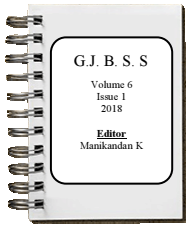
Guru Journal of Behavioral and Social Sciences
Volume 6 Issue 1 (Jan – Mar, 2018)
ISSN: 2320-9038 www.gjbss.org



Executive Functions in Early and Late Bilinguals

Nikita, M., Ankit Lohani., & Abhishek, B. P.
All India Institute of Speech and Hearing, Mysore, India.

Received: 13 Feb 2018
Revised: 18 Feb 2018
Accepted: 22 Mar 2018

Keywords:
Early bilinguals, Executive functions, Late bilinguals.

Abstract

Bilinguals i.e. individuals exposed to two or more language are known to enjoy several advantages compared to monolinguals and better executive functions is one of them The present study aimed at studying executive functions vary in early and late bilinguals. Forty bilingual participants were enrolled for the study. Attention domain was assessed by employing Navon letter identification task, Cognitive flexibility was tapped using stroop object task, For response inhibition task, the flanker's task was used. The reaction time and accuracy scores of the early and late bilinguals were almost same across the tasks and the results did not vary statistically showing that the executive functions may not vary with age of acquisition of second language.

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Bilingualism is defined as the usage and proficiency in at least two languages by an individual, which may change, depending on the opportunities to use the language and exposure to other users of the languages. Bilingualism can be classified on the basis of many domains like age of acquisition of second language, manner of acquisition of second language, proficiency etc. Based on age of acquisition of second language, bilinguals can be classified as early bilinguals and late bilinguals. Early bilinguals learn the second language along with the first language (simultaneously). In general, the second language is acquired by the age of 4 to 5years. Late bilinguals on the other hand are the ones who learn second language after 6 to 7 years. Bilinguals are assumed to enjoy several advantages including superior executive functions compared to monolinguals. There is another view concerning executive functions in bilinguals, attributing executive function to be responsible for bilingual advantage.

Bilingualism has been found to have positive effects on the linguistic, cognitive and emotional abilities of an individual. It helps an individual to become more sensitive to fine distinctions between languages. Further it enhances the effective use of their first language and aids in learning other languages. Various studies conducted in this area have found that bilingualism can enhance a bilingual's cognitive processes throughout life and they could develop better cognitive functions which are termed as the bilingual advantage where bilinguals demonstrate a superior performance relative to the monolinguals (Bialystok, Craik, Klein, & Viswanathan, 2004). Apart from just being able to converse with a wider range of people bilingualism also helps in resolving internal conflicts and gives the mind a workout that strengthens its cognitive muscles. It has been found that there is a delay in cognitive damage and hence the onsets of dementia symptoms are significantly delayed in bilingual individuals. Also improved cognitive skills in bilinguals are beneficial as they help in developing more efficient and faster monitoring systems and also better performances on the various tasks of executive functioning.

Bilingualism has been found to have a positive effect in the efficiency of the executive functioning (EF) system. Executive function is an umbrella term comprising of many cognitive process and behavioural competence (Chan, Shum, & Chen, 2008), which include cognitive flexibility, response inhibition or resistance to inference, verbal reasoning, problem solving, sequencing, the ability to sustain attention, resistance, utilization of feedback, multitasking and the ability to deal with novelty. It is a neurologically based skill involving mental control and self-regulation. Additional components of executive function traditionally include resistance to

interference, set-shifting, working memory (the ability to manipulate contents of short- term memory) and planning ability, all of each also may implicate inhibitory process. (Diamond, 2002; Eagle, 2002).

Vishwanathan and Bialystok (2009) found faster and better performance by bilinguals on tasks of cognitive flexibility and inhibitory control which made them conclude that bilingualism is responsible for enhanced executive control. Bunge (2002) found that bilinguals had an advantage over monolinguals in tasks of interference suppression. Similar results were found on nonverbal tasks to manage the two languages without the interference from the language systems. Hence it was concluded that throughout lifespan bilingualism is an important component in executive processing and bilinguals performed better than monolinguals in tasks of attention. Cognitive linguistic flexibility, inhibition and selective attention abilities has always been an advantage of bilingualism as bilinguals have more experience in switching between various languages which has attracted many researchers across the world to carry out research pertaining to this field.

