jia & Aaronson, 2003; McDonald, 2006) . Bilinguals who arrived in the U.S. at the age of 9 or earlier had significantly higher scores for both receptive and expressive vocabulary subtests than those who arrived at later ages (Portocarrero et al., 2007). Mori and Calder (2013) investigated the vocabulary abilities of bilingual Japanese students who attend to Japanese-medium supplementary high-schools in the U.S., and found high correlations between age of arrival and vocabulary size in the language of host country. While the L1 Japanese participants who arrived in the U.S. before the age of 9 developed good L2 vocabulary at the cost of diminished L1, those whose age of arrival was above 9 could maintain their L1vocabulary with grade-level equivalent vocabulary in L2 (Mori & Calder, 2013). This may suggest that a later age of arrival may be beneficial for the heritage language, but disadvantageous for the majority language.

However, despite the decrease in the heritage language and increase in the language of formal education, some studies found that bilinguals still lag behind the monolinguals in vocabulary skills in the language of instruction (Leseman, 2000; Mancilla-Martinez & Lesaux, 2011; Verhallen & Schoonen, 1998), and even when bilingual children can level up to monolinguals in receptive vocabulary skills, they fail to do so for expressive vocabulary (Mieszkowska et al., 2017). As a result, they fall behind the monolingual speakers of both languages (Barbosa et al., 2019).

As observed for cognitive abilities, SES plays a significant role on children's vocabulary size regardless of their language status (monolingual or bilingual) too (Hemsley et al., 2010; Lee & Jackson, 2017; Leseman, 2000). For instance, in their longitudinal study, Hart and Risley (2003) measured vocabulary size of children first when they were 7 – 9 months old. They re-tested these children when they reached 3 years old, and those with low family income and parental education had access to 30 million fewer words than those with higher SES (Hart & Risley, 2003). Investigating the relationship between parental education and child's vocabulary size in more detail, Özkara (2014), found that maternal education rather than father education was a significant predictor for children's vocabulary growth, and this was the case for both bilingual and monolingual groups. It is usually the mothers spending more time with the children, and mothers' vocabulary size – which is highly correlated with years of education – affects children's vocabulary growth (Schady, 2011).

2.5. The Present Study

The main aim of the present study is to investigate the cognitive and linguistic abilities of Syrian refugee children living in Turkey and whether their bilingual status act as a protective factor against the detrimental effects of traumatic war experiences on these abilities. We analyse cognitive (i.e., WM, shifting, IC, fluid intelligence) and linguistic (i.e., Turkish and Arabic vocabulary) abilities of displaced Syrian children in comparison to two non-refugee control groups living in Turkey: simultaneously bilingual Arabic-Turkish minority children and Turkish monolingual children. If bilingual advantage hypothesis holds true and refugee children perform poorer than minority bilinguals, one may think that learning Turkish did not enhance cognitive abilities of Syrian children at all. However, including one more control group (i.e., Turkish monolingual children) would lead to a healthier evaluation even if the bilingual hypothesis holds true.

9.0 – 10.0 year old (± 7 months) children participated in the study so that Syrian children could have at least one year of schooling. Two main things were targeted with this age group: i) observing the cognitive effects of war related experiences in early childhood period ii) effect of exposure to systematic Turkish immersion on Syrian refugee children.

It was hypothesised that displaced Syrian refugee children would lag behind their peers in the control groups both in cognitive and linguistic measures, mainly due to their pre- and post-arrival experiences. However, based on the past research presented in 2.1., the gap between low-SES monolinguals and low-SES Syrian refugees was expected to be smaller compared to that of between non-refugee bilinguals and Syrian refugees.

CHAPTER 3

METHOD

The current chapter introduces the research methodology. Relevant details of the participants, participant recruitment procedure, measures and testing procedure are supplied under separate sub-sections. The main aim of the present study is stated in the end of this section.

The study protocol was approved by Middle East Technical University Human Research Ethics Committee and the parents of the children signed a consent form before participating in the study.

3.1. Participants

We tested 25 Arabic-Turkish bilingual Syrian refugees who live in Turkey (henceforth Syrian group, M_{age} = 9.51, *SD* = 0.36, 17 girls) and two control groups consisting of 30 Arabic-Turkish non-refugee bilinguals (henceforth Antakian group, M_{age} = 9.45, *SD* = 0.43, 13 girls) and 20 non-refugee Turkish monolinguals (henceforth Monolingual group, M_{age} = 9.54, *SD* = 0.46, 11 girls). These 74 children attended Turkish state schools.

3.1.1. Syrian Group

Families were recruited via the Association for Solidarity with Asylum Seekers and Migrants (ASAM) in Ankara and Gaziantep. 72% of the Syrian children were tested at ASAM offices while 28% of them were tested in their houses in Antakya and Ankara. The time since arrival in Turkey ranged between 1 and 7.5 years (*M* = 5.40; *SD* = 1.86)[1]. Number of years of schooling ranged from 1 to 4 for Syrian group (*M* = 2.76, *SD* = 0.83).

Syrian children were recruited for the study if the caregivers reported that the children were able to speak Turkish and if they were registered in a Turkish state school. All parents were monolingual speakers of Arabic. Although systematic exposure to Turkish starts with schooling, language onset is taken as the arrival to Turkey since children start hearing Turkish on television, from their neighbourhoods or older

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[1] As the there was a big gap in range of their years of stay in Turkey, we re-analysed our data by removing the children who stayed for less than 3 years in Turkey (*N* = 3). Yet, the results did not change, so we kept the range for years of stay in Turkey as 1 – 7.5.

siblings. Refugee families spoke no additional language (e.g., Turkmen, Kurdish) at home. All parents reported Arabic to be their children's dominant language.

3.1.2. Antakian Group

The children in this group are Arab descent Turkish citizens who constitute the third largest ethnic minority group residing in Turkey (KONDA, 2006), and the onset of bilingualism starts from birth for this group. Sharing borders with Syria, Antakya[2] is the southernmost city in Turkey and is home for the majority of this minority group. We visited villages populated by Arabic speaking minorities and contacted the local authorities and the teachers in Antakya to reach bilingual children. All children in this group were tested through home visits by the first author of this paper. Both Arabic (North Levantine Dialect) and Turkish are spoken as home language. However, children received education only in Turkish language for around 4 years (*Range* = 3-5, *SD* = 0.64), and all parents reported that use of Turkish was more frequent than Arabic, and that Turkish was their children's dominant language.

The family attitude towards the use of Arabic in Antakya differs from family to family. Some families reported that the use of Arabic at home cause the children encounter more difficulties at school. They added that their children might get confused when they go to school, and they may not have a "native like" accent in Turkish. Parents who do not want their children's Arabic to affect their accent while speaking Turkish avoid speaking Arabic at home. Those who encourage their children to speak Arabic stressed the importance of the maintenance of their ethnic identity. They stated that they do not want their children to lose connection with their grandparents.

3.1.3. Monolingual Group

We recruited monolingual Turkish children through personal contact and local authorities in Ankara. We tested all of them through home visits. Turkish was the language of instruction (*M* = 3.75, Range = 3-5, *SD* = 0.85), and was the only language spoken at home. 37 children were tested in total, but we removed data from 16, who were diagnosed as gifted or had high-school graduate mothers, as these factors would make it difficult to compare the groups.

3.2. Measures and Procedure

In this section, the materials used to assess cognitive and language abilities of children are introduced one by one. After the introduction of the tasks, the administration procedure and scoring criteria are explained.

Caretakers orally answered the questions addressing participant demographics (Table 1) and traumatic experiences (Table 2). After the questionnaire, participants completed

[2] The historical ancient name Antakya (Antioch) will be used to refer to today's Hatay province.

tasks assessing cognitive and language development. We used a series of tests measuring executive functions. We used a backward digit-span task for WM, Berg's card sorting test (BCST; Mueller, 2013) for shifting ability, a happy-sad task (Lagattuta, Sayfan and Monsour, 2011) for inhibitory control, and Raven's Coloured Progressive Matrices to measure fluid intelligence. To measure vocabulary, we used the Turkish Expressive and Receptive Language Test (TIFALDI) and its Arabic adaptation.

