Cognitive Effects of Third Language Experience and the Role of Language Proficiency

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Abstract

This study aimed to investigate the extension of bilingual advantage into trilingualism and the role of proficiency in possible cognitive effects of third language (L3) experience. To this end, the data were collected from 51 Turkish young adults in three language groups through the administration of the Stroop task. The first group had 17 high-school graduates learning English and Arabic at intermediate-level. The second group consisted of 17 junior students studying Islamic Studies offering instruction in Turkish (30%), English (40%) and Arabic (30%). The last group had 17 junior students from English medium Social Sciences programs. Results revealed no additional cognitive benefits of trilingualism compared to bilingualism, yet high proficiency in L3 was associated with the enhancement of inhibition.

Keywords: Trilingualism, bilingual advantage, inhibition, language proficiency

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Introduction

Since Executive Functions (EFs) can contribute to success in many aspects of life (Diamond, 2013), research exploring its enhancement has gained popularity in recent years. Experiences in different activities can positively influence EFs (Cuevas, Rajan, & Bryant, 2018). Of these experiences, learning a second language (L2) or a third one (L3) is argued to train the general control processes in the course of simultaneous management of more than one language which requires activation of goal-relevant linguistic representations and suppression of goal-irrelevant ones, thereby leading to the enhancement (Bialystok, Craik, Green, & Gollan, 2009; Green 1998; Li, Legault, & Litcotsky, 2014). The generally held view is that life-long L2 experience can offer cognitive benefits for children and elderly people (Bialystok, Craik, & Luk, 2012. However, there exists rather limited research in the literature exploring the role of L2 and L3 experiences in possible cognitive effects after puberty, and the extant one has yielded contradictory results (e.g., Schlegel, Rudelson, & Tse, 2012; Xie, 2018). Therefore, the recent research attempts to fill this gap in the literature and sets out to

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investigate whether L3 experience adds to the alleged bilingual advantage and to what extent proficiency plays a role in possible effects of L3 experience on inhibition.

Literature Review

Executive Functions and Bilingual Advantage

Executive Functions (EFs) has garnered a significant amount of attention thanks to its critical role in many of the skills appreciated in the 21st century ranging from creativity to self-control (Diamond, 2013). Yet, it is one of the most befuddling constructs in the field due to the presence of numerous models. In their review, Baggetta and Alexander (2016) revealed that, out of 48 models, the unity and diversity model proposed by Miyake et al. (2000) is the most frequently cited one composed of three components: inhibition, updating, and shifting. Miyake and Friedman (2012) define EFs as the set of general-purpose control processes that people employ to regulate their thoughts and behaviors. Given the significant role of EFs in daily life activities, its enhancement has gained popularity as well. Experiences in different activities (e.g., music training) can positively influence cognition and brain plasticity, thus enhancing EFs (Cuevas et al., 2018). One of these experiences is learning an additional language (Bialystok, 2017).

Weinreich (1953) introduced the idea that bilinguals need to resolve the competition caused by the interference pertaining to the activation of more than one language. In the same vein, Green (1998) proposes, in his inhibitory control (IC) model, that the ability to use more than one language appropriately calls for the regulation of supervisory attention system (SAS) (Burgess & Shallice, 1996) which can mediate the process of contention scheduling to activate goal-relevant language specific schemas and inhibit potential competitors as irrelevant schemas. In other words, the SAS is employed to focus on the intended language whilst avoiding intrusions from the unintended one(s). Likewise, Bialystok et al. (2009) argue that, in order to handle the joint activation of two languages in mind, bilinguals make use of cognitive control processes for language management intensively and frequently. Li et al. (2014) suggest that L2 experience leads to cross-domain effects since EFs and language functions are dependent upon the same integrated brain network. To sum up, use of multiple languages could function as training to the control mechanism, thereby enhancing its capacity.