Cognitive flexibility or set shifting is the ability of an individual to shift quickly between different response sets (Anderson, 2002). Prior and MacWhinney (2010) claimed that this switching requires the selection of a situation-appropriate language between two active language systems. There are a series of nonverbal tasks also such as the local-global task where a global larger figure composed of local smaller figures would be presented. This task comprises of both congruent and incongruent trials and the difference between the speed of responding for a congruent trial from the time that of an incongruent trial will be considered as the shifting effect.

Response Inhibition or interference refers to the ability to block the extra information in order to focus on a particular task. There are many tasks to measure inhibition in bilinguals. One such is the Stroop task where there would be asterisks appearing in colored ink along with color words appearing in both congruent and incongruent ink. The difference between the speed of responding to all the asterisks and the speed for naming the incongruent stimuli will be considered as the Stroop effect. Simon's task can also be used wherein colored squares would appear on either one side of the computer screen and participants have to press either the right shift key or left shift key for the respected colors. The difference between the speed of response when the trial is congruent and the speed of response when the trial is incongruent would be calculated as the Simon effect. Flanker task is another task where there will be a central target stimulus along with the presence of congruent (same direction) and incongruent flankers (opposite direction). Here the central target stimulus will be assigned a particular direction either left or right.

Attention refers to how an individual can actively process specific information in the environment. Attention in bilinguals can be measured using Navon's figures where a bigger recognisable shape, such as a letter is presented. The larger letter will comprise of smaller different shapes and the subjects have to pay attention and perceive the global as well as the local features of the items presented. Attentional Network Task (ANT) can also be used which is a combination of the Flanker task (Eriksen & Eriksen, 1974) and a cue reaction time task (Posner, 1980) where three attentional networks measure the ability of an individual to attend to a task. In addition Simon's task and Stroop task can also be used to test for attentional capacity.

Studies have compared the executive functions in monolinguals and bilinguals and the result favour bilinguals. In the current day scenario, it is difficult to find monolinguals, hence high proficient and low proficient bilinguals are recruited in most of the studies, these days. A recent study by Margret and Abhishek (2017) found that the executive functions would be better in high proficient bilinguals in comparison to low proficient bilinguals. Some proponents in this direction have stated that the executive functions would be better in early bilinguals

compared to monolinguals regardless of the proficiency factor as the second language is learnt before the critical age.

The present study aimed at findings out the effect of age of acquisition of second language on executive functions. It was decided to consider bilinguals who were all proficient in second language but the age of acquisition of second varied across the participants, some participants acquired the second language by the age of 5 while others learnt the second language after 6 years.

Objective

1. To determine the reaction time and accuracy for three domains of executive functions namely attention, cognitive flexibility and response inhibition.

Method

Participants

Purposive sampling was carried out for recruiting participants for the study. Forty Kannada-English bilinguals in the age range of 18-22 years were considered. The participants were divided into two groups based on age of acquisition. The first group of participants acquired L2 by 5 years while the second group acquired L2 after 5 years. LEAP Q (Ramya & Goswami, 2009) was administered on the participants and it was revealed that the all the participants had 'good' proficiency in second language.

Instruments

Navons' letter identification task was used to tap attention. The task of the participant was to see if the letter shape and the he letter constituent was the same, The stimulus was presented on DMDX auto mode and the task of the participant was press 1 if the two were the same and press 0 in case the shape and constituents were different.

Figure 1: Example for Navon's letter

To tap cognitive linguistic flexibility, stroop-object task was used. The stimulus was again presented through DMDX and pictures were used in this task. Few pictures were congruent (like banana yellow in colour) and few pictures were incongruent (like post box blue in colour). The task of the participant was to press 1 to indicate congruent trails and 0 for incongruent trials.