A Turkish monolingual experimenter administered Raven's Coloured Progressive Matrices and Turkish vocabulary tests for the Syrian group only. A bilingual experimenter, also the author of this paper, is a bilingual speaker of Arabic (Levantine dialect spoken in Antakya) and Turkish, administered the remaining tests for all groups and provided both Arabic and Turkish instructions to Syrian group before each task.

3.2.1. Caretaker Questionnaire

We took maternal education and poverty index as the SES measure. None of the mothers in Syrian, Antakian and monolingual groups were university graduates. Mothers in Syrian group received between 0 and 12 years of education, mothers in Antakian group received 5 to 8 years of education, and monolingual mothers' years of education ranged from 0 to 11.

The poverty index is a measure of income adjusted for family size, which varied over a large range here, from 3 to 13 people. We calculated poverty index as the difference between monthly family income and the breadline, the minimum amount of income required for a family to be able to afford enough food to live a healthy life. Approximate amount of daily calorie intake per person stated by World Health Organisation (WHO) is taken into account while calculating the breadline (Confederation of Turkish Trade Unions, 2019, 2020, and 2021). Participants' overall individual characteristics are presented in Table 1.

Table 1: *Individual characteristics of the participants by groups.*

	Groups		
	Syria	Antakya	Monolingual
N	25	30	20
Boys/Girls	8/17	17/13	9/11
Age range	8.92-10.25	8.50-10.33	8.83-10.58
Age in years	9.51 (0.36)	9.45 (0.43)	9.54 (0.62)
Child education	2.76 (0.83)	4 (0.64)	3.75 (0.85)
Kindergarten	.32 (.08)	.97 (.08)	.68 (.09)
Grade level	3.16 (.14)	4 (.12)	3.75 (.15)
Maternal education	5.28 (3.66)	5.80 (1.35)	6.40 (2.33)
Poverty index	-3949.04 (1473.70)	-686.32 (966.37)	-243.10 (1406.44)

*Notes. SD*s are shown in parentheses.

We measured children's traumatic experiences and somatic responses in a nine-question trauma index questionnaire. The questions were developed in consultation with the psychologists working with refugee populations at ASAM, and are listed in Table 2. They probed particular traumatic experiences (e.g., losing a family member) and somatic responses (such as frequent headaches, bedwetting, etc.). (Appendix A).

6 of the children in Syrian group had lost at least one parent. Those who had lost both parents were being raised by their grandparents. One of the Syrian children's fathers went missing during the war, one of Antakian and one of monolingual children had imprisoned fathers and were being raised by their mothers. 22 out of 25 Syrian caregivers reported that their houses were damaged during the war. Also, eight children in Syrian group were reported to show somatic symptoms (e.g., wetting bed, frequent headaches).

Table 2: *Trauma index by groups*

	Groups		
	Syria	Antakya	Monolingual
Losing mother	16%	0%	0%
Losing father	24%	0%	0%
Parents divorced	8%	3.33%	0%
Father missing	4%	3.33%	5%
House damage	88%	0%	0%
Family members injured	4%	3.33%	0%
Exposure to violence	12%	0%	0%
Parents lost a family member	44%	0%	5%
Somatic symptoms	32%	-	-
Total trauma index (out of 9)	2.28 (1.37)	0.10 (0.30)	0.15 (0.36)

Note: *SDs are shown in parentheses.*

3.2.1. Backward Digit-span Task

Working memory (WM) was assessed using the Memory for Digit Span sub-test from the Wechsler Intelligence Scales for Children-Revised (Wechsler, 1974). Memory for Digit Span assessment consists of two parts: forward digit-span and backward digit-span. Both sections contain 14 sets of digits in increasing order (i.e., *n* representing the number of digits in each set: n, n, n+1, n+1, … n+6, n+6). In forward digit span task, children were asked to repeat the digits uttered by the experimenter in the same order. This task was given to prepare the children for the actual test (i.e. backward digit span task). In the backward digit-span task, children were again expected to repeat the digits uttered by the experimenter, but in reverse order. Syrian children were free to choose the language they wanted to hear the digits in, because we did not want their performance to be affected by their language proficiencies.[3] The test was terminated when the child failed to complete two consecutive sets consisting of same number of digits. Children received 1 point for each series they could complete successfully. The number of correctly remembered digit series were taken as WM measure. The maximum score in this test was 14.

3.2.3. Happy-sad Inhibitory Control task

The Stroop Colour and Word Test (SCWT) is a very widely used neuropsychological test assessing inhibitory control ability (Stroop, 1935). However, since Syrian children had interrupted schooling in Arabic and they may not have developed advanced Turkish literacy skills as their peers, the happy-sad task (Lagattuta, Sayfan and Monsour, 2011), a variant of the Stroop task, was administered. Participants were expected to say “happy” when shown a sad face and “sad” for a happy face. This task had desirable measurement properties because it did not show a ceiling effect in adults (Lagattuta, Sayfan and Monsour, 2011). We computerised this happy-sad task sets using OpenSesame (Mathôt, Schreij, & Theeuwes, 2012) with the *NimStim* Set of Facial Expressions http://www.macbrain.org/faces/index.htm (Tottenham et al., 2009). Caucasian female model 9 and Caucasian male model 24 were selected (publication of the models’ photos is prohibited).

Assignment of the emotion faces were counterbalanced by gender of the model stimuli (i.e. in all groups, half of the children saw male faces while the other half saw female faces). The children saw 10 sad and 10 happy faces in a random order, followed by a practice session of 4 happy and 4 sad faces. Children were instructed to say “sad” (in either Turkish or Arabic) when they saw a happy face and “happy” when they saw a sad face, with responses logged by the experimenter. For the sake of reliability, whole process was audiotaped and keyboard responses were checked against the oral responses. 12 out of 25 Syrian children responded in Turkish. We calculated accuracy (percent correct) and reaction time (RT) in milliseconds for this task.

3.2.4. Berg’s card sorting task

Wisconsin Card Sorting Test (WCST; Berg, 1948) is a widely used test to assess EF and especially shifting ability. We used a 64-trial computerised version of WCST: Berg’s Card Sorting Test as a measure of shifting ability. The children were presented 4 cards on screen, three of which were stimulus cards and one of which was a response card. The stimulus cards differed in displayed number, colour and shape. On each trial, children were expected to match the response card to one of the stimulus cards according to a sorting rule of either colour, shape or number. The rule changed after

[3] 12 of 25 Syrian children preferred to hear the digits in Turkish. To test whether language of administration caused a difference, we compared Turkish hearers and Arabic hearers WM scores, and we did not find a significant difference between the groups.

10 consecutive correct responses, but the child was not told this. After the instructions, children completed a practice session which terminated after 5 consecutive correct responses. During the task, children received oral feedback (i.e. *right* or *wrong*) in addition to the written feedback flashing on the screen. We analysed the percentage of perseverative errors (i.e., following the previous rule even after getting negative feedback; shifting errors) and percentage of correct responses (i.e., shifting accuracy).

3.2.5. Raven's Coloured Progressive Matrices

Raven's Coloured Progressive Matrices (CPM) is a non-verbal measure of fluid intelligence and abstract reasoning abilities in children between the ages of 5 and 11 (Raven, et al., 1998). It does not require mathematical or linguistic knowledge, thus, it can be used for the testing of bilinguals and people with low education background. For Turkey, reliability and validity of CPM has been tested for children between the ages of 4 – 6, and it was found to be strongly correlated with Bender-Gestalt Test, TONI-3 Test and WISC-R Test Scores (Kargin, 2017). The test consists of 3 sets (A, AB and B) with 12 items each. Problem items are ordered in an ascending difficulty. In each problem, the children are expected to complete a coloured drawing or a matrix by choosing the appropriate piece among six alternatives.

The manual (Raven et al., 1998) was followed for the administration of the test and the answers were transferred to the scoring sheet by the experimenters. The analysis was performed with the raw scores (i.e., 1 point for each correct response, 36 points maximum), because standard scores were absent for our participants groups (see also (Tsimpli et al., 2020b).