Inhibition is the most thoroughly researched components of EFs in relation to L2 experience-induced enhancement of EFs, and is defined as the deliberate inhibition of dominant, automatic or prepotent responses when needed (Miyake et al., 2000). The general consensus is that life-long L2 experience enables bilingual children and older adults to have better inhibitory control abilities compared to monolinguals (Bialystok et al., 2012). On the other hand, the same trend is not clearly observed in the research with young adults. While some researchers revealed positive effects of L2 experience on inhibition (Bialystok, Craik, & Ryan, 2006; Blumenfeld & Marrian, 2011, 2014; Chung-Fat-Yim, Sorge, & Bialystok, 2017; Yang & Yang, 2016), others indicate the null-effects (Antón, Carreiras, & Duñabeitia, 2019; Kalia, Wilbourn, & Ghio, 2014; Kousaie, Sheppard, Lemieux, Monetta, & Taler, 2014; Paap & Greenberg, 2013). The contradiction is obvious in the review papers as well. While van den Noort et al. (2019)

suggest that the majority of the papers reveal bilingual advantage, Paap's (2019) review indicated the opposite. Paap, Mason, Zimiga, Silva, & Frost (2020) argue that van den Noort et al. selected a limited amount of research with a possible tendency to give more weight to evidence confirming their hypothesis. Employing bias correction strategies, Lehtonen et al. (2018) found the null effects in their meta-analytic review of 152 studies on adults.

The contributions of life-long L2 experience has been intensively explored, yet the short-term or intensive L2 instruction as of/after puberty is also worthwhile to be investigated given the huge number of learners in the world receiving language education during this period. Challenging the critical period hypothesis (Lenneberg, 1967), albeit limited, scientific research indicates that receiving L2 instruction after puberty for one month (Qi et al., 2019), three months (Mårtensson et al., 2012) or nine months (Schlegel et al., 2012) is associated with EFs-related brain changes. With respect to inhibition, Sullivan, Janus, Moreno, Astheimer, and Bialystok (2014) analyzed the neural data from university students taking introductory Spanish courses and found electrophysiological changes in the post-test with larger P3 amplitude, indicating the strengthening of the neural network involved in inhibition. Yet, the behavioral data of the study revealed no bilingual advantage. Xie (2018), though, found positive influences of a one-year intensive L2 instruction on conflict monitoring measured by behavioral tasks. As such, it could be argued that more quality and intensive L2 experience is needed for behavioral differences to emerge (Driemeyer, Boyke, Gaser, Büchel, & May, 2008; Gurunandan, Carreiras, & Paz-Alonso, 2019). This also echoes the findings of Vega-Mendoza, West, Sorace, and Bak (2015) revealing no radical difference in the cognitive effects of language learning in adulthood compared to the one in childhood, yet stressing that increased exposure and proficiency in L2 provide more opportunity to switch between languages more, thereby training inhibition.

Extension of Bilingual Advantage to Trilingualism

On the basis of the IC model by Green (1998), it could be suggested that since trilinguals have a larger pool of lexical items, they encounter more competition to resolve, thus having better inhibitory control abilities. However, similar to the findings germane to bilingual advantage, research looking into the extension of bilingual advantage to trilingualism has yielded inconsistent results. Paap, Johnson, and Sawi (2014) pooled the data of young adults based on a wide range of inhibition tasks from two other studies (Paap & Greenberg, 2013; Paap & Sawi, 2014) and tested the hypothesis based on the IC model. Their findings revealed that trilingualism does not enhance inhibition more as compared to bilingualism. In fact, monolinguals were found to perform significantly better than both bilinguals and trilinguals on some of the measures (e.g., reaction time for antisaccade). On the other hand, Poarch and Bialystok (2015) indicated that proficient bilingual and trilingual children outperform their monolingual counterparts on the flanker task, yet did not provide any evidence demonstrating that negotiating among three languages offers added benefits as opposed to two. Likewise, Vega-Mendoza et al. (2015) having young adults as participants found the same results as Porch and Bialystok did. Additionally, Guðmundsdóttir and Lesk

(2019) found no significant group differences in the performances of adult monolinguals, bilinguals, and trilinguals on the Simon task, suggesting no bilingual advantage at all. Given the contradictory findings in the field, Guðmundsdóttir and Lesk suggest that one reason might be the recruitment of heterogeneous participants with different cultural and language background.