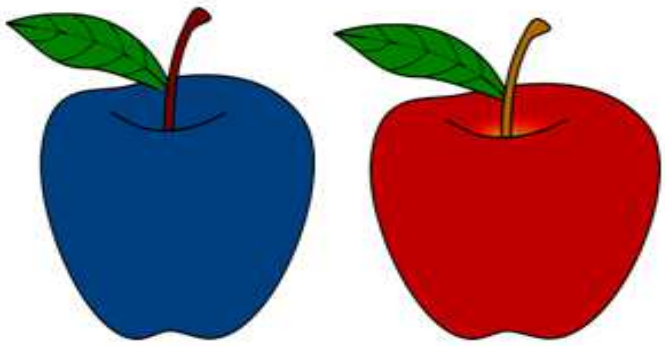

Figure 2: Example for Stroop Object task

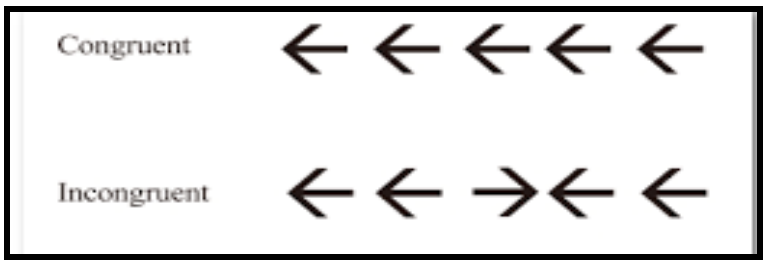

Figure 3: Example for Flanker's task

Flanker's task was used to tap response inhibition domain. Pictures indicating an arrow of arrows were used in this task. In few pictures, the central target and the other arrows were aligned in the same direction (congruent trial). In few other trails (incongruent), the central arrow and the other arrows were aligned in the different direction and the task of the participant was to press 1 to indicate congruent and 0 to press incongruent trails. The reaction and accuracy for each task was determined.

Results and Discussion

The mean reaction time for group 1 (early bilinguals) on the three tasks (Navon's letter identification, stroop-object task and Flanker's task) was 1534.34, 1511.22 and 1495.66 milliseconds respectively. While the accuracy scores were 88%, 94% and 96% respectively. The reaction time for group 2 on the same three tasks in the same order were 1531.28, 1455.66 and 1392.33 milliseconds, the accuracy scores were 89%, 94% and 93% respectively. The reaction time was more for Navon letter identification task compared to the other tasks. This hold true for both early as well as late bilinguals. The accuracy scores were in the same direction; this indicates that reflects the task complexity

Table 1

Reaction time for the two groups on the three tasks

Group	Task 1	Task 2	Task 3
Group 1	1534.34 ms	1511.42 ms	1495.63 ms
Group 2	1531.28 ms	1455.61 ms	1392.66 ms