Raven's CPM could not be administered for some children in Syrian and Antakian group due to the COVID-19 interruption. As a result, we could obtain fluid intelligence scores from 15 children in Syrian group, 9 children in Antakian group, and 20 children in monolingual group.

3.2.6. Turkish Expressive and Receptive Language Test (TIFALDI)

Turkish Expressive and Receptive Language Test (TIFALDI) was used to assess receptive and expressive vocabulary skills of the children (Berument & Güven, 2013). TIFALDI consists of black-and-white illustrations with 101 items in receptive sub-scale and 80 items in the expressive sub-scale.

On receptive sub-scale, there are four numbered drawings, and on each image plate and the child points to the picture that best describes the word uttered by the experimenter. As for the expressive vocabulary test, the child sees only one drawing and is asked to name the related drawing.

The responses of children's were coded to an excel sheet during the testing. The experimenter started with the age-relevant item and the children were expected to give 8 consecutive correct answers to achieve a basal score in both sub-scales. The number of correct responses after 8 consecutive correct responses were added on the basal score. This gave us the raw score and the standard score was determined based on the manual given for different age-ranges. No score could be entered for the cases where children could not reach basal score. This case was observed only in Syrian group: out of 25 children, 9 children in expressive sub-scale, and 2 children in receptive sub-scale failed to reach the basal score.

3.2.6.1. Modification of TİFALDİ to test Arabic Vocabulary

To make sure that we use matched vocabulary tasks across the two languages, we adapted TİFALDİ into Arabic. The same scoring method in Turkish version of TIFALDI was followed. However, some modifications were needed due to the morphological differences between the two language systems. While Turkish is a gender-neutral language, Arabic has grammatical gender system. Unmarked/default forms of the nouns are masculine while feminine forms are marked in Arabic (Haywood, J. A., & Nahmad, H. M., 1965) and feminine nouns usually marked by "-aa" sound (Alkohlani, 2016).

On the other hand, grammatical and morphological gender system is absent in Turkish; in other words, nouns are not marked to indicate gender except for some words, especially the borrowed ones, e.g., *aktör* vs *aktris* (actor/actress), *prens* vs *prenses* (prince/princess) (Braun 2001: 285). This basic difference between the two languages brought forth the need for a modification in receptive vocabulary test. For instance, the target word in item number 61 in receptive vocabulary test is *öğretmen* (teacher). On the related page, there are four different pictures: one male and three female figures. The correct drawing that best illustrates the word *teacher* is the male figure. In Turkish, there is only one word (i.e., *öğretmen*, gender-neutral) that stands for both male and female teacher. Yet, in Arabic, *mudarris* is used for male teacher and *mudarrisaa* is used for female teacher. For such items, the experimenter read out both masculine and the feminine forms of the words in Arabic TIFALDI receptive sub-scale. This was necessary, because if the experimenter said the word marked by only one gender (e.g., *mudarris*) the participant would eliminate the other competing alternatives (i.e., three other female figures on the same page) very easily.

Five Syrian university students translated the items in both sub-scales of TIFALDI individually. The experimenter compared the translations. Later, the Arabic version of the test was completed by another group consisting of six different Syrian university students, who suggested further changes (e.g., excluding item numbers 73, 100 and 101 (i.e., *devirmek/to knock down, viyadük/viaduct, faraş/dustpan*, and replacing item number 36 (i.e., *papatya/daisy*) with *jasmine* which is a better-known flower in their culture) for items that do not have Arabic equivalents. Finally, four bilingual speakers of Arabic and Turkish from Antakya region who reported the language and the pictures to be appropriate.

One other challenge was the variety of vocabulary use by the speakers of Arabic including those who live in the same region. This can be explained by the phenomenon of diglossia, which very briefly refers to the coexistence of colloquial and standard forms of the same language (Ferguson, 1959). Standard Arabic (SA) is used in formal platforms and written activities but the regional dialect is used in daily life in ordinary conversations and one acquires the standard Arabic by schooling, not at home (Ayari, 1996). Besides the differences between formal and colloquial Arabic, there are regional differences within the same city both in Syrian group and Hatay group. For example, in Hatay region, children from Antakya district used the verb "*ʿayyen/to look*" while this was not familiar to children from Sweydiyye (*Samandağ* in Turkish). In Sweydiyye district "*wakked*" is used. As for the Syrian refugee group, neither of these verbs were familiar and they used "*šūf*" or "*anẓur*" instead. For this reason, more than one item was accepted as correct in expressive vocabulary subscale depending on the dialect.

The scoring procedure was the same with TIFALDI's Turkish version. 25 out of 30 Antakian children were able to complete receptive vocabulary sub-scale; however, all children in Antakya group failed to reach the basal score in the Arabic expressive vocabulary sub-scale.

3.2.7. Statistical Analyses

SPSS statistics program Version 24.0 for windows (IBM Corp., 2016) was used for the analyses. 2 children from Syrian group were unable to receive WCST test due to COVID-19 interruption. Listwise deletion could cause biased results since the sample size would be reduced. To address this missing data problem and to avoid biased results the missing values were imputed using the expectation-maximization (EM) algorithm.

Using Mahalanobis' distance and boxplots, one case from monolingual group was identified to be an outlier, and it was removed from the analyses. A skewed distribution was observed for poverty index and IC RT variables. The poverty index variable in this study contained both positive and negative values. Families who had greater income than the breadline had positive values, while those earning below the breadline had negative values. To fix the skewedness in the data we needed to have positive values first, and to present poverty index with positive values across the participants, all values were subtracted from the highest value plus 1. Thus, the child with least poverty had the value 1, and greater values indicated greater poverty. Later, to normalise the distribution for both poverty index and IC RT, the values were transformed using lg(10) function. Further analyses were conducted to ensure no violation of the assumptions of linearity, multicollinearity and homoscedasticity.

One-way Multivariate Analyses of Variance (MANOVA) was performed to observe how groups' profiles (i.e., age, poverty index, maternal education, attendance to kindergarten, child's years of schooling, child's grade level, and trauma index) differ from each other. Later, another set of one-way MONOVA was run to investigate group effect (i.e., Syrian, Antakian, and Monolingual) on performance on 5 EF measures: WM, IC accuracy rate, IC reaction time, shifting accuracy rate, shifting error rate. However, as the sample sizes changed due to the missing data in Raven's test, a separate test of Univariate Analysis of Variance (ANOVA) analysis was run to compare groups' performance for the Raven's fluid intelligence test.

Only the children in Syria and Antakya group were assessed for their Arabic skills. Independent-samples t-test (two-tailed) was used to compare the means of these two groups. Effect sizes are reported with 95% confidence intervals and significance was reported based on Bonferroni correction for all comparisons to avoid Type 1 errors. Following MANOVA and ANOVA analyses, the relationship between cognitive and language abilities were investigated using Pearson's correlation coefficient, and effect sizes were reported based on Cohen's (1992) guidelines.

A linear multiple regression model was computed to investigate the associations between 5 predictor variables from individual characteristics (i.e., poverty index, maternal education, attendance to kindergarten, child's years of schooling, and trauma index) and 6 cognitive outcome variables (i.e., WM, IC accuracy rate, IC reaction time, shifting accuracy rate, shifting error rate, fluid intelligence).

To investigate the relationship between individual characteristics and linguistic outcome variables (Turkish receptive test, Turkish expressive test. Arabic receptive test, Arabic expressive test) a hierarchical linear regression was run controlling for the dominant language variable. Later, refugee and non-refugee bilingual children's scores in their dominant and non-dominant languages were compared using ANOVA analyses.

CHAPTER 4

RESULTS

4.1. Caregiver Questonnaire

All caregivers in Syrian group reported that Arabic is the dominant language for the Syrian refugee children, and it was Turkish for both control groups. All children were matched on age [$F(2,72) = .24$, $\eta p^2 = .007$, $p = .79$] and maternal education [$F(2,72) = 1.05$, $\eta p^2 = .028$, $p > .05$]. Mean of monthly income was below the breadline for all three groups; however, Syrian group suffered more from poverty compared to the control groups [$F(2,72) = 6.49$, $\eta p^2 = .153$, $p = .003$]. The control groups were similar on financial status, $p = 1$.

