**PB230 Replication**

**Study Preregistration**

**Study Title:** *Critical Period Effects in Second Language Learning: The Influence of Maturational State on the Acquisition of English as a Second Language* by Jacqueline S. Johnson & Elissa L. Newport (1989, *Cognitive Psychology*)

# I. Preliminary Analyses

As this was a between-person experimental design, any missing data due to non-completion of the task were deleted listwise. I had a final sample of 2725 participants. The distributions of reported score were as follows: native skewness = -0.18, kurtosis = .01; 3 to 7 age group skewness = -.02, kurtosis = -.11, 8 to 10 age group skewness = -.14, kurtosis = .02, 11 to 15 age group skewness = .12, kurtosis = -.32, 17 to 39 age group skewness = .09, kurtosis = .04. Figure 1 shows the distribution of scores for all conditions.

**Chart

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**Figure 1.** Distribution of heads reported in cheating and cheater conditons. The mean for each conditon is represnted by the dashed red horizontal line.

Descriptive statistics for the number of heads reported in the cheating and cheater conditions are presented in Table 1. The mean number of heads reported in the cheating condition was 5.74 (SD = 1.14), whereas the mean number of heads reported in the cheater condition was 4.72. The descriptive provide initial support for the alternate confirmatory hypothesis.

Table 1

*Descriptive statistics for score as a function of group.*

|  |  |  |
| --- | --- | --- |
| group | *M* | *SD* |
| native | 268.64 | 2.93 |
| three\_seven | 269.31 | 2.86 |
| eight\_ten | 256.51 | 6.00 |
| eleven\_fifteen | 235.67 | 13.08 |
| seventeen\_thirtynine | 210.20 | 23.89 |

*Note.* *M* and *SD* represent mean and standard deviation, respectively.

# II. Confirmatory Analysis

Four independent t-tests were performed to test the difference in mean English grammar test score between native English speakers, and those who were first exposed to English as a second language at the age of 3-7, 8-10, 11-15, and 17-39.

Participants in the native group obtained a slightly lower score (M = 268.64, SD = 2.93) than did those in the 3-7 group (M = 269.31, SD = 2.86), *t*(1088) = -3.7965, p < .001, d = -0.23. There was a mean difference in score between the groups of 0.67 (see Figure 2). The 95% confidence interval associated with this mean difference was obtained with 5,000 bootstrap resamples and did not include zero (Mdiff = 0.67, 95% CI = -1.01, -0.32). As such, the difference in mean score between those in the native group versus those in the 3-7 group is statistically significant.

Participants in the 3-7 group obtained a higher score (M = 269.31, SD = 2.86) than did those in the 8-10 group (M = 256.51, SD = 6), *t*(778.83) = -44.937, p < .001, d = -2.72. There was a mean difference in number of heads called between the groups of 12.8 (see Figure 3). The 95% confidence interval associated with this mean difference was obtained with 5,000 bootstrap resamples and did not include zero (Mdiff = 12.8, 95% CI = -13.35, -12.235). As such, the difference in mean score between those in the 3-7 group versus those in the 8-10 group is statistically significant.

Participants in the 8-10 group obtained a higher score (M = 256.51, SD = 6) than did those in the 11-15 group (M = 235.67, SD = 13.08), *t*(763.28) = 33.811, p < .001, d = 2.048. There was a mean difference in number of heads called between the groups of 22.84 (see Figure 4). The 95% confidence interval associated with this mean difference was obtained with 5,000 bootstrap resamples and did not include zero (Mdiff = 22.84, 95% CI = 19.63, 22.05). As such, the difference in mean score between those in the 8-10 group versus those in the 11-15 group is statistically significant.

Participants in the native group obtained a higher score (M = 235.67, SD = 13.08) than did those in the 3-7 group (M = 210.20, SD = 23.89), *t*(843.18) = 21.827, p < .001, d = 1.322. There was a mean difference in number of heads called between the groups of 25.47 (see Figure 5). The 95% confidence interval associated with this mean difference was obtained with 5,000 bootstrap resamples and did not include zero (Mdiff = 25.47, 95% CI = 23.176, 27.757). As such, the difference in mean score between those in the 11-15 group versus those in the 17-39 group is statistically significant.

These results indicate a clear relationship between age of arrival in the United Kingdom and test performance. Participants who were exposed to English at a younger age got better scores on the test than those who were exposed to the language later in life. Test performance decreased as age of first exposure to English increased. This supports the critical period theory of language acquisition. The null hypothesis states that there is no relationship between the age of exposure to English and participants’ performance in the test. Given these results, I reject the null hypothesis.

Chart, waterfall chart

Description automatically generated**Figure 2.** The mean score in the 3-7 group was significantly greater than in the native group.

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**Figure 3.** The mean score in the 3-7 group was significantly greater than in the 8-10 group.

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**Figure 4.** The mean score in the 8-10 group was significantly greater than in the 11-15 group.

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Description automatically generated**Figure 5.** The mean score in the 11-15 group was significantly greater than in the 17-39 group.