Portfolio assignment 1: Regression

Experimental methods II - 2018; Mikkel Wallentin, Adam Finnemann

February 1, 2018

Sleep deprivation excercise

In this excercise we are going to look at response time as a function of days of sleep deprivation (see details below).

Deadline

February 8, 2018.

Reporting:

Use r_markdown in RStudio for your report. Submit report as a single pdf-file. Include commented code and figures all the way from data import.

Mark the beginning of each answer to a question with its relevant number/letter.

Students who worked with their study group in class may submit the same assignment report. Make sure to add your group number and note all the names of the people who contributed to the assignment in the beginning of the report.

Submit report to Blackboard.

Data

Find the data entitled "sleepstudy.csv" in Blackboard.

```
##load data, e.g.
#setwd("~/your_data_folder/")
#sleepstudy<-read.csv("sleepstudy.csv")
#str(sleepstudy)
```

Tasks

1. Plot the data:

1.a: Get the data from one participant, e.g. using subset(). Make a linear regression for reaction time as a function of days of sleep deprivation, e.g. using lm(). Report the F-statistics. 1.b: How many degrees of freedom does the relevant F-distribution have? 1.c: At which F-value does a regression with this distribution become statistically significant ($p<0.05$)? 1.c: Make a plot of the F-distribution.

2. For all participant in the experiment:

2.a: Find the coefficients (slope and intercept) for the regression for reaction time as a function of days of sleep deprivation (a hint for the solution: use group_by() in tidyverse or this function here: https://stat.ethz.ch/R-manual/R-devel/library/nlme/html/lmList.html) 2.b: Combine both scatter plot and

regression line in the same figure. You may also include all participants in one plot. 2.c: Collect and report the inferential statistics for each participant in a table using t-statistics, including t-value, df and p-value. 2.d: How many individual participants display a statistically significant effect of sleep deprivation (p-values uncorrected for mulitple comparisons)?

3. Across participants:

3.a: Use the slopes you found for each participant in exercise 2 as a new dataset. Test the hypothesis that the slopes are larger than zero against the null-hypothesis that the slopes are zero (i.e. no differences in response time exist as a function of time). 3.b: Justify your use of test statistics. 3.c: Report inferential statistics. 3.d: Make a plot with the mean reaction time and standard errror bars for each day across participants and plot the averaged regression line in the same figure.

Voluntory bonus task

Add 10% white/uniform noise to the Reaction data. What happens to the single participant coefficients statistics and to the group effects?

Study Details

The data are from a study by Belenky et al. (2003), for the sleep-deprived group and for the first 10 days of the study, up to the recovery period.

Reference

Gregory Belenky, Nancy J. Wesensten, David R. Thorne, Maria L. Thomas, Helen C. Sing, Daniel P. Redmond, Michael B. Russo and Thomas J. Balkin (2003) Patterns of performance degradation and restoration during sleep restriction and subsequent recovery: a sleep dose-response study. Journal of Sleep Research 12, 1???12.

Study abstract

Daytime performance changes were examined during chronic sleep restriction or augmentation and following subsequent recovery sleep. Sixty-six normal volunteers spent either 3 (n = 18), 5 (n= 16), 7 (n = 16), or 9 h (n = 16) daily time in bed (TIB) for 7 days (restriction/augmentation) followed by 3 days with 8 h daily TIB (recovery). In the 3-h group, speed (mean and fastest 10% of responses) on the psychomotor vigilance task (PVT) declined, and PVT lapses (reaction times greater than 500 ms) increased steadily across the 7 days of sleep restriction. In the 7- and 5-h groups speed initially declined, then appeared to stabilize at a reduced level; lapses were increased only in the 5-h group. In the 9-h group, speed and lapses remained at baseline levels. During recovery, PVT speed in the 7- and 5-h groups (and lapses in the 5-h group) remained at the stable, but reduced levels seen during the last days of the experimental phase, with no evidence of recovery. Speed and lapses in the 3-h group recovered rapidly following the first night of recovery sleep; however, recovery was incomplete with speed and lapses stabilizing at a level comparable with the 7- and 5-h groups. Performance in the 9-h group remained at baseline levels during the recovery phase. These results suggest that the brain adapts to chronic sleep restriction. In mild to moderate sleep restriction this adaptation is sufficient to stabilize performance, although at a reduced level. These adaptive changes are hypothesized to restrict brain operational capacity and to persist for several days after normal sleep duration is restored, delaying recovery.