Children who attended kindergarten received 1 and those without kindergarten education received 0. There was no significant difference between control groups' kindergarten attendance ($p = .054$), but Syrian children's kindergarten education was lower than both control groups [$F(2,72) = 16.36$, $\eta p^2 = .313$, $p = .00$].

Syrian children's years of stay in Turkey correlated with the years of schooling they received, meaning the earlier they come to Turkey the earlier they started receiving education ($r = .68$, n = 25, $p = .00$). Still, they registered in schools later than their control peers and attended to lower grades than their age-matched controls [$F(2,72) = 10.74$, $\eta p^2 = .23$, $p =.00$]. Accordingly, their years of schooling was lower than the control groups [$F(2,72) = 19.07$, $\eta p^2 = .346$, $p = .00$]. Lastly, Syrian group had higher trauma index than the control groups [$F(2,72) = 55.69$, $\eta p^2 = .607$, $p = .00$]. Non-refugee groups' years of schooling, grade levels, attendance to kindergarten, and trauma indexes were at similar levels, $p > .05$.

4.2. Cognitive Tests

The Box's M value of 62.259 was non-significant ($p = .303$), which indicates that covariance matrices between the groups are equal for the purposes of the MANOVA. Children's performance on cognitive tests was significantly dependent on the group they came from (i.e., Syrian, Antakian and Monolingual) [$F(10,136) = 2.85$, $p = .003$; Wilk's $\Lambda = 0.684$, $\eta p^2 = .17$]. Pair-wise comparisons were visited for the measures where a group effect was observed. Groups' mean scores and standard deviations for EF measures are presented along with MANOVA results in Table 3.

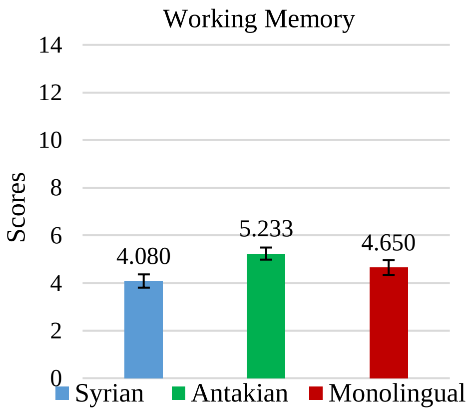
4.2.1. Working Memory (WM)

The total numbers of correctly remembered digit sequences in backward-digit span task were taken as WM capacity indicator. A group effect was observed for WM [F(2,72) = 4.686, ηp^2 = .12, *p* = .012]. The Syrian group showed significantly lower accuracy than the Antakian group, *p* = .009. However, Syrian children's WM scores were similar to monolinguals, *p* = .53 (see Figure 1).

Groups' WM scores showed a moderate positive correlation with children's attendance to kindergarten (*r* = .35, n = 75, *p* = .001) and years of schooling (*r* = .24, n = 75, *p* = .020). The correlation between WM performance and trauma index was on a negative direction (*r* = -.39, n = 75, *p* = .00).

Multiple linear regression analysis was run with individual characteristics as predictor variables and WM as outcome variable. 21.2% of the variance in WM variable could significantly be explained this model [F(5,69) = 3.72, *p* = .005]. However, only kindergarten attendance (β = .25, *p* = .048) and trauma points (β = -.30, *p* = .042) significantly contributed to the model. SES, and child's years of schooling were not significant predictors.

Figure 1. *Backward digit-span test scores.*



4.2.2. Inhibitory Control (IC)

On the Happy-Sad inhibitory control (IC) task, we analysed the percentage of correct responses and the reaction time. Accuracy rates did not differ across the groups [F(2,72) = 1.73, ηp^2 = .05, *p* = .185] (see Figure 2). Attendance to kindergarten was moderately associated with higher accuracy rates on IC task (*r* = .29, n =75, *p* = .006). However, when individual characteristics, including kindergarten attendance, were put into regression analysis as predictor variables, the model failed to explain the variance in IC accuracy rate [R^2 = .089, F(5,69) = 1.35, *p* = .25].

In contrast with the accuracy measure, groups did differ in their response times [F(2,72) = 4.57, ηp^2 = .113, *p* = .014], with the Antakian group having the slowest RTs (see Figure 3). Pairwise comparison analysis indicated that monolingual group had similar RTs with Syrian group (*p* = .10) and faster RTs than the Antakian group (*p* = .012), and this was not associated with any of the participant characteristics. When the same characteristics were put as predictor variables in the regression analysis, the model failed to explain the variance in IC reaction time. In other words, SES, child education and trauma were not significant predictors for IC reaction time [R^2 = .066, F(5,69) = .98, *p* = .44].

Figure 2. *Accuracy rates on inhibitory control task.*

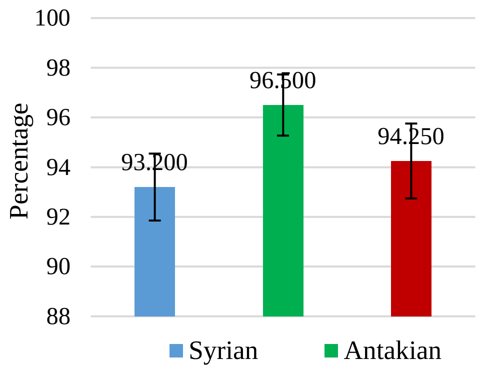
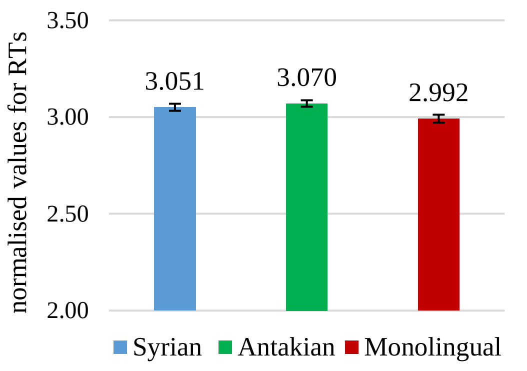


Figure 3. *Normalised reaction time values for IC task.*



4.2.3. Shifting

MANOVA analyses indicated no significant group effect neither on shifting accuracy rate [F(2,72) = .86, ηp^2 = .023, *p* = .43] nor on shifting error rate [F(2,72) = 2.59, ηp^2 = .067, *p* = .08]. Shifting accuracy rate positively correlated with kindergarten attendance, with a small effect size (*r* = .24, n = 75, *p* = .020); however, it was not found to be a predictor after the regression analysis. Children's shifting error rate, on the other hand, correlated with child's years of schooling (*r* = -.25, *p* = .015) and kindergarten education (*r* = -.33, *p* = .002) in a negative direction. Higher trauma points were associated with higher perseverative error rates (*r* = .27, *p* = .009). Regression analysis results suggested that individual participant characteristics could explain 14.6% percent of variance in error rate in the shifting task with a significant *p* value [F(5,69), *p* = .048], but only kindergarten education was a predictor for the perseverative error rates in shifting task (β = -.26, *p* = .047).

