

VISUOSPATIAL PROCESSING IN THE RESOLUTION OF THE CORSI TEST IN BILINGUALS AND MONOLINGUALS CHILDREN

Samira Bouayed¹, Annamaria Lammel¹, & Louise Goyet²

¹*Université Paris 8-Vincennes-Saint-Denis, Paragraphe Laboratory (France)*

²*Université Paris 8 -Vincennes-Saint-Denis, Dysco Laboratory (France)*

Abstract

Several studies have shown that bilingual children perform are better than monolingual children, particularly in terms of mental flexibility and code switching. The aim of this study is to investigate whether the context of language learning modifies the strategies of information retrieval in visuo-spatial working memory illustrated by the nature of the errors made on one hand by bilinguals and on the other hand by monolinguals. To achieve this, we used the Corsi block tappink task (Corsi, 1972), a visuospatial working memory assessment tests. This study was conducted with 66 children aged 6 to 8 years (33 bilingual children and 33 Francophone children) and 58 bilingual subjects aged 8 to 10 years (29 bilingual children and 29 Francophone children). The results obtained from this study show a distinct visuo-spatial behavioral treatment patterns between the bilingual children and the monolingual children.

Keywords: *Bilingualism, working memory, Corsi Block.*

1. Introduction

Many researchers have investigated how the cognitive abilities of bilingual subjects emerge and develop compared to monolinguals. Among these studies, it has been shown that the simultaneous learning of several languages is beneficial for the development of executive functions in young children (Bialystok & al., 2014). This benefit is illustrated, in bilingual children, by their better abilities in terms of cognitive processing speed and cognitive flexibility when compared to monolinguals. Other studies conducted in children and adults have shown that learning simultaneously two languages could further develop resistance to interference (Bialystok et al., 2004, 2006, 2011). This benefit would be linked to the alternation of the two systems of mental representations of languages. Building upon this research, the present study aims to investigate whether the context of language learning modifies the strategies of information retrieval in visuo-spatial working memory. The general hypothesis predicts a difference in cognitive profiles which is illustrated by the nature of the errors made on one hand by bilinguals and on the other hand by monolinguals.

2. Method

This study was carried out with 66 children Group 1: 6 years to 7 years, 11 months old ($M = 7.5$; $SD = 0.86$) including 33 bilingual subjects and 33 monolingual subjects and 58 children Group 2: 8 years to 10 year, 11 months old ($M = 10.02$; $SD = 0.59$); 29 bilingual subjects and 29 monolingual subjects. The experimental protocol consists of the Corsi block-tapping task (Corsi, 1972), which is specifically used to measure visuospatial working memory. Following a demonstration, the participant must reproduce a sequence of tapping block. Success in the Corsi block tapping task is defined according to: (i) The correct direction of the progress of the tapping sequence, (ii) the correct location of the tapping block and (iii) the exact number of tapping blocks. These criteria will make it possible to identify whether there are differences in terms of cognitive treatment between bilinguals and monolinguals.

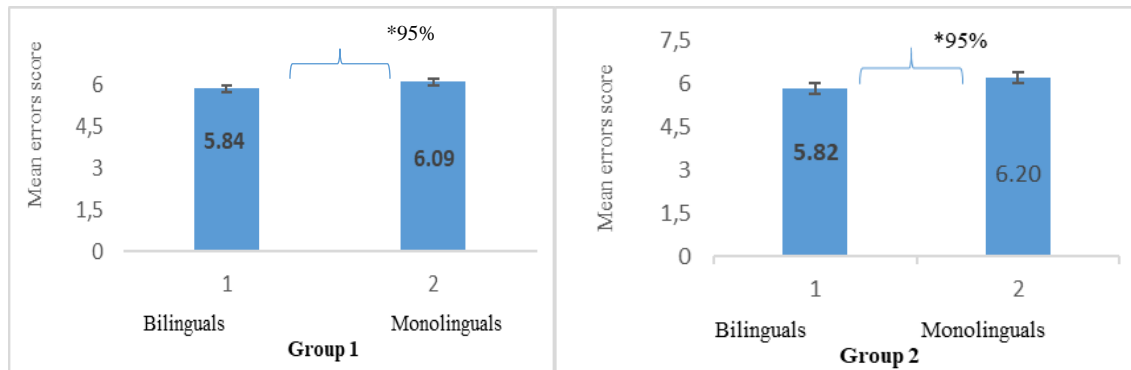
3. Results

The results of analysis of errors committed in visuo-spatial memory, show a significant difference in favor of Bilingual subjects: in subjects aged 6-8 years old, the mean errors score ($M = 5.84$; $SD = 1.60$) compared to Monolingual subjects ($M = 6.09$; $SD = 1.42$) and in bilingual subjects aged

8-10 years old, the mean errors score ($M=5.82$; $SD=1.66$) compared to Monolingual subjects ($M=6.20$; $SD=1.32$) (Cf. figure 1).

The quantitative results of this study were differentiated according to the three success criteria: direction errors, location errors and number errors of tapping blocks in memory visuospatial sequences for the two groups.

Figure 1. Mean Errors Score in Spatial Memory (Bilinguals Vs. Monolinguals aged 6-8 years old (Group 1) and 8-10 years old (Group 2)).

