

260-2015-11-30-speed-lab

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Announcements

- Quiz 4 next Monday, 12/7
- Exam 3 discussion, Exam 4 review 12/9
- Exam 4 on Monday, 12/14, 8a, **305 Wagner**
- Paper/blog posts due this Friday.

Grades thus far

Today's Topics

- Measuring the speed of thought

The speed of thought

Speed limits on thought and action

Why should I care?

- Safe following speeds in driving
- False starts in track

False starts in track

- Sprinter starts moving < 100 ms (0.1s) after starting gun
- Measured by force platforms in starting blocks
 - [ReacTime False Start Detection System](#)

Examples

<http://condellpark.com/kd/reactiontime.htm>

Why 100 ms?

- Fastest possible reaction time!
- Ear \rightarrow brain \rightarrow legs
- [Kosinski review](#)

Let's measure!

- Groups of $n > 10$
 - Mixed sex, single sex (if time)
 - Timer: Erin, or other students
 - Data scribe: Dr. G
- Measure ankle to shoulder (in cm) for each participant, 3x
 - Record on [spreadsheet](#)

Let's measure!

- Measure mass reaction time (10+ times)
 - Ankle condition
 - Shoulder condition
- Calculate average speed of conduction
 - ankle -> brain -> hand
 - shoulder -> brain -> hand
 - speed = distance/time

Data analysis

- [Link to Google Docs](#)

Download data

- As .csv, comma-separated value

Load data into RStudio

```
body <- read.csv('~Downloads/psych-260-bbh-203-nerve-conduction-lab - body-measurements.csv')
str(body)
```

```
## 'data.frame': 12 obs. of 5 variables:
## $ Group : Factor w/ 2 levels "a","b": 1 1 1 1 1 1 2 2 2 2 ...
## $ Participant : int 1 1 1 2 2 2 1 1 1 2 ...
## $ Sex : Factor w/ 2 levels "f","m": 2 2 2 1 1 1 2 2 2 1 ...
## $ Ankle_shoulders_cm: int 125 124 123 110 115 112 127 125 121 111 ...
## $ Measure_num : int 1 2 3 1 2 3 1 2 3 1 ...
```

Load data into RStudio

```
times <- read.csv('~Downloads/psych-260-bbh-203-nerve-conduction-lab - time-measurements.csv')
str(times)
```

