Data Description & Data Analysis I

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```
screen_data = read_xlsx("C:\\Users\\igome\\Downloads\\620W22-Project2-Data (1).xlsx", sheet = 1)
baseline_data = read_xlsx("C:\\Users\\igome\\Downloads\\620W22-Project2-Data (1).xlsx", sheet = 2)
```

BASELINE DATA

```
baseline_data = baseline_data %>% mutate(
                          Workmate =as.factor(workmate),
                          Academic = as.factor(academic),
                          Non.Academic = as.factor(non.academic),
                          Pets = as.factor(pets),
                          Sex = as.factor(sex),
                          Degree = as.factor(degree),
                          Job = as.factor(job),
                          Age = age,
                          Course.Hours = course.hours,
                          Siblings = siblings,
                          Apps = apps,
                          Devices = devices,
                          Procrastination = procrastination
                          )

table1::table1(~  Workmate + Academic  + Non.Academic + Pets +  + Age + Course.Hours + Degree + Job + S
```

	Overall
	(N=32)
Workmate	
0	21 (65.6%)
1	9 (28.1%)
2	2 (6.3%)
Academic	
0	9 (28.1%)
1	9 (28.1%)
2	14 (43.8%)
Non.Academic	
0	11 (34.4%)
1	10 (31.3%)
2	11 (34.4%)
Pets	
0	29 (90.6%)
1	3 (9.4%)
Age	
Mean (SD)	23.4 (2.05)
Median [Min, Max]	23.0 [21.0, 30.0]
Course.Hours	
Mean (SD)	13.0 (1.72)
Median [Min, Max]	13.0 [9.00, 17.0]
Degree	
0	14 (43.8%)
1	18 (56.3%)
Job	
0	16 (50.0%)
1	16 (50.0%)
Siblings	
Mean (SD)	0.781 (1.01)
Median [Min, Max]	0 [0, 3.00]
Apps	
Mean (SD)	5.19 (5.37)
Median [Min, Max]	4.00 [1.00, 32.0]
Devices	
Mean (SD)	2.31 (0.965)
Median [Min, Max]	2.00 [1.00, 6.00]
Procrastination	
Mean (SD)	35.5 (13.0)
Median [Min, Max]	34.5 [12.0, 68.0]

STEP 1: Making first time pickup variable

```
screen_data$Pickup.1st = strptime(screen_data$Pickup.1st, format = "%H:%M")

screen_data = screen_data %>% mutate(Pickup.1st.minute=(hour(Pickup.1st)*60+minute(Pickup.1st)))


 #NEED TO SHIFT WAKE-UP TIME, SO VARIABLE ARE ASSOCIATED WITH NEXT DAY.
```

```
screen_data$Pickup.1st.minute = c(screen_data$Pickup.1st.minute[-1],NA)

screen_data = screen_data%>% mutate(Pickup.1st.minute = ifelse(Time == 30,NA,Pickup.1st.minute))
```

```
screen_data_complete =
  screen_data %>% filter(is.na(Pickup.1st.minute) == FALSE) %>% select("ID","Time","Day","Tot.Scr.Time"
```

STEP 2: SANITY CHECK

```
screen_data_complete[as.numeric(screen_data_complete$Tot.Scr.Time) < as.numeric(screen_data_complete$To
```

```
## Warning in `[.tbl_df`(screen_data_complete,
## as.numeric(screen_data_complete$Tot.Scr.Time) < : NAs introduced by coercion

## Warning in `[.tbl_df`(screen_data_complete,
## as.numeric(screen_data_complete$Tot.Scr.Time) < : NAs introduced by coercion
```

```
## # A tibble: 1 x 9
##      ID  Time Day   Tot.Scr.Time Tot.Soc.Time Pickups Pickup.1st
##   <dbl> <dbl> <chr> <chr>        <chr>        <chr>   <dttm>
## 1    NA    NA <NA>  <NA>         <NA>         <NA>    NA
## # ... with 2 more variables: Pickup.1st.minute <dbl>, Imputed <dbl>
```