Figure 4. *Shifting accuracy rates.*

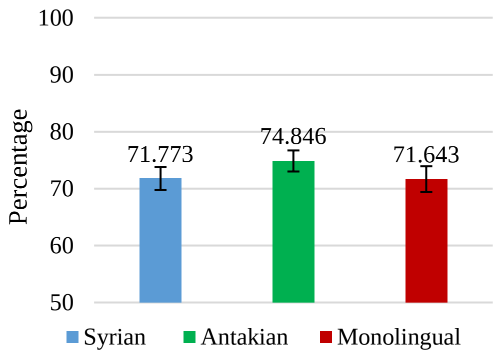


Figure 5. *Shifting error rates.*

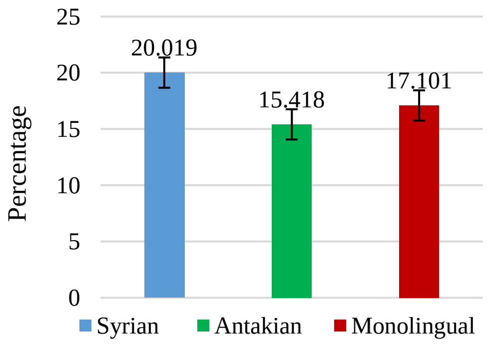


Table 3. *Means and standard deviations on EF measures*

	Groups						MANOVAs		
	Syrian		Antakian		Monolingual				
N	25		30		20				
EFs	M	SD	M	SD	M	SD	F	ηp^2	*p*
WM	4.08	1.52	5.23	1.33	4.65	1.31	4.69	.115	**.012**
Shifting accuracy	71.77%	9.61	74.84%	9.77	71.64%	11.20	.86	.023	.426
Shifting errors rates	20.02	7.36	15.42	5.83	17.10	9.62	2.59	.067	.082
IC accuracy	93.20%	8.40	96.50%	4.94	94.25%	6.74	1.73	.046	.185
IC reaction time in ms	30507	.103	30702	.086	29918	.084	8084	.999	**.014**

4.2.4. Fluid Intelligence

Raw scores obtained from Raven's CPM was taken as the fluid intelligence measure. Univariate analysis results showed that groups' fluid intelligence score means significantly differed from each other [F(2,41) = 11.08, $\eta p^2 = .35$, *p* = .00] (Table 3). Syrian children's fluid intelligence was poorer than both control groups, *p* = .001.

Higher years of schooling (*r* = .41, n = 44, *p* = .003) and receiving kindergarten education (*r* = .35, n = 44, *p* = .010) moderately correlated with better performance on fluid intelligence test. Children had poorer fluid intelligence scores as they suffered more from poverty (*r* = -.39, n = 44, *p* = .005). Largest effect size was observed between the trauma index and fluid intelligence in negative direction (*r* = .56, n = 44, *p* = .00).

Linear regression analysis indicated that 38.4% of the variance in fluid intelligence test scores could be explained by participant characteristics [F(5,38) = 4.74, *p* = .002]; however only trauma index was a significant predictor among these characteristics (β = -.37, *p* = .03).

Table 4. *Distribution of raw scores obtained in Fluid intelligence ability assessed by Raven's CPM across the groups.*

	Groups			ANOVAs		
	Syria	Antakya	Monolingual			
	N = 15	N = 9	N = 20	F	df	p
Raw scores	23.93 (4.62)	30.33 (3.5)	29.10 (3.11)	11.08	2	**.00**
Range	15-33	26-35	21-33			

4.3. Language Tests

Standard scores obtained in the vocabulary test were taken as independent variables for this measure. Sample sizes were not equal across the sub-tests, thus We ran univariate ANOVAs for each vocabulary subtest (i.e., receptive vs expressive) for both languages (i.e., Turkish and Arabic).

4.3.1. Turkish Vocabulary

Univariate analyses indicated a significant group effect for Turkish receptive vocabulary [$F(2,70) = 95.27$, $\eta_p^2 = .73$, *p* = .00] (see Table 5). Syrian group scored significantly lower than both non-refugee groups (*p* = .00), while non-refugee groups did not differ in Turkish receptive vocabulary sub-test (*p* > .05).

Table 5. *Turkish vocabulary scores across the groups.*

	Groups						ANOVAs		
	Syria		Antakya		Monolingual				
Sub-tests	M	SD	M	SD	M	SD	*F*	η_p^2	*p*

Receptive	74.09	10.84	104.37	7.07	100.67	6.56	95.27	.73	**.00**
Expressive	66.88	5.57	116	12.45	113	10.35	134.16	.81	**.00**

Greater receptive vocabulary size in Turkish was strongly associated with child's dominant language, which is also spoken dominantly at home (r = .85, n = 73, p = .00). It was also associated with duration of schooling (r = .45, n = 73, p = .00) and receiving kindergarten education (r = .53, n = 73, p = .00). Trauma (r = -.77, n = 73, p = .00) and poverty (r = -.33, n = 73, p = .002), on the other hand, correlated with smaller Turkish receptive vocabulary size. No correlation was found between maternal education and receptive vocabulary size in Turkish (r = .15, n = 73, p > .05).

A multiple regression analysis was conducted with individual characteristics and dominant language variables taken as predictor variables. This model could explain 76.7% of the variance in Turkish receptive scores at a significant level [F(6,66) = 36.27, p = .00]. Among the predictor variables, only dominant language (β = .66, p = .00) and trauma points (β = -.26, p = .01) significantly predicted Turkish receptive vocabulary performance of children. When controlled for dominant language, the model could still explain the variance in receptive scores significantly [R^2 = .044, F(5,66) = 2.50, p = .039].

As for Turkish expressive vocabulary scores, ANOVA analysis was run, and a significant group effect was found [F(2,63) =134.16, η_p^2 = .81, p = .00]. Syrian children lagged behind the control groups, p = .00, while Antakian group and monolingual group obtained similar Turkish expressive vocabulary scores, p > .05.

Turkish expressive vocabulary performance significantly correlated with children's dominant language with a large effect size (r = .90, n = 66, p = .00), with trauma index (r = -.75, n = 66, p = .00), children's years of schooling (r = .47, n = 66, p = .00), kindergarten education (r = .47, n = 66, p = .00) and poverty index (r = -.36, n = 66, p = .001).

The regression model with children's characteristics along with dominant language as predictor variables could explain 86% percent of variance in Turkish expressive vocabulary sub-scale significantly [F(6, 59) = 60.41, p = .00]. Dominant language (β = .77, p = .00), maternal education (β = -.21, p = .01), and trauma index (β = -.26, p = .003) were significant predictors. When controlled for the dominant language, the model still accounted for a significant variance in expressive vocabulary outcome [R^2 = .051, F (5,59) = 4.30, p = .002].

4.3.2. Arabic Vocabulary

We first compared Syrian and Antakian children's Arabic receptive vocabulary scores (Table 6). Antakian group (N = 25) a had significantly smaller Arabic receptive vocabulary compared to Syrian refugee children [t(48) = -9.35, p = .00]. Levene's test indicated unequal variances (F = 6.33, p < .05), so degrees of freedom were adjusted from 48 to 37.59. Since none of the Antakian children could complete Arabic expressive vocabulary test, results of independent-samples t-test are presented only for Arabic receptive vocabulary test in Table 6.

For expressive language, none of the Antakian children reached a basal score, meaning that they all failed to complete the test. All Syrian children (*N* = 25) were able to complete the test, and so we conclude that Arabic vocabulary is importantly better in the Syrian group than the Antakian group.

Table 6. *Arabic vocabulary scores.*

	Groups						
	Syrian		Antakian				
Sub-tests	M	SD	M	SD	*t*	*df*	*p*
Receptive	95.04	14.60	63.80	8.13	-9.35	48	.00
Expressive	102.24	17.95	-	-	-	-	-

Similar to what was observed for Turkish vocabulary measures, dominant language (also the home language) was strongly correlated with Arabic receptive scores (r = .80, n = 75, p = .00). Interestingly, children in both groups who had more years of schooling (r = -.49, n = 50, p = .00) and who attended to kindergarten (r = -.52, n = 75, p = .00) also had poorer performance in Arabic receptive vocabulary subtest measured based on TIFALDI standard scores. Children with greater trauma (r = .54, n = 75, p = .00) and poverty index (r = .32, n = 75, p = .011), Syrian children in other words, scored higher on Arabic receptive subtest.

Linear regression analysis conducted with individual characteristics along with language dominancy, the model explained %71.3 of the variance in Arabic receptive sub-test outcome with a significant *p*-value [F(6,43) = 17.79, p = .00], and only language dominancy was found to be a predictor factor. When controlled for the dominant language, the model failed to predict children's performance on Arabic receptive sub-test [R^2 = .067, F(5,43) = 2.02, p > .05].