Ms-milliseconds

Table 2

Accuracy scores (in %) for the two groups on the three tasks

Group	Task 1	Task 2	Task 3
Group 1	88	94	91
Group 2	89	94	93

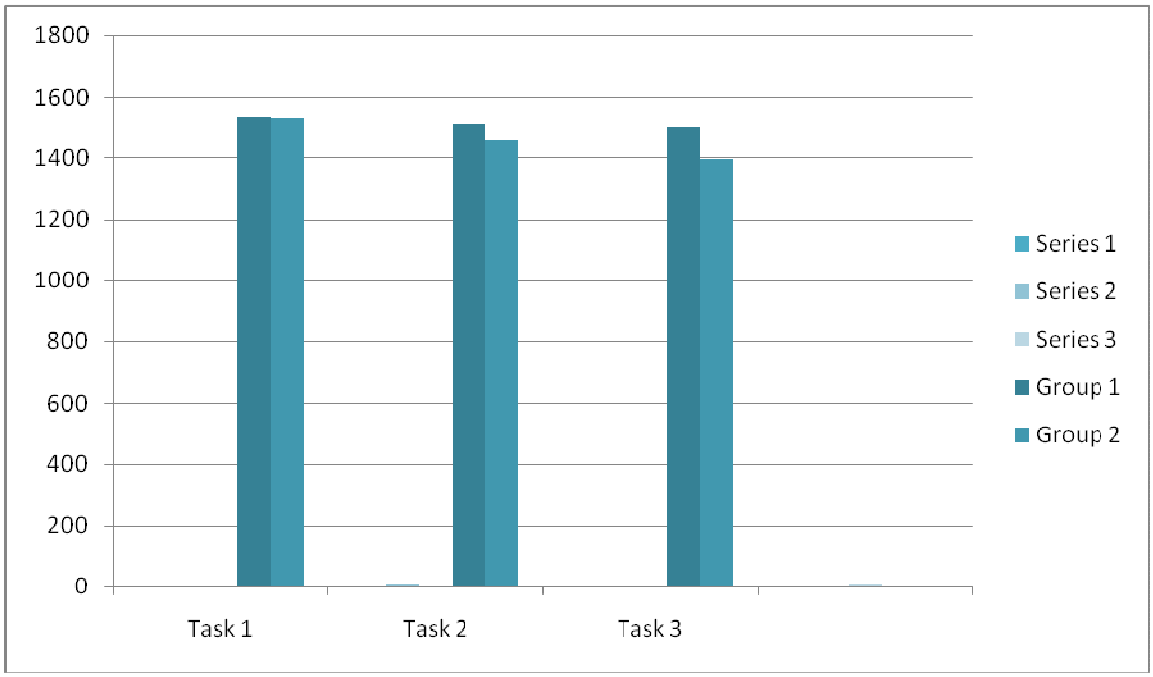

Figure 4: Reaction time for the two groups across the two tasks

In order to verify if there was a significant difference between the groups on the three tasks, Mann Whitney U test was used. The data was skewed and did not abide by the properties of normal distribution. The statistic was applied individually for reaction The Z scores obtained was 1.18, 1.34 and 1.66 respectively and the corresponding p value showed no significant difference between the two groups on any of the tasks. The test statistic was applied for accuracy scores also; the Z scores obtained was 0.02, 0.93 and 0.97. The corresponding p values ($p<0.05$) showed no significant difference The results showed that there was no significant difference between early and late bilinguals in terms of both reaction time as well as accuracy.

The executive functions is viewed as a definite advantage in bilinguals, many studies have compared executive functions in either monolinguals or bilinguals or low and high proficient bilinguals. Some researchers argue that executive function is better in early bilinguals compared to late bilinguals. This research question addressed in the present study and the results obtained showed that the early and late bilinguals performed equally well. The study was carried out on young bilingual adults as a preliminary attempt and can be replicated in children in order to see if the results would vary

Conclusion

The study was carried with the aim of investigating executive functions in early and late and bilinguals. 20 early bilinguals and 20 late bilinguals in the age range of 18-25 years were considered. It was decided to consider three of the numerous executive functions (attention, cognitive flexibility and response inhibition). Attention was tapped using Navon's letter identification, stroop-object task for cognitive flexibility and Flanker's task for tapping response inhibition. The output was derived in terms of reaction time (in milliseconds) and accuracy (percentage). The statistical analysis revealed that both early and late bilinguals performed equally well indicating that executive function did not vary as a function of age of acquisition.

References

Anderson, P. (2002). Assessment and development of executive function during childhood. *Child Neuropsychology, 8,* 71–82,.

Bialystok, E., Craik, F. I. M., Klein, R., & Viswanathan, M. (2004). Bilingualism, aging and cognitive control: Evidence from the Simon task. *Psychology and Aging, 19,* 290-303.

Bunge, E. (2002). Bilingualism and the Development of Executive Function: The Role ofAttention . *Child development perspectives*. 2 , 117-121.

Chan, R., Shum, D., & Chen , E. (2008) Assessment of executive functions: Review of instruments and identification of critical issues. *Archives of Clinical Neuropsychology* 23, 201–216.

Diamond. V. (2002). Bilingual children show advantages in nonverbal auditory executive function task . *International Journal of Bilingualism*, 18(6) 717– 729.

Eagle, J. (2002). The source of enhanced cognitive control in bilinguals: Evidence from bimodal bilinguals. *Psychological Science, 19,*1201–1206.

Eriksen, B. A. (1974). Effects of noise letters upon the identification of a targetletter in a nonsearch task. *Perception and Psychophysics.*

Margret, V., & Abhishek. (2017). Executive functions in high and low proficient bilinguals. Unpublished Masters Dissertation, submitted to the University of Mysuru,

Prior, A., & MacWhinney, B. A. (2010). Bilingual advantage in task switching. *Bilingualism:Language and Cognition, 13,* 253-262.

Posner, M. I. (1980). Orienting of attention. *Journal of Experimental Psychoogy,* 32, 3–25,

Ramya, M., & Goswami, S. P. (2009). Language Proficiency Questionnaire: An Adaptation of LEAP-Q in Indian Context , Masters disseration done at AIISH.