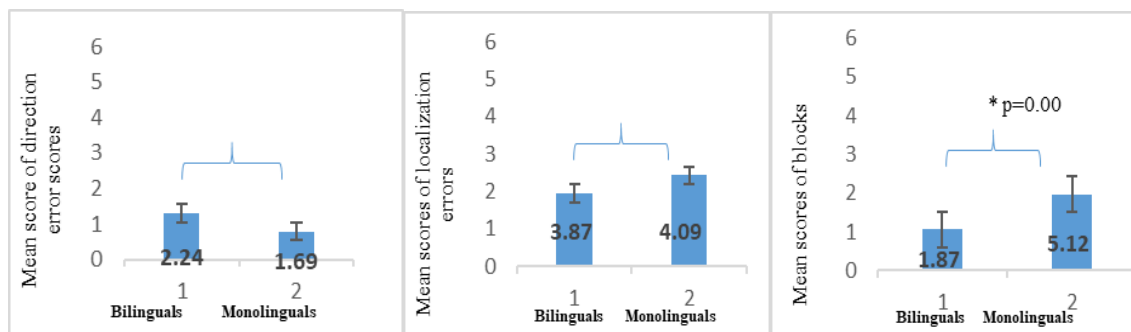


3.1. Group 1: 6-8 years old

The results of mean directional errors for Bilingual subjects ($M=2.24$; $SD=1.47$) show a higher mean errors score than Monolingual subjects ($M=1.69$; $SD=1.44$). The analysis of localization errors shows higher mean errors score in Monolingual subjects ($Avg=4.09$; $SD=1.28$) than Bilingual subjects ($Avg=3.87$; $SD=0.99$). Furthermore, the analysis of the number errors shows low mean errors score in Bilingual subjects ($M=1.87$; $SD=1.38$) compared to Monolingual subjects, ($M=5.12$; $SD=1.65$) These results show that monolingual subjects make more localization and number errors than bilingual subjects (Cf. figure 2). And the bilinguals make more directional errors than monolinguals.

The results show a significant effect of number error scores between bilinguals and monolingual children in group 1 (6-8 years old) $p<0.001$

Figure 2. Mean Directional, localization and number error Scores in Spatial Memory for the Group 1 (Bilinguals Vs. Monolinguals aged 6- 8 years old).

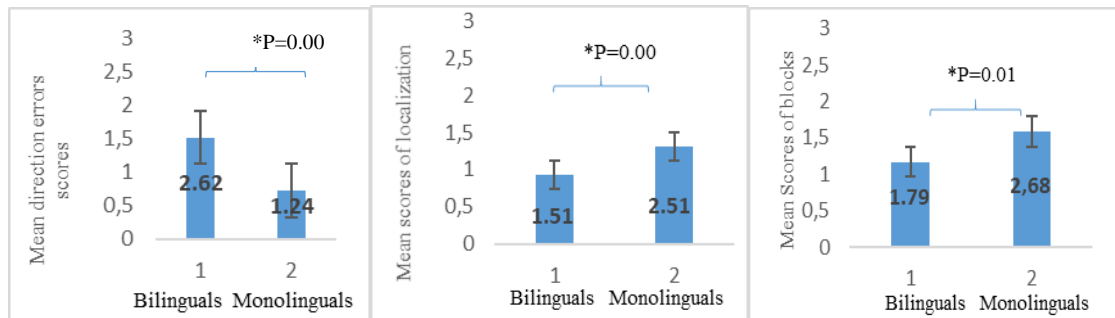


3.2. Group 2: 8-10 years old

The results of mean directional error score for Bilingual subjects ($M=2.62$; $SD=0.99$) show a higher mean errors score than Monolingual subjects ($M=1.24$; $SD=1.13$). The analysis of localization errors shows a higher mean errors score in Monolingual subjects ($Avg=2.51$; $SD=0.89$) compared to Bilingual subjects ($Avg=1.51$; $SD=0.77$). The analysis of the number errors shows a low mean errors score in bilingual subjects (Mean=1.79; $SD=1.15$), compared to Monolingual subjects ($M=2.68$; $SD=1.36$). These results show that monolingual subjects make more localization and number errors than bilingual subjects. (Cf. figure 3). And the bilinguals make more directional errors than monolinguals.

The result shown a significant effect of directional errors ($p<0.001$), localization error ($p<0.001$) and number errors ($p<0.001$) on group 2 aged 8-10 years old.

Figure 3. Mean Directional, localization and number error Scores in Spatial Memory for the Group 2 (Bilinguals Vs. Monolinguals aged 8-10 years old).



4. Discussion

In this study, we were to highlight a behavioral profile of visuo-spatial cognitive treatments specific to bilingual subjects. Statistical analyses show that all bilingual subjects commit on average more directional errors which demonstrates that they have greater difficulty in retrieving visuo-spatial information than monolingual subjects. In addition, the analyses show a large difference in errors in the number of blocks tapping in favour of bilingual subjects. These results indicate that bilingual subjects have well retained the number of blocks to be rendered in the path and, depending on the complexity of the visuo-spatial sequence, bilingual subjects use more cognitively challenging visuo-spatial techniques. The two groups of subjects implement distinct treatments.

5. Conclusion

These results support our hypothesis and show that language learning changes strategies used in a visuospatial working memory task. Visuospatial information retrieval strategies differ between bilingual and monolingual subjects, demonstrating distinct visuo-spatial behavioral treatment patterns between the two populations. This effect could be explained by the diversity of linguistic systems which promotes the development of executive functions.

References

- 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.
- Bialystok, E., Poarch, G., Luo, L., & Craik, M. (2014). Effects of bilingualism and aging on executive function and working memory. *Psychology and Aging*, 29 (3), 696-705.
- Corsi, P. (1972). *Human memory and the medial temporal region of the brain and memory*. McGraw Hill University.