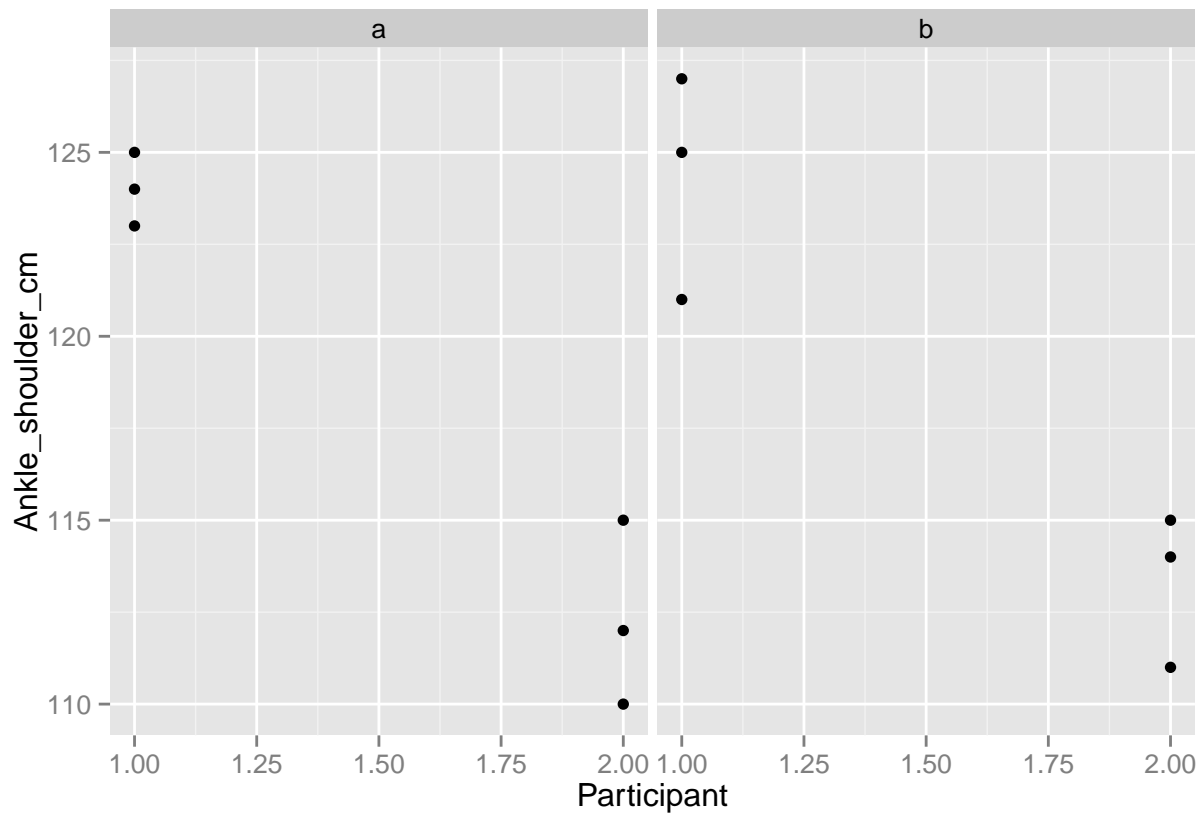
```
## 'data.frame': 40 obs. of 4 variables:
## $ Group      : Factor w/ 2 levels "a","b": 1 1 1 1 1 1 1 1 1 1 ...
## $ Trial_num   : int  1 2 3 4 5 6 7 8 9 10 ...
## $ Ankle_shoulder: Factor w/ 2 levels "ankle","shoulder": 2 2 2 2 2 2 2 2 2 2 ...
## $ Time_secs  : num  5 4 6 5.5 4.75 5.25 6.24 4.8 6.5 4.2 ...
```

Get ready to plot

```
# Load libraries
require(ggplot2)
require(dplyr)
```

Plot body measurements

```
qplot(x=Participant, y=Ankle_shoulder_cm, data=body, facets = . ~ Group)
```



Average body measurements within participants

```
mean_length <- body %>%
  group_by(Group, Participant) %>%
  summarize(mean_part_cm = mean(Ankle_shoulder_cm))
mean_length
```

```
## Source: local data frame [4 x 3]
## Groups: Group
##
##   Group Participant mean_part_cm
## 1     a           1    124.0000
## 2     a           2    112.3333
## 3     b           1    124.3333
## 4     b           2    113.3333
```