Neither correlation nor regression analyses ran for Arabic expressive sub-test bore any significant values, thus no results for analysis are presented.

4.3.3. Language dominancy

Lastly, using independent-samples t-test, bilingual groups were compared for their dominant (i.e., Arabic for Syrian group versus Turkish for Antakian group) and non-dominant languages (i.e., Turkish for Syrian group versus Arabic for Antakian group) in receptive vocabulary sub-test. It was observed that Antakian children obtained smaller vocabulary scores in their non-dominant language (i.e., Arabic; M = 63.80, SD = 8.13) than Syrian children did in their non-dominant language (i.e., Turkish; M = 73.09, SD = 10.84) [t(46) = -3.74, p = .001]. When groups' dominant languages were compared, Syrian children showed poorer vocabulary abilities in Arabic (M = 95.04, SD = 14.60) than Antakya group did in Turkish (M = 104.37, SD = 7.07) [t(53) = 3.10, p < .01].

CHAPTER 5

DISCUSSION

In the current study, our aim was to investigate the effect of displacement trauma on cognitive and linguistic abilities of Syrian refugee children. To do this, we compared behavioural performance in cognitive tasks (i.e., WM, IC, shifting and fluid intelligence) and vocabulary abilities of Syrian refugee, non-refugee Antakian bilingual and Turkish monolingual children. All three groups were matched on age and mother's years of education. However, when compared with non-refugee control groups, the Syrian refugee group was exposed to a greater number of traumatic experiences, suffered more from poverty, and was more disadvantageous educationally: they received less schooling, fewer Syrian children attended kindergarten, and they attended to lower grades than their age-matched peers (i.e. Antakian group and monolingual group).

In the following parts of this section, the current study's findings addressing children's cognitive and language ability will be discussed.

5.1. Cognitive Abilities

Syrian bilingual refugee children had poorer WM than the non-refugee Antakian bilingual children. This finding supports the previous research suggesting that WM is majorly affected by depression, stress and trauma (e.g., Nikolin et al., 2021, Park et al., 2014). Syrian children and Turkish monolingual children, on the other hand, performed similarly on the digit-span task assessing WM. Literature has shown that low-income family input triggers less cognitive stimulation (Blom et al., 2014; Bradley & Corwyn, 2002). Thus, although both Syrians and monolinguals come from low-SES backgrounds, Syrian children constitute a more disadvantageous profile as they suffer from both poverty and early traumatic experiences at a greater extent, and it would be expected for the refugee children to fall behind the monolingual children in their WM ability. Yet, they were able to match monolinguals in the WM test, which might be owing to the bilingual status they hold (Morales et al., 2013). As for the control groups, Antakian children, and monolingual children performed similarly on the WM task. In other words, no bilingual advantage was observed in non-refugee low SES groups for WM ability. In his paper, Yang (2017) states that bilingualism does not guarantee advantage in WM skills, and bilinguals who switch between their languages use less WM resources. Also, imbalanced bilinguals and non-proficient bilinguals may not demonstrate an advantage over monolinguals in WM tasks (Vejnovic et al., 2010). Thus, it can be inferred that the habit of using Arabic and Turkish in mixture and low Arabic proficiency of Antakian bilinguals did not allow them to outperform monolinguals in the WM task. Contrary to Chen et al.'s (2019) conclusion, WM was not predicted by SES measured by financial status and mother's years of education, but rather by trauma index. The detrimental effects of traumatic events is well-recognised in the past research as well (e.g., Petkus, Lenze, Butters, Twamley, & Wetherell, 2018). Besides trauma experiences, attendance to kindergarten and higher years of schooling correlated with better WM ability, which was similar to what was observed in the previous studies (e.g., Brod, Bunge, & Shing, 2017; Souza-Talarico, Caramelli, Nitrini, & Chaves, 2007). This is because those who attend school participate in more intellectual and cognitively demanding activities compared to those who do not go to school, and develop better cognitive abilities in turn (Gathercole, Pickering, Knight, & Stegmann, 2004; Parisi et al., 2012). Attending to kindergarten, but not years of schooling, was an important predictor of enhanced WM ability. This highlights the significance of early childhood education on cognitive development (for a review see Burger, 2010).

Cognitive flexibility starts developing around the age of four (Zelazo, 2006), which is also the age at which most of the Syrian children in this study went through the dangerous journeys to come to Turkey, and lived in the camps before they were settled. Gabrys, Dixon, & Anisman (2017) showed that exposure to traumatic events (e.g., war in this context) prior to the age of 5 may affect individuals' cognitive shifting abilities. However, the present study failed to conclude the same findings in Gabrys' and friends' study (2017). Groups showed no significant difference on neither accuracy nor error rate measures on shifting task, meaning all the three groups had similar mental flexibility. Learning Turkish might have provided the Syrian children with the chance of compensating for the detrimental effects of forced displacement on the shifting ability. Children's shifting ability scores measured by card sorting task (BCST) were not correlated with SES, but it was negatively affected by the adverse experiences. In addition, attending to kindergarten was a significant predictor, and schooling had an enhancing effect on the development of shifting ability.

In IC ability, accuracy rates of the groups' were comparable to each other, and pre-school education had a positive effect on it. As for IC reaction times; however, Antakian group was significantly slower than Turkish monolingual group, while Syrian children did not differ from neither of the control groups. SES, education and trauma did not play a predictive role for the IC ability. Despite being simultaneous bilinguals, Antakian group did not show an advantage over the monolingual group in the IC task, which is in contrast with the previous research highlighting the boosting effect of early onset of bilingualism on cognitive control (e.g., Luk, De Sa, & Bialystok, 2011), and bilingual advantage in IC reaction time (Naeem, Filippi, Periche-Tomas, Papageorgiou, & Bright, 2018). Inspecting the language environments of bilinguals might allow us to better interpret these results. For instance, Treffers-Daller, Ongun, Hofweber and Korenar (2020) observed that English-Turkish bilinguals who mix their languages a lot took longer time to respond in inhibition task. Similarly, in Antakian community, adults and children are dense code-switchers: they mix both languages within a sentence. As a result, Antakian children may not be feeling the need to switch between Arabic and Turkish in accordance with their interlocutor, because they know that they are going to be understood no matter which language they choose.

Thus, there is little competition between the languages. This provides evidence for the adaptive control hypothesis suggested by Green and Abutalebi (2013) (cf., Hofweber, Marinis, & Treffers-Daller, 2019). Poor Arabic language proficiency (Singh & Mishra, 2012) and imbalanced bilingual profile (Costa, Hernández, & Sebastián-Gallés, 2008; Yow & Li, 2015) may further explain the absence of bilingual advantage on the IC task. In comparison to Antakian bilinguals, we postulate that Arabic and Turkish languages are relatively in a greater competition in Syrian children's language contexts as they shift between languages depending on their environments (e.g., school versus family) (Green & Abutalebi, 2013). This, in turn, could have offered cognitive benefits to Syrian refugees in their IC abilities.

The detrimental effect of Syrian children's trauma experiences was observed most vividly in their fluid intelligence ability since Raven's test was the only measure where Syrian refugee children obtained significantly lower scores than both control groups. These results could be due to the past war experiences of the refugee children. However, the literature suggests that SES plays a greater role on poor fluid intelligence than trauma (DePrince, Weinzierl, & Combs, 2009; Keyes, Platt, Kaufman, & McLaughlin, 2017; Sheridan, Peverill, Finn, & McLaughlin, 2017). For instance, Platt and colleagues (2018) found a greater effect of poverty on fluid intelligence than trauma. Indeed, although the majority of the families in our control groups were also living below the breadline, Syrian families reported to suffer from extreme financial difficulties (i.e., not being able to afford basic nutrition, not being able to pay the bills, etc.), temporary work, being underpaid and unhealthy house conditions. Thus, our control groups remained at a relatively better financial status than the Syrian group, and poverty was associated with poorer performance on the fluid intelligence test. Yet, the poorer fluid intelligence performance is not limited to poverty. The effect of reasoning and problem solving (i.e., fluid intelligence) on learning and academic success has been long studied, and it was suggested that children with better fluid intelligence abilities attain more successful profiles at school (Deary, Strand, Smith, & Fernandes, 2007; Rohde & Thompson, 2007). The present study presented that this relationship was bi-directional, and better fluid intelligence was related to children's level of education too (see also Cliffordson & Gustafsson, 2008; Sanginabadi, 2020). Nonetheless, our regression analysis showed that the trauma was the only predictor factor for the fluid intelligence. Based on these, poorer fluid intelligence scores of Syrian group in this study could be the result of mainly the traumatic displacement experiences accompanied with a shared effect of poverty and educational disadvantages.