The relationship between proficiency in L2 or L3 and inhibitory control skills has also been a focus of recent research in the field. Costa, Santesteban, and Ivanova (2006) explored the language-switching performance of highly proficient bilinguals across various conditions: from dominant to dominant language (L1-L2), dominant to weak language (L2-L3), and dominant to rather weak language (L4). The participants showed asymmetrical switching costs in the last condition, indexing the presence of inhibitory control abilities. Likewise, Linck, Schwieter, and Sunderman (2012) found more reliance on inhibition during L1-to-L3 switches than L2-to-L3 ones, indicating that efficiency of inhibition is more robust when there is a large discrepancy in language dominance. Similarly, Marian, Blumenfeld, Mizrahi, Kania, and Cordes (2013) indicated that the higher level of interference in the less proficient language, suggesting it is harder to suppress co-activation of stronger languages. They also revealed that language proficiency influences the speed and accuracy in Stroop performances, with overall performance increasing as the level of proficiency goes up. Furthermore, Heidlmayr, Moutier, Hemforth, Tanzmeister, and Isel (2014) found that the use of multiple languages improved the capacity of inhibitory control and inhibition was influenced by the frequency of L3 use rather than L2 one. Yet, it should be noted that these findings are based on the performances of the participants on linguistic Stroop tasks.

In short, EFs can be improved thanks to the experiences in different fields, one of which is learning an additional language. Albeit limited, the existing research indicated inconclusive findings about the bilingual advantage and its extension to trilingualism, particularly in the case of young adults. Given the presence of little research and the contradictory results of the extant one, it would prove useful to compare trilinguals with bilinguals and explore the role of proficiency on the effects of L3 experience. Therefore, the aim of the current study was to investigate whether trilingualism differs from bilingualism in relation to the alleged enhancement of inhibition, and to what extent proficiency could play a role in any possible cognitive effects of managing more than one language.

Based on these considerations above, the following research question was investigated in this current study: Is there a joint effect of language experience (bilingual vs. trilingual) and task type (congruent vs. incongruent) in the Stroop performances of young adults?

a. Is there a joint effect of language experience and task type in accuracy?
b. Is there a joint effect of language experience and task type in latency?

In the light of the findings of extant research on inhibition employing the Stroop task (Marian et al. 2013), a Stroop effect is expected to be observed in groups with regard to the interference caused by incongruent tasks (Hypothesis 1). Next, high-proficiency (both in L2 and L3) trilinguals could be faster (Hypothesis 2) and more accurate (Hypothesis 3) in the Stroop task than high proficiency-bilinguals thanks to constant practice of inhibition by suppressing additional competing words from two non-target

languages (Green, 1998) and the reinforcement of L3 (Heidlymayr et al. 2013). With respect to the role of proficiency, high-proficiency trilinguals are expected to be more accurate (Hypothesis 4) and faster (Hypothesis 5) in the Stroop task than moderate-proficiency (both in L2 and L3) trilinguals due to the positive relationship between proficiency and Stroop performances (Marian et al., 2013), and the positive effects of frequency of L3 use on the capacity of inhibition (Heidlmayr et al., 2014).

Methodology

Participants

Fifty-one Turkish male students from one of the foundation universities in Istanbul participated in the current study. They formed three groups: moderate-proficiency trilinguals, high-proficiency trilinguals, and high-proficiency bilinguals.

The group of moderate-proficiency trilinguals consisted of 17 high-school graduates (M_{age} = 18.59 years, range 17–21 years, *SD* = 1.06) enrolled at English and Arabic courses at the preparatory language schools of the university. They formed a homogeneous group considering educational background and language proficiency. They had started learning English and Arabic as of the age of 12 and 15 respectively. They had all finished a religious high school practicing the same curriculum, and obtained high scores from the verbal part of the nationwide university entrance examination. Upon their admission to the university, they were given Michigan Test of English Language Placement and assigned to pre-intermediate classes in September, 2015. They took 24 contact hours of English every week and were intermediate-level students at the time of the data collection. Additionally, they were all the learners of Arabic with pre-intermediate proficiency level as well, and took 6 hours of Arabic during the same period. In order to proceed to their faculty program, namely Islamic Studies, they need to fulfill the language requirements of the university (i.e., receiving a minimum score of 5.5 from IELTS Academic Test to pass the English preparatory school during the first year; finishing the Arabic preparatory school in their second year at the same university; and attending three-month speaking course for Arabic in Jordan. This group was considered to have moderate-proficiency in English (L2) and Arabic (L3), and Turkish as their L1.

