260-2017-04-24-speed-lab

PSYCH 260.003

2017-04-24 09:52:34

## Today's topic

* Measuring the speed of nervous system conduction
* And, a tiny lesson in open, transparent, reproducible data science

## Question

* How fast does the nervous system conduct information?
* [Prior evidence](https://psu-psychology.github.io/psych-260-spring-2017/lecture-notes/260-2017-03-29-somatosensation.html#15)
	+ Proprioception vs. touch
* Why do we care?

## Prediction

We predict that the speed of conduction will be ...

## Scheme

* Speed = Distance/Time
* Chain of participants to make distance larger
	+ If typical person ~ 1.5 m, then
	+ at s=30 m/s, t = d/s -> 1.5/30 = 0.05 secs.

## Condition 1 (ankle)

* Squeeze ankle
* ankle\_shoulder + shoulder\_brain + brain\_decide + brain\_shoulder + shoulder\_hand

## Condition 2 (shoulder)

* Squeeze shoulder
* shoulder\_brain + brain\_decide + brain\_shoulder + shoulder\_hand
* Condition 1 - Condition 2
* ankle\_shoulder + ~~shoulder\_brain~~ + ~~brain\_decide~~ + ~~brain\_shoulder~~ + ~~shoulder\_hand~~

## Measure

* sum(ankle\_shoulder) for all participants -> Distance
* mean(time(Condition 1)) - mean(time(Condition 2)) -> Time
* Speed = Distance/Time

## Materials

* Stop watch
* Tape measure

## Decisions

* Same hand or dominant?
* Alternate ankle/shoulder or one condition before the other?
* How many trials?
	+ Fixed number?
	+ When reach asymptote?

## Data files

* Data file with [body measurements](https://docs.google.com/spreadsheets/d/1NFGu-M4AGf_4IHf-o4y3sCHUZ3Ao-CpBUpXqCsQrAIg/edit#gid=0)
	+ participant, ankleshoulder (cm)
* Data file with [reaction times](https://docs.google.com/spreadsheets/d/1NFGu-M4AGf_4IHf-o4y3sCHUZ3Ao-CpBUpXqCsQrAIg/edit#gid=1626241513)
	+ trial {1...n}, condition {ankle, shoulder}, time (s)

# Load R packages
library("googlesheets")
suppressPackageStartupMessages(library("dplyr"))
suppressPackageStartupMessages(library("ggplot2"))

## Measuring distance

psych260 <- gs\_title("psych-260-spring-2017")

## Sheet successfully identified: "psych-260-spring-2017"

psych260 %>%
 gs\_read(ws = "distance") ->
 distance

## Accessing worksheet titled 'distance'.

##
Downloading: 130 B
Downloading: 130 B
Downloading: 130 B
Downloading: 130 B

## No encoding supplied: defaulting to UTF-8.

dist.hist <- ggplot(data = distance, aes(x=ankleshoulder)) +
 geom\_histogram(bins = 5)



## Sum distance

with(distance, summary(ankleshoulder))

## Min. 1st Qu. Median Mean 3rd Qu. Max.
## 122.0 125.5 132.0 133.2 137.5 149.0

# Calculate sum
dist.sum = with(distance, sum(ankleshoulder))

The total distance is 2531 cm.

## Measuring time

psych260 %>%
 gs\_read(ws = "time") ->
 time

## Accessing worksheet titled 'time'.

##
Downloading: 110 B
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Downloading: 120 B

## No encoding supplied: defaulting to UTF-8.

# Plot data
time.plot = ggplot(data = time, aes(x=trial, y=time, color=condition)) +
 geom\_point() +
 geom\_line()



## Calculate time difference

time %>%
 filter(condition == "ankle") ->
 ankle.times

time %>%
 filter(condition == "shoulder") ->
 shoulder.times

time.diff <- data\_frame(trial=unique(time$trial),
 time=ankle.times$time - shoulder.times$time)

time.diff.plot = ggplot(data = time.diff, aes(x=trial, y=time)) +
 geom\_point() +
 geom\_line()



## Calculating speed

time.diff$speed <- (dist.sum)\*.01/time.diff$time

speed.hist <- ggplot(data = time.diff, aes(x=speed)) +
 geom\_histogram(bins = 5)



## Plot time series of speeds

speed.plot <- ggplot(data = time.diff, aes(x=trial, y=speed)) +
 geom\_point() +
 geom\_line()

speed.plot



## Summarizing findings

* We tested the mean speed of neural propagation in a sample of n=19 college-age adults.
* The mean speed of neural propagation over 5 trials was 17.5 m/s with a range of [-87.28, 90.39] m/s.
* These findings are/are not generally in accord with values we would expect from the literature.

## Limitations

## How to replicate/extend

## Contributors

## Resources

This document was prepared in RStudio 1.0.36 on 2017-04-24 09:52:39.

sessionInfo()

## R version 3.3.2 (2016-10-31)
## Platform: x86\_64-apple-darwin13.4.0 (64-bit)
## Running under: OS X El Capitan 10.11.6
##
## locale:
## [1] en\_US.UTF-8/en\_US.UTF-8/en\_US.UTF-8/C/en\_US.UTF-8/en\_US.UTF-8
##
## attached base packages:
## [1] stats graphics grDevices utils datasets methods base
##
## other attached packages:
## [1] ggplot2\_2.2.1 dplyr\_0.5.0 googlesheets\_0.2.1
##
## loaded via a namespace (and not attached):
## [1] Rcpp\_0.12.10 xml2\_1.1.1 knitr\_1.15.1 magrittr\_1.5
## [5] hms\_0.3 munsell\_0.4.3 colorspace\_1.3-2 R6\_2.2.0
## [9] httr\_1.2.1 stringr\_1.2.0 plyr\_1.8.4 tools\_3.3.2
## [13] grid\_3.3.2 gtable\_0.2.0 DBI\_0.6-1 htmltools\_0.3.5
## [17] openssl\_0.9.6 yaml\_2.1.14 lazyeval\_0.2.0 assertthat\_0.2.0
## [21] rprojroot\_1.2 digest\_0.6.12 tibble\_1.3.0 readr\_1.1.0
## [25] purrr\_0.2.2 rsconnect\_0.7 curl\_2.5 evaluate\_0.10
## [29] rmarkdown\_1.4 labeling\_0.3 stringi\_1.1.5 cellranger\_1.1.0
## [33] scales\_0.4.1 backports\_1.0.5 jsonlite\_1.4