Sum body measurements across groups

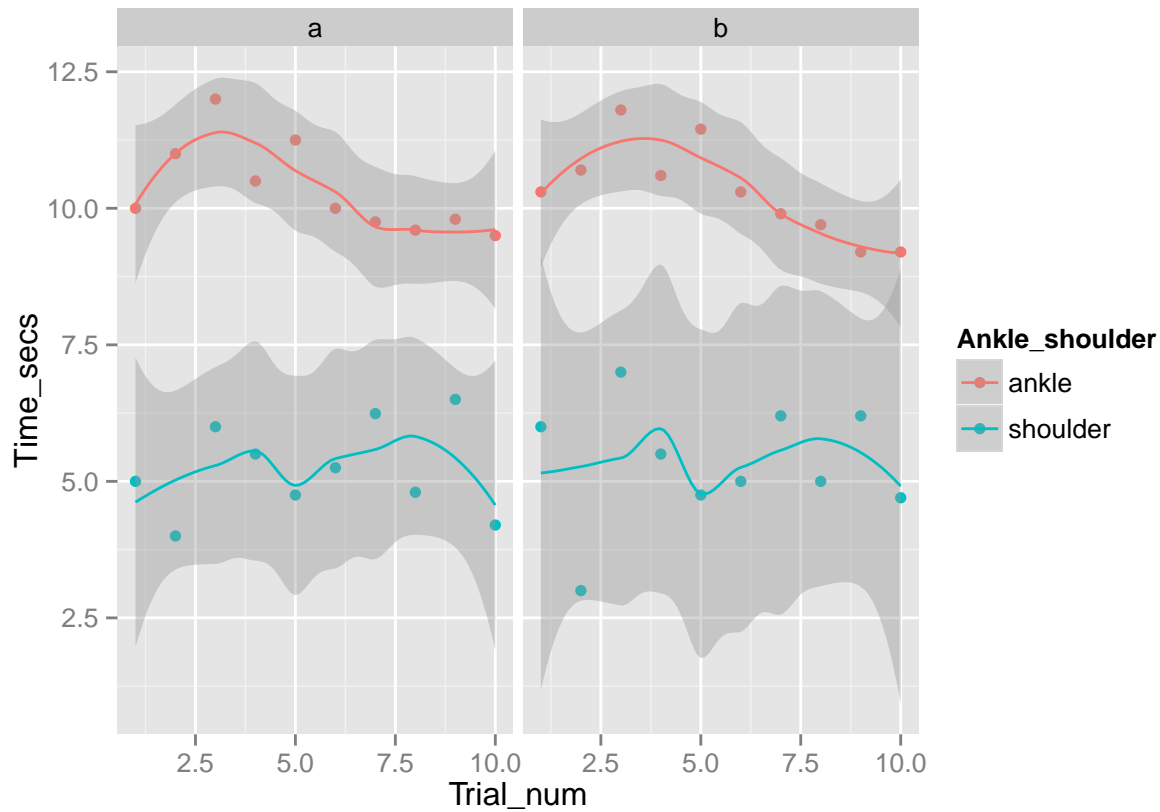
```
total_length <- mean_length %>%
  group_by(Group) %>%
  summarize(total_cm = sum(mean_part_cm))
total_length
```

```
## Source: local data frame [2 x 2]
##
##   Group total_cm
## 1     a 236.3333
## 2     b 237.6667
```

Plot times

```
qplot(x=Trial_num, y=Time_secs, data=times, facets = . ~ Group, color=Ankle_shoulder, geom=c("point", "line"))

## geom_smooth: method="auto" and size of largest group is <1000, so using loess. Use 'method = x' to change
## geom_smooth: method="auto" and size of largest group is <1000, so using loess. Use 'method = x' to change
```



Calculate time difference

```
ankle_times <- times %>%
  filter(Ankle_shoulders=="ankle") %>%
  select(Time_secs)

shoulder_times <- times %>%
  filter(Ankle_shoulders=="shoulder") %>%
  select(Time_secs)

times$Secs_diff <- ankle_times$Time_secs - shoulder_times$Time_secs
```