The group of high-proficiency trilinguals consisted of 17 junior students (M_{age} = 21.88 years, range 21–24 years, *SD* = .99) enrolled at the courses offered by Islamic Studies whose curriculum is conducted in Turkish (30%), English (40%) and Arabic (30%). These participants received the same high-school education as the moderate-proficiency trilinguals did. They had completed both English and Arabic preparatory schools and two-year academic study at the faculty, thus having high proficiency both in English (L2) and Arabic (L3), and Turkish as their L1.

The group of high-proficiency bilinguals consisted of 17 junior students (M_{age} = 21.29 years, range 20–23 years, *SD* = .97) enrolled at courses offered by the English medium Social Sciences programs. They were a heterogeneous group in terms of their educational background, yet their proficiency in English was similar to the high-proficiency trilinguals. They all had studied English at the preparatory school of the same university and successfully completed the program prior to their faculty study by

getting a minimum score of 5.5 from IELTS Academic. They all knew only two languages, namely Turkish (L1) and English (L2). Yet, it should be noted that these participants had received more courses in English as compared to the high-proficiency trilinguals.

Materials

In the current research, the standard version of Stroop color naming task was used to measure inhibition since bilingual language processing involves stimulus-stimulus conflict which is better reflected by the Stroop task (Blumenfeld & Marrian, 2014). Stroop (1935) developed the naming color tasks in a series of experiments. In the first one, the test required participants to read color names of the print written in different colors (incongruent condition, e.g., the word 'red' printed in 'blue') or in black (congruent condition). In the second one, incompatible words and control patches were used to be named. The findings indicated that color-naming in incongruent conditions is significantly slower and less accurate as compared to the congruent ones, which is called the Stroop effect.

The Stroop task employed in the recent study was an adapted neurocognitive testing battery provided by BrainBaseline Lab (2015). An application available for iOS and iPad was used for data collection. The stimuli were the printed focal color names 'red', 'green', 'blue', and 'yellow' in capital. The names were presented in the center of the screen. The trial started with a fixation cross. The stimulus appeared after the cross and the participants were asked to identify its color and pressed one of the four buttons (two on the middle of the left side of the screen with their initials: R (red) and G (green), and two on the middle of the right side of the screen with their initials: B (blue) and Y (yellow). Each participant watched a model video illustrating what to do, and did a practice test indicating correct or incorrect upon each answer. Following the practice, the real trial started when the participant hit the 'begin the test' button. Each trial included 24 congruent, 24 incongruent and 10 neutral stimuli in a randomized order. They did not receive any feedback upon their response to each stimulus. Two dependent variables were obtained from the Stroop task: accuracy and latency. Accuracy was operationalized as the total score of the correct answers while the latency was operationalized as the average response time. The maximum score for the accuracy was 24 both for congruent and incongruent conditions. Latency was measured in milliseconds (ms).

Data Collection

The data were collected between December 19, 2015 and January 9, 2016 in the cognitive psychology laboratory at the university. The participants were reached via email or personal contact and invited to the laboratory at their convenience. Upon arrival at the laboratory, they filled in an informed consent form and completed a background questionnaire. Early bilinguals or the ones who knew more than three languages were not given the Stroop task. Participants were not offered any compensation in return for their participation. They were only informed that they would

be able to learn about their Stroop task performances at the end of the semester upon request.

Results

The research question of the recent study is concerned with additive cognitive benefits of learning a third language (L3) and the role of proficiency in the possible effects of L3 experience. Table 1 presents the descriptive statistics.

Table 1. Descriptive statistics for accuracy and latency according to congruency

		Accuracy				Latency (ms)			
		Congruent		Incongruent		Congruent		Incongruent	
	n	M	SD	M	SD	M	SD	M	SD
Trilinguals_MP	17	23.12	2.02	21.88	2.20	850.1	161.9	986.2	211.4
Trilinguals_HP	17	23.24	1.15	22.76	1.2	773.4	100.6	801.5	100.7
Bilinguals_HP	17	23.29	.92	20.76	5.19	834.8	211.2	987.7	258.4
Total	51	23.22	1.42	21.80	3.37	806.1	169.3	925.2	216.12