When the overall findings in this study is compared to the studies investigating the EFs of refugees, the present study's findings do not overlap the findings in Chen and colleagues (2019) paper. In their study, they did not find an association between EFs and exposure to trauma. However, it is important to note that the refugee children in that study – in contrast to current study – had resettled in an Arabic speaking country. Resettlement in a country where they can understand and be understood may have helped children adapt to the new country more easily. More importantly, they also receive education in their mother tongue, which paves the way of an enhanced cognitive development.

5.2. Language Abilities

Past research has demonstrated monolingual advantage in majority language (Turkish in our case) when compared to bilinguals (e.g., De Houwer, Bornstein, & Putnick, 2012), but the non-refugee bilingual children (i.e. Antakian group) in this study did not differ in their Turkish vocabulary performance when compared to their monolingual peers. Our findings might have failed to mirror the previous research, because Antakian children's Turkish development was supported by several channels: Turkish is the society language, immersion language, and the dominant language spoken by the parents (Dixon et al., 2012). Syrian children had a smaller Turkish vocabulary repertoire than both control groups.

As for bilingual children's language scores, it was parallel with what parents reported in the questionnaires: Syrian children were better in Arabic, while Antakya children were better in Turkish. Lending support to previous studies highlighting the importance of language input at home, the dominant language spoken at home was the predictor for bilingual children's vocabulary knowledge (Bohnacker et al., 2016; Bohnacker, Haddad, & Öberg, 2021). Children's success on vocabulary tests was also related to the years they spent in school. The longer children attended Turkish immersion schools, the lower their Arabic vocabulary scores got. Conversely, the longer duration of schooling led to greater Turkish vocabulary size. When the non-refugee parents were interviewed, they all stated that the children's Arabic was better before they started to school. It seems that receiving literacy instruction in Turkish starting from the age of 6-7, and having an increasing Turkish input from also the community causes imbalance, limited Arabic to home-context. Indeed, immersion language, which is supported by majority language has been argued to cause regression in heritage language while improving L2 vocabulary (Linck, Kroll, & Sunderman, 2009; Paradis, Soto-Corominas, Chen, & Gottardo, 2020). As a result, systematic and consistent schooling in majority language cause a language dominancy shift from home language to immersion language (Extra, Aarts, van der Avoird, Broeder, & Yagmur, 2001).

Antakian children's Arabic vocabulary size was smaller than that of their Turkish. This could be because their Arabic input is limited to bilingual house input although they grew up hearing it from birth. Also, Antakian children's receptive vocabulary scores were higher than their expressive vocabulary scores, which is reflective of their language contexts at home. That is, Antakian parents speak both Arabic and Turkish at home (i.e., bilingual context), but the children feel more comfortable to respond in Turkish (i.e., language supported by society, school and TV) even when they are spoken to in Arabic, because they know that they will be understood by their parents no matter what language they choose. This pratice eventually allowed Antakian children develop better receptive skills than expressive skills. Moreover, Antakian group obtained lower Arabic vocabulary scores than the Syrian refugee children. The difference in groups' language abilities could be resulting from the varying amounts of input. For example, although Antakian children are exposed to Arabic in a mixed use with Turkish and there are very few occasions where they have to speak Arabic (e.g., with elder people who do not know Turkish – which is very rare). Syrian children, on the other hand, are exposed to regular Turkish input through formal education, society and media. The difference between the Arabic skills of the bilingual groups points out to the context of their language acquisition. Despite their later age of onset, Syrian children were better at their L2 (i.e., Turkish) than Antakian children were in their heritage language (i.e., Arabic).

Lastly, refugee children's L1 and dominant language (Arabic) was poorer than control groups' dominant language (Turkish). While schooling supported Syrian children's L2 (Turkish) development, their mother tongue (Arabic) showed a regression as the years they were immersed in Turkish increased. However, Syrian children still had better Arabic skills than Antakian children as Arabic was the dominantly spoken language at home. This shows that language of immersion is indeed a significant factor in children's language dominancy and both for minority and refugee children; heritage language development is highly dependent on house input.

5.3. Summary and General Discussion

The refugee group in the present study suffered from many stressors; some lost their parents, majority of them witnessed their houses being destroyed or damaged during the war, they have gone through dangerous journeys to pass the Syrian border (e.g., paying the smugglers, sleeping on the ground for days, having no shelter in heavy weather conditions) and were living in war conflict areas prior to arrival in Turkey. They also attended school for a significantly shorter period than their control groups due to interrupted education back in their countries, started to go to school at a later age than their peers did, attended lower grades than their age requires, and were immersed in a foreign language, Turkish. They suffered and continue to suffer from unhygienic environments and malnutrition. All these adversities have been shown to have a negative impact on cognitive development, especially in the early childhood period in the literature (Bradley & Corwyn, 2002; Falconer, Bryant, Felmingham, Kemp, Gordon, Peduto, Olivieri, & Williams, 2008; Hayes, VanElzakker, & Shin, 2012; Kim et al., 2020; Mezzacappa, 2004). The present study also found parallel associations between trauma, schooling, early childhood education and cognitive abilities. Trauma and limited pre-school education were common predictors for refugee children's poor WM and fluid intelligence abilities.

Overall, Syrian refugee children were still able to catch up with the EF abilities of the non-refugee, typically developing monolingual children who had better financial and educational backgrounds. It is crucial to interpret this picture carefully. Observing no difference on EF measures between children with such imbalanced backgrounds may actually indicate a cognitive advantage, probably brought by holding bilingual status (see Blom et al., 2014; Carlson & Meltzoff, 2008).

5.3. Limitations

There was no vocabulary test available in Syrian dialect appropriate for the age range of the children this study to best of our knowledge. For this reason, the Arabic vocabulary tests (i.e., receptive and expressive) used in this study were not standardised. They were translated for the use of the current study only, and is it not possible to compare Arabic vocabulary scores of the Syrian refugee children in this study with the Arabic language scores of the children in other studies.

5.4. Recommendations

Algorithms that can predict the cognitive abilities that are prone to be affected negatively by trauma can be developed. In addition, further studies can be conducted to develop models that can suggest intervention studies taking the trauma index, type and age of exposure to trauma into account.

The reports of MoNE depict that only about less of pre-school age Syrian children attend to kindergarten in Turkey. The significance of attendance to kindergarten for cognitive development has been underscored in the present study, as well as previous studies. Education policies promoting pre-school education, especially for under-privileged populations, would foster stimulation of cognitive development.

Lastly, as has been shown by previous studies, immersion in majority language may have a suppressing effect on heritage languages in the long run. To sustain minority languages, community centres and language trainings can be provided.

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APPENDICES

APPENDIX A: PARENTAL INFORMED CONSENT FORM

Veli Onay Formu

Sevgili Anne/Baba,

Bu çalışma, Orta Doğu Teknik Üniversitesi Yabancı Diller Eğitimi Bölümü ve Edinburgh Üniversitesi Psikoloji Bölümü ortaklığında ve British Academy Newton Fonu çerçevesinde öğretim üyesi Dr. Duygu Özge ve proje asistanı Özlem Yeter tarafından yürütülmektedir. Bu form sizi araştırma koşulları hakkında bilgilendirmek içi hazırlanmıştır.

Bu çalışmanın amacı nedir?