Merge dataframes so can plot speeds

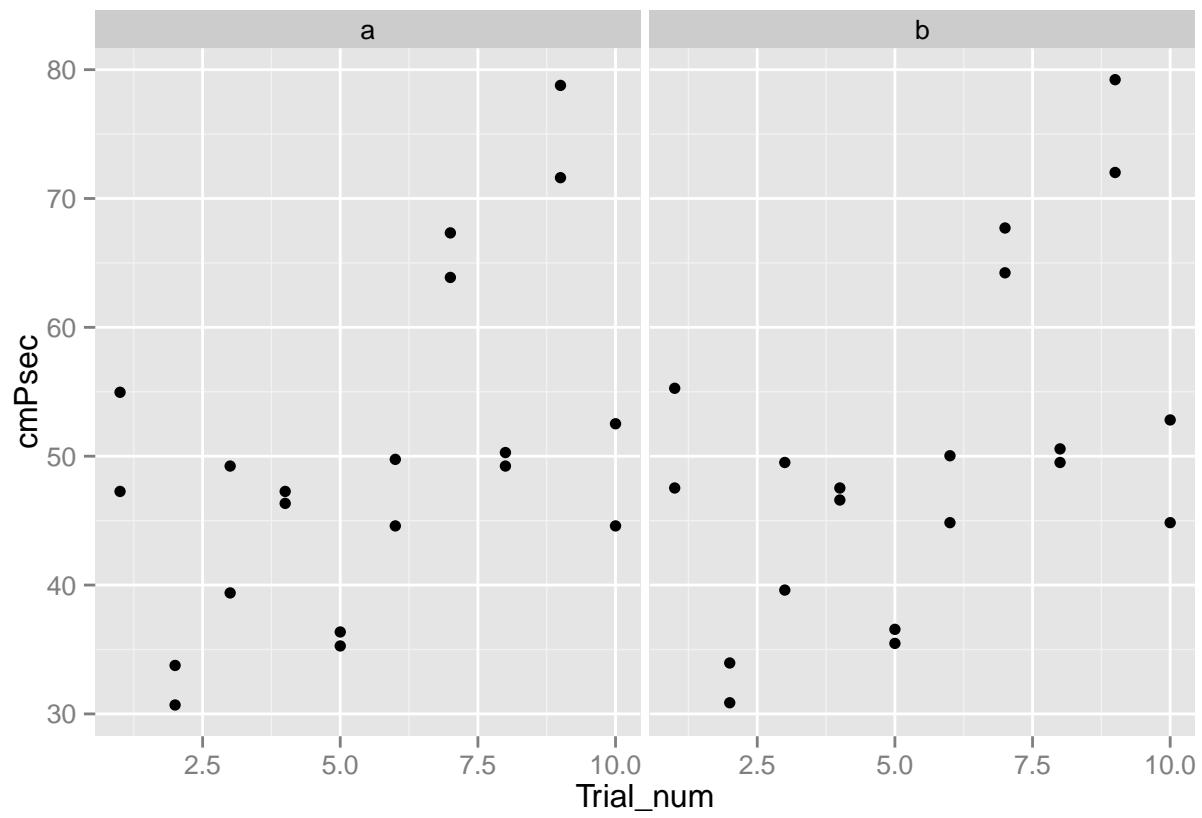
```
merged <- merge(total_length, times, by="Group")
merged
```

```
##      Group total_cm Trial_num Ankle_shoulders Time_secs Secs_diff
## 1      a 236.3333      1      shoulder      5.00      5.00
## 2      a 236.3333      2      shoulder      4.00      7.00
## 3      a 236.3333      3      shoulder      6.00      6.00
## 4      a 236.3333      4      shoulder      5.50      5.00
## 5      a 236.3333      5      shoulder      4.75      6.50
```

## 6	a	236.3333	6	shoulder	5.25	4.75
## 7	a	236.3333	7	shoulder	6.24	3.51
## 8	a	236.3333	8	shoulder	4.80	4.80
## 9	a	236.3333	9	shoulder	6.50	3.30
## 10	a	236.3333	10	shoulder	4.20	5.30
## 11	a	236.3333	1	ankle	10.00	4.30
## 12	a	236.3333	2	ankle	11.00	7.70
## 13	a	236.3333	3	ankle	12.00	4.80
## 14	a	236.3333	4	ankle	10.50	5.10
## 15	a	236.3333	5	ankle	11.25	6.70
## 16	a	236.3333	6	ankle	10.00	5.30
## 17	a	236.3333	7	ankle	9.75	3.70
## 18	a	236.3333	8	ankle	9.60	4.70
## 19	a	236.3333	9	ankle	9.80	3.00
## 20	a	236.3333	10	ankle	9.50	4.50
## 21	b	237.6667	1	shoulder	6.00	5.00
## 22	b	237.6667	2	shoulder	3.00	7.00
## 23	b	237.6667	3	shoulder	7.00	6.00
## 24	b	237.6667	4	shoulder	5.50	5.00
## 25	b	237.6667	5	shoulder	4.75	6.50
## 26	b	237.6667	6	shoulder	5.00	4.75
## 27	b	237.6667	7	shoulder	6.20	3.51
## 28	b	237.6667	8	shoulder	5.00	4.80
## 29	b	237.6667	9	shoulder	6.20	3.30
## 30	b	237.6667	10	shoulder	4.70	5.30
## 31	b	237.6667	1	ankle	10.30	4.30
## 32	b	237.6667	2	ankle	10.70	7.70
## 33	b	237.6667	3	ankle	11.80	4.80
## 34	b	237.6667	4	ankle	10.60	5.10
## 35	b	237.6667	5	ankle	11.45	6.70
## 36	b	237.6667	6	ankle	10.30	5.30
## 37	b	237.6667	7	ankle	9.90	3.70
## 38	b	237.6667	8	ankle	9.70	4.70
## 39	b	237.6667	9	ankle	9.20	3.00
## 40	b	237.6667	10	ankle	9.20	4.50