Note. Trilinguals_MP = moderate-proficiency trilinguals, Trilinguals_HP = high-proficiency trilinguals, Bilinguals_HP = high-proficiency bilinguals

Descriptive statistics indicate that the participants had similar performance in accuracy but their scores were lower in incongruent tasks as compared to the congruent ones. In congruent tasks, high-proficiency trilinguals had higher means than moderate-proficiency trilinguals and bilinguals. Yet, all means were close to the maximum score, 24, suggesting a ceiling-effect. This poses a threat to the assumption of normality. As for latency, the values of skewness and kurtosis were within the acceptable range for normality. In both congruent and incongruent tasks, high-proficiency trilinguals were the fastest. Moderate-proficiency trilinguals and high-proficiency bilinguals had similar performances.

In order to examine whether there is an interaction between language groups and task type in terms of accuracy, a 3 X 2 mixed ANOVA was conducted, with language groups (moderate-proficiency trilinguals, high-proficiency trilinguals, high-proficiency bilinguals) as the between-subjects factor, and task type (congruent, incongruent) as the within-subjects factor (see Table 2).

Table 2. ANOVA summary table for the effects of language group and congruency on accuracy

Source	SS	df	MS	F	Partial Eta^2
Group	16.02	2	8.01	1.10	
Error (Group)	349.47	48	7.28		
Task	50.82	1	50.82	8.63*	.152
Error (Task)	282.77	48	5.89		
Group * Task	18.41	2	9.21	1.56	

Note. * $p < .01$

The ANOVA results revealed a significant main effect of task on accuracy. A paired-samples t-test comparing the performances of the participants on congruent tasks ($M = 23.22$, $SE = .20$) with those on incongruent tasks ($M = 21.804$, $SE = .47$) revealed a significant difference between these two conditions, $t(50) = 2.91$, $p < .01$, $d = -.88$.

In order to examine whether there is an interaction between language groups and task type in terms of latency, a 3 X 2 mixed ANOVA was conducted, with language groups (moderate-proficiency trilinguals, high-proficiency trilinguals, high-proficiency bilinguals) as the between-subjects factor, and task type (congruent, incongruent) as the within-subjects factor (see Table 3). The preliminary assumptions for the analysis were found to be fulfilled.

Table 3. ANOVA summary table for the effects of language group and congruency on latency

Source	SS	df	MS	F	Partial Eta^2
Group	492388.65	2	246194.32	3972*	.14
Error (Group)	2975308.94	48	61985.60		
Task	361581.66	1	361581.66	65275**	.58
Error (Task)	265890.59	48	5539.39		
Group * Task	34238.26	2	17119.13		

Note. * $p < .05$, ** $p < .001$

The ANOVA results revealed significant main effects of group and task type on latency. As for the differences among groups, post-hoc comparisons were conducted using Bonferroni adjusted alpha levels of .0125 per test. The findings indicated that high-proficiency trilinguals ($M = 767.44$, $SE = 24.07$) were significantly faster than moderate-proficiency trilinguals ($M = 918.18$, $SE = 43.01$); $t(25.13) = 3.058$, $p < .01$, $d = 1.05$, yet there was no significant difference between high-proficiency bilinguals ($M =$

911.24, *SE* = 55.13) and moderate-proficiency trilinguals, $t(32) = .10$, $p > .0125$, $d = .04$; or between high-proficiency trilinguals and high-proficiency bilinguals, $t(21.89) = -2.39$, $p > .0125$, $d = .82$. In addition, with respect to the differences between task types, the participants performed significantly faster in congruent tasks (*M* = 806.08, *SE* = 23.70) than incongruent ones (*M* = 925.16, *SE* = 30.26), $t(50) = -7.76$, $p < .001$, $d = 1.36$.

Discussion

The primary objective of this study is to look into whether trilingualism differs from bilingualism in contributing to the enhancement of inhibition, and to what extent proficiency plays a role in any possible cognitive effects of L3 experience. To this end, the data collected from three groups of language learners: moderate-proficiency trilinguals, high-proficiency trilinguals, and high-proficiency bilinguals. The findings of the recent research would contribute to the literature of bilingual advantage that consists of rather limited research exploring its extension to trilingualism, and add to our understanding of linguistic and cognitive processes together with their plasticity.