Çalışmanın amacı, Arapça ve Türkçe öğrenerek büyüyen çocukların dil ve bilişsel gelişimlerini ve bu gelişimlerinin etkileyen faktörlerin araştırılmasını hedeflemektedir.

Çocuğunuzun katılımcı olarak ne yapmasını istiyoruz?:

Çalışmanın amacını gerçekleştirebilmek için çocuklarınızın desteğine ihtiyaç duymaktayız. Bu amaç doğrultusunda çocuğunuzla aşağıdaki etkinlikler gerçekleştirilecektir:

1. Özel olarak hazırlanılmış resimler gösterilecek ve çocuğunuza kelimeler verilecek. Verilen kelimeyi en iyi anlatan resmi seçmesi istenecek.

2. Belli bir örüntü izleyen geometrik şekiller gösterilecek ve en son sıradaki kutucuk boş bırakılacak. Verilen şıklardan çocuğunuzun örüntüyü takip eden şekli seçmesi istenecek.

3. Çocuğunuza bazı kartlar verilecek ve bu kartları bir kurala göre sınıflandırması istenecek. Daha sonra aynı kartları her seferinde farklı bir kurala göre sınıflandırması istenecek.

4. Çocuğunuza bazı cümleler ve sözcükler dinletilecek ve bu cümlelerle ilgili bazı resimler gösterilecek. Bu sırada çocuğunuzun cümleleri duyduğunda hangi resimlere ne kadar süre baktığını, göz hareketleri izlenecek ve kaydedilecek.

5. Çocuğunuza bir üzgün bir mutlu yüz resimleri gösterilecek ve çocuğunuzdan gördüğü resmin tersini söylemesi istenecek. Böylece, çocuğunuzun baskılama yetisi ölçülecek. Buradaki etkinlik hızlı olduğu için cevapları yazmak mümkün olmadığından etkinlik ses kaydına alınacak daha sonra cevaplar yazıya dökülecek.

6. Çocuğunuza belli bir sayı dizisi verilecek ve o sayı dizisini tekrar etmesi istenecek.

Sizden çocuğunuzun katılımcı olmasıyla ilgili izin istediğimiz gibi, çalışmaya başlamadan çocuğunuzdan da sözlü olarak katılımıyla ilgili rızası mutlaka alınacaktır.

Çocuğunuzdan alınan bilgiler ne amaçla ve nasıl kullanılacak?

Çocuğunuzdan alacağımız cevaplar ve kayıtlar tamamen gizli tutulacak ve sonuçlar araştırmacılar tarafından sadece bilimsel araştırma amacıyla kullanılacaktır. Elde edilecek bilgiler sadece bilimsel amaçla (yayın, konferans sunumu, vb.) kullanılacak, çocuğunuzun ya da sizin ismi ve kimlik bilgileriniz, hiçbir şekilde kimseyle paylaşılmayacaktır. Genel araştırma sonuçlarının özeti tarafımızdan size ulaştırılacaktır.

Çocuğunuz ya da siz çalışmayı yarıda kesmek isterseniz ne yapmalısınız?

Bu çalışmaların çocuğunuzun üzerinde hiçbir yan etkisi olmayacağından emin olabilirsiniz. Yine de, bu formu imzaladıktan sonra hem siz hem de çocuğunuz katılımcılıktan ayrılma hakkına sahipsiniz. Katılım sırasında sorulan sorulardan ya da herhangi bir uygulama ile ilgili başka bir nedenden ötürü çocuğunuz kendisini rahatsız hissettiğini belirtirse, ya da kendi belirtmese de araştırmacı çocuğun rahatsız olduğunu öngörürse, çalışmaya sorular tamamlanmadan ve derhal son verilecektir. Şayet siz çocuğunuzun rahatsız olduğunu hissederseniz (dilediğiniz takdirde çocuğunuzun yanında bulunabilirsiniz), böyle bir durumda çalışmadan sorumlu kişiye çocuğunuzun çalışmadan ayrılmasını istediğinizi söylemeniz yeterli olacaktır.

Bu çalışmayla ilgili daha fazla bilgi almak isterseniz:

Çalışmaya katılımınızın sonrasında, bu çalışmayla ilgili sorularınız yazılı biçimde cevaplandırılacaktır. Çalışma hakkında daha fazla bilgi almak için aşağıdaki iletişim adreslerini kullanabilirsiniz:

Dr. Duygu Özge: duyguo@metu.edu.tr (tel. 0312 210 75 45)

Özlem Yeter: ozlem.yeter@metu.edu.tr (tel. 0536 487 78 65)

Yukarıdaki bilgileri okudum ve çocuğumun bu çalışmada yer almasını onaylıyorum.

Ebeveyn adı-soyadı: ______________

İmza:________________

Çocuğun adı soyadı ve doğum tarihi:________________

Bugünün Tarihi: ______________________________

APPENDIX B: CAREGIVER QUESTIONNAIRE

1. Çocuğunuzun adı soyadı nedir?
2. Çocuğunuzun doğum tarihi nedir? (ay/gün/yıl şeklinde yazınız)
3. Cocuğunuzun cinsiyeti nedir?
4. Çocuğunuz hiç okula gitti mi? Ne kadar süre? (Anaokulu ve ilkokul dahil)
5. Anne hayatta mı?
6. Annenin eğitim durumu nedir?
7. Anne çalışıyor mu? Mesleği/alanı ne?
8. Baba hayatta mı?
9. Babanın eğitim durumu nedir?
10. Baba çalışıyor mu? Mesleği/alanı ne?
11. Anne-baba beraber mi?
11. Ailenin aylık geliri yaklaşık kaç TL'dir?
12. Aile hangi şehirde ve hangi mahallede yaşamaktadır?
13. Ailenin ayn şehirde veya mahallede yaşayan sürekli görüştükleri akrabaları var mı?
14. Ev içinde hangi diller konuşulmaktadır?
15. Evde birden çok dil konuşuluyorsa her bir dilin konuşma sıklığı nedir? (örn. Arapça yarı yarıya, bazen, nadiren. Türkçe bazen, sıklıkla, nediren)
16. Çocuğunuzun kardeşi var mı? Varsa kardeşleriyle hangi dilde iletişim kurmaktadır?
17. Çocuğunuz arkadaşlarıyla hangi dilde iletişim kurmaktadır?
18. Çocuğunuzun Türkçe bilgisini nasıl değerlendirirsiniz? (çok iyi, iyi, orta, başlangıç seviyesinde)
19. Çocuğunuz ilk kez Türkçe'yi kaç yaşında duymaya/öğrenmeye başladı?
20. Çocuğunuz Türkçe'yi nereden ve kimden öğrendi?
21. Çocuğunuzun Türkçe konuşma sıklığını nasıl değerlendirirsiniz? (Her zaman, çoğunlukla, zaman zaman, nadiren, hiç)
22. Çocuğunuz Türkçe dilinde okuyup yazabilmekte mi?
23. Çocuğunuzun Arapça bilgisini nasıl değerlendirirsiniz? (Oldukça iyi, iyi, orta seviyede, başlangıç seviyesinde)
24. Çocuğunuz ilk kez Arapça'yı kaç yaşında duymaya/öğrenmeye başladı?
25. Çocuğunuz Arapça'yı nereden ve kimden öğrendi?
26. Çocuğunuzun Arapça konuşma sıklığını nasıl değerlendirirsiniz? (Her zaman, çoğunlukla, zaman zaman, nadiren, hiç)

27. Çocuğunuzun herhangi bir rahatsızlığı var mı? (sürekli karın/baş ağrıları, yatak ıslatma, vb.)

28. Çocuğunuzda üstün zekalılık, hiperaktivite bozukluğu, öğrenme güçlüğü, dikket eksikliği gibi bir durum gözlemlediniz mi? (öğretmen ve doktor görüşleri var mı?)

29. Aileden herhangi bir yakınızı kaybettiniz mi?

30. Suriye’den ne zaman göç ettiniz?

31. Suriyede olduğunuz bölgede savaş yoğun hissediliyor muydu? Eviniz hasar gördü mü?