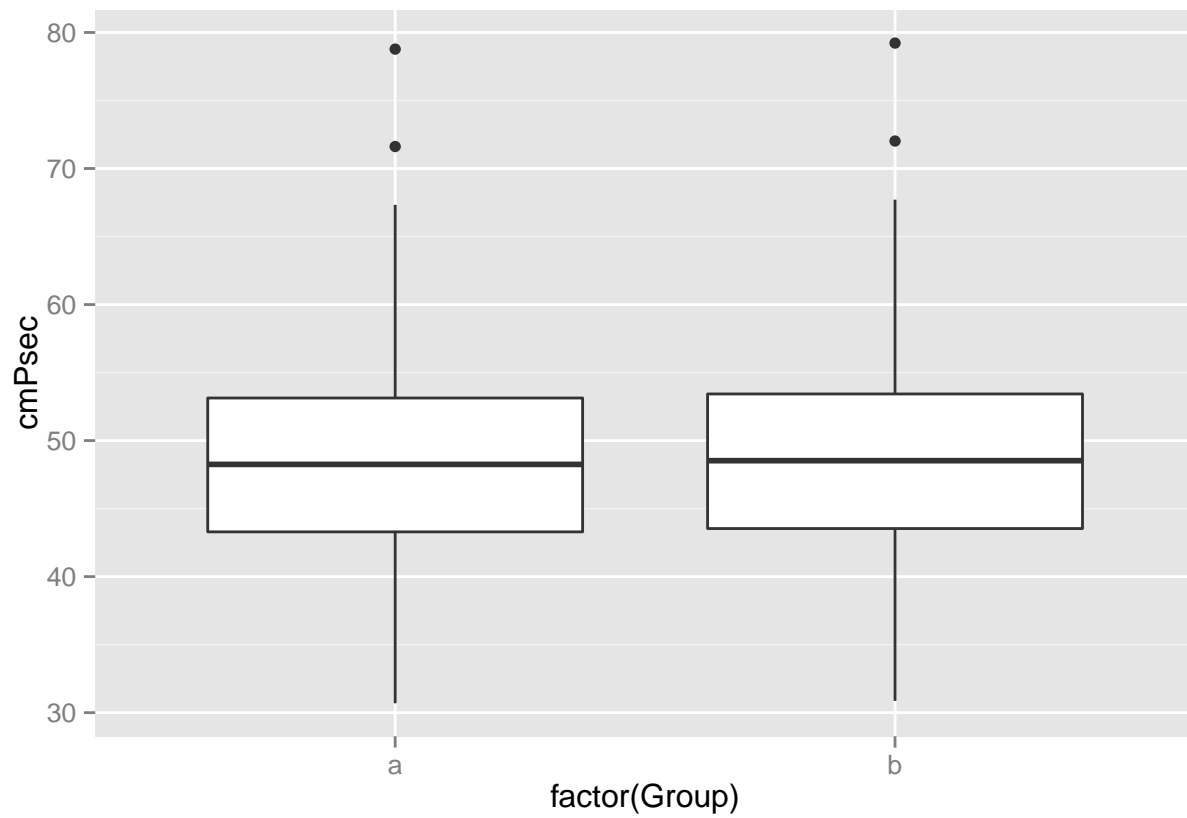
Plot speeds vs. Trial_num

```
merged <- merged %>%
  mutate(cmPsec=total_cm/Secs_diff)
qplot(x=Trial_num, y=cmPsec, data=merged, facets = . ~ Group)
```



Plot speeds by Group

```
qplot(x = factor(Group), y=cmPsec, data=merged, geom="boxplot")
```



Next steps

- Write up (2-4 pp, double-spaced)
 - Introduction
 - Methods
 - Results
 - Discussion
- Worth 15 points (extra credit or replace paper/blog)