In tune with the prediction of the first hypothesis, the findings of the current study revealed that all participants were significantly more accurate and faster in congruent tasks as compared to incongruent ones, indicating the Stroop effect due to the higher level of interference caused by incongruent tasks. This finding corroborates the research employing the Stroop task to measure inhibition (e.g., Marian et al., 2013).

High-proficiency trilinguals as compared to high-proficiency bilinguals were predicted to be significantly more accurate and faster by the second and third hypotheses respectively. However, the finding indicating a non-significant group difference was at odds with our expectations based on the propositions of IC model by Green (1998) and the findings of Heidlymayr et al. (2013). On the other hand, this finding echoes the results of extant research (Guðmundsdóttir & Lesk, 2019; Porch & Bialystok; 2015; Vega-Mendoza et al., 2015), revealing that dealing with three languages does not suffice to offer additional cognitive benefits in comparison to bilingualism. Schroeder and Marian (2017) suggest three possibilities to explain why trilinguals do not outperform bilinguals. First, there could be an upper limit for the activated competitor words in the language system, and trilingualism would not impose additional inhibitory demands beyond what bilingualism does. Second, the inhibitory control abilities of young adults could be near their ceiling level, and they could not advance further. Last, trilingualism might increase inhibitory demands, yet this might not be sufficient enough to enhance the capacity of inhibition.

According to the fourth and fifth hypotheses of the current research, proficiency was predicted to play a role in increasing the demands on inhibition. As such, high-proficiency trilinguals would outperform moderate-proficiency trilinguals in accuracy and latency. Not the accuracy but the latency findings confirmed our predictions, which is to some extent consistent with the results of research by Marian et al. (2013) and Heidlmayr et al. (2014), indicating the role of proficiency and frequency of L3 use in the cognitive benefits that trilingualism offers respectively. Given the propositions by Schroeder and Marian (2017) and the critical period hypothesis (Lenneberg, 1967), this finding is of utmost importance since it implicates that young

adults are not at their ceiling level and are capable of enhancing their inhibition through such experiences as an additional language learning after puberty. These results are in tune with those of research revealing EFs-related brain changes (e.g., Qi et al., 2019) and behavioral changes (e.g., Xie, 2018) induced by a short-term or intensive L2 instruction after puberty. In addition, this provides evidence for the argument that more quality and intensive language experience is needed for behavioral differences to appear (Driemeyer et al., 2008) since the less experience learners have in controlling languages, the less they need to employ control mechanisms, thereby practicing them less (Poarch & van Hell, 2012).

The finding of the recent research indicating a non-significant group difference between high-proficiency bilinguals and moderate-proficiency trilinguals in either accuracy or latency could sound to be at odds with the role of proficiency since high-proficiency bilinguals could be expected to outperform moderate-proficiency trilinguals. This could be explained by the role of L3 experience even at a lower proficiency level in mental training associated with the asymmetrical switching costs found between low proficient or non-dominant L3 and dominant languages (e.g., Costa et al., 2006; Linck et al., 2012). In other words, these costs are thought to indicate that learning an additional L3 at a moderate level of proficiency can impose extra demands on the inhibition, thereby training its functions as well. Given the significant group difference between high-proficiency and moderate-proficiency trilinguals but non-significant group difference between high-proficiency bilinguals and moderate-proficiency trilinguals might imply that moderate-proficiency trilinguals' enhanced inhibitory control abilities were emerging, yet did not reach the performance of high-proficiency trilinguals.

The non-significant group differences between bilinguals and trilinguals regardless of the proficiency level could also be explained by the background of the participants. The participants in the trilingual groups were homogenous in the sense that they followed the same high-school curriculum and had socio-economic status. On the other hand, those in the bilingual group were heterogeneous. They were from different high schools and different academic programs. Insufficient interindividual variability might have caused group differences not to emerge (Bialystok, 2017). In addition, some background-related specifics (e.g., person and language outcome) can moderate the acquisition of multiple languages (Baumgart & Billick, 2018), thus modulating the scope of the inhibitory mechanism and playing a role in the enhancement of EFs based on L2/L3 experience. Furthermore, the language of the Stroop task was the second language, namely English, for the participants in the current study. However, the stimulus language was not expected to have a significant influence on the Stroop performances on the basis of the findings of Abunuwara (1992). In addition, the focal color names were used in the present study since they are the least vulnerable to the effects of differences in proficiency (Marian et al., 2013). Nevertheless, the findings should be read with a caution given the fact that the stimulus language could also have had an effect on the results of the present study.

