

## Homework 2

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### Abstract Anticipatory timing study

**Background** We used data of the US Naval Postgraduate School study, which examined the reaction time and hand-eye coordination of 113 visitors in Human Systems Integration Laboratory using a Bassin timer. Person's ability to estimate the speed of a moving light and its arrival at a designated point was estimated. 70 males and 43 females (age 2-52 years) completed the trial five times, and for each of them anticipatory timing was recorded.

**Statistical Methods** The data was initially examined with EDA plots. There was no missing data in this dataset. To examine predictors of anticipatory time, we applied general linear model with repeated measurements and separate exchangeable covariance structures for males and females (proc mixed, SAS 9.1). Absolute value of anticipatory timing was an outcome; covariates included age (continuous), gender, and trial (continuous). All possible interactions were investigated. Since plot for time vs age showed non-linear association, quadratic term of age was introduced. LSMEANS option was used to calculate means of anticipatory time at different ages for males and females.

**Results** EDA graphs showed no interaction between age and gender, trial and age, and trial and gender. These results were in agreement with the results of likelihood ratio test showing not statistically significant interactions ( $\chi^2=1.5$ ,  $df=3$ ,  $p>0.5$ ). The reduced final model included main effects of age, gender, trial and quadratic term of age since it was highly statistically significant ( $p=0.0002$ ). The anticipatory timing was decreasing with age ( $\alpha_{age}=-0.016$ ,  $p=0.0001$ ). The anticipatory timing decreased with the number of trials ( $\alpha_{trial}=-0.006$ ,  $p=0.03$ ). The difference between genders was not statistically significant ( $p=0.82$ ), although plots showed that anticipatory timing was slightly smaller for men at all ages. Mean anticipatory times obtained at ages 40 and 8 years confirm this result: at 40 years, mean anticipatory times were 0.093 s (SE=0.018) for women and 0.088 s (SE=0.019) for men, whereas at age of 8y anticipatory times were 0.177 s (SE=0.013) and 0.172 s (SE=0.018) for women and men, respectively. The difference between anticipatory times for women and men was the same at 40 and 8 years, was equal to 0.004, and was not statistically significant ( $t=0.23$ ,  $p=0.82$ ).

**Conclusion** In brief, mean anticipatory timing decreased with age in a non-linear fashion. There was no significant difference between genders averaged over age. As the number of the trial increased, mean anticipatory timing significantly improved.

Good!