Conclusion

The present study aims to fill the gap in the literature of bilingual advantage, stemming from very little amount of research that probes the extension of this alleged advantage to L3 experience after puberty, and has inconclusive findings. To this end, data were collected from 51 young adults in three groups having L2 and/or L3 experience: moderate-proficiency trilinguals, high-proficiency trilinguals, and high-proficiency bilinguals. The Stroop task was employed to measure inhibitory control abilities. The findings revealed no additional cognitive benefits of trilingualism as compared to bilingualism, yet proficiency in L3 was found to be related to the enhancement of inhibition.

Limitations and Suggestions for Further Research

Limitations of the present research and suggestions for further one are worth mentioning. First, the findings of current study are based on the Stroop task performances. Given the criticism regarding reliability and validity of the inhibition tasks due to the nature (Paap, Anders-Jefferson, Zimiga, Mason, & Mikulinsky, 2020) or the calculation of dependent variable (Draheim, Mashburn, Martin, & Engle, 2019; Rey-Mermet, Gade, & Oberauer, 2018); this study needs to be replicated and the results need to be confirmed by other studies employing more robust measures such as antisaccade as a benchmark task of inhibition (Hutton & Ettinger, 2006; Rey-Mermet et al., 2018) and/or a threshold version of Stroop or Flanker tasks (Draheim, Tsukahara, Martin, & Engle, in review). Second, the Stroop task employed in the present study was in L2. With this caveat in mind, further research could probe the role of L2/L3 proficiency on the enhancement of EFs by manipulating the stimulus language in the Stroop task. Third, the results are not universally applicable since they are specific to L1 Turkish learners of L2 English and L3 Arabic studying in an instructed setting in one of the foundation universities in Turkey. Therefore, caution should be exercised in generalizing the results to other bilinguals or trilinguals in other settings. Last, having 17 participants in each group is smaller than ideal. As such, further work can involve larger sample sizes to cross-validate and extend these findings in a longitudinal pre-test/post-test design.

Author's Note

The following ethical considerations were followed in conducting the study. First, participation in the study was on a voluntary basis. Second, when the participants arrived at the laboratory, they filled in an informed consent form. They were provided with the sufficient information pertaining to the goal of the study and the benefits they would reap from their participation. Third, it was made clear to them that they would not be subjected to any harm whatsoever. Fourth, they were informed that they could leave at any time during the administration of the task, and had rights not to allow the researcher to use their data after the task completion. Last, they were ensured that their names would be kept confidential and not be used for any purposes.

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Üçüncü Dil Deneyiminin Bilişsel Etkileri ve Dil Yetisinin Rolü

Öz

Bu çalışma, ikidillilik avantajının üçdilliliğe uzantısını ve dil yeterliliğinin üçüncü dil deneyiminin muhtemel bilişsel etkisi üzerindeki rolünü araştırmayı amaçlamaktadır. Bu doğrultuda, Stroop task kullanarak, üç gruptaki 51 genç yetişkinden veri toplanmıştır. Birinci grupta, orta seviyede İngilizce ve Arapça öğrenen 17 lise mezunu vardır. İkinci grup, öğretim dili Türkçe (%30), İngilizce (%40) ve Arapça olan İslami Bilimler bölümünde okuyan 17 üçüncü sınıf üniversite öğrencisinden oluşmaktadır. Son grupta, öğretim dili İngilizce olan Sosyal Bilimlerin ilgili bölümlerinde okuyan 17 üçüncü sınıf üniversite öğrencisi vardır. Sonuçlar, üç dilliliğin, ikidilliliğe göre ilave bilişsel etkisinin olmadığını, ancak üçüncü dildeki yüksek dil yeterliliğinin ketlemeyi olumlu yönde etkilediğini göstermektedir.

Anahtar sözcükler: üçdillilik, ikidilliliğin üstünlüğü, ketleme, dil yetisi