```
table(screen_data_complete$Day)
```

```
##
##       Fri    Friday       Mon    Monday       Sat  Saturday       Sun    Sunday
##         8       118         8       118         8       119         8       119
##       Thu  Thursday       Tue   Tuesday       Wed Wednesday
##         8       120        10       148         8       120
```

Day is written differently, need to update to make sure day is uniformed.

STEP 1: Figure out the dates for the ones written in number. There appears to be one user (ID # 10) who inputed numbers instead of the day. So wil need to insert the correct days. Given that all 34 users collected the data during the same dates, we can simply assume that users 10 data is also collected on the same dates (and hence days), as the other users. I manually fixed this on excel.

```
library(dplyr)
screen_data_complete = screen_data_complete %>%
  mutate(day = recode(Day,
                      "Friday" = "Fri",
                      "Monday"  = "Mon",
                      "Saturday" = "Sat",
                      "Sunday" = "Sun",
                      "Thursday" = "Thu",
                      "Tuesday" = "Tue",
                      "Wednesday" = "Wed"))
#Factor and relevel days
screen_data_complete$day  = factor(screen_data_complete$day, levels=c("Sun", "Mon", "Tue", "Wed", "Thu"

#Create binary weekend vs no weekend d
screen_data_complete = screen_data_complete %>%
  mutate(if_weekend = day %in% c("Sun", "Sat","Fri"))
```

MAKE NUMERIC VARIABLES, NUMERIC

```r
screen_data_complete = screen_data_complete %>% mutate(
  Tot.Scr.Time = as.numeric(Tot.Scr.Time),
  Tot.Soc.Time = as.numeric(Tot.Soc.Time),
  Pickups = as.numeric(Pickups),
  ID = as.factor(ID)
)
```

```
## Warning in mask$eval_all_mutate(quo): NAs introduced by coercion

## Warning in mask$eval_all_mutate(quo): NAs introduced by coercion

## Warning in mask$eval_all_mutate(quo): NAs introduced by coercion
```

```r
table(screen_data_complete$day)
```

```
##
## Sun Mon Tue Wed Thu Fri Sat
## 127 126 158 128 128 126 127
```

```r
#table(screen_data_complete$Pickup.1st)
```

```r
table(screen_data_complete$Time)
```

```
##
##  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
## 32 32 32 32 32 32 32 32 32 32 31 32 32 32 32 32 32 32 32 32 32 32 32 31 31
## 27 28 29
## 31 30 30
```

MAKE WAKEUP TIME

```r
# ggplot(screen_data_complete, aes(x = Time, y = Tot.Scr.Time,
#                          color = if_weekend)) +
#         geom_line(aes(color = as.factor(screen_data_complete$ID))) +
#         geom_point() +
#         labs(x = "",y ="Total Screen Time (min)", caption = "(a) total screen time" ) +
#        # ylim(15,702) +
#       #  scale_color_manual(labels = c("weekdays", "weekends"), values =
#         #                     c("black","red")) +
#     theme_minimal() +
#     theme(axis.text.x = element_text(angle = 60, hjust = 1),
#           axis.title.y = element_text(size = 8, hjust = 1),
#           plot.caption = element_text(hjust=0.5,vjust = 0.1, size=9),
#           legend.title = element_blank())

# https://stackoverflow.com/questions/60436663/spaghetti-plot-using-ggplot-in-r
scr_time_plot = ggplot(screen_data_complete, aes(Time, Tot.Scr.Time, color = ID))+
  geom_line() +
  labs(x = "Day",y ="Total Screen Time (min)", caption = "(a) total screen time" ) +
  geom_line(data = screen_data_complete, aes(Time, y= Tot.Scr.Time),size = 0.5) +
   theme_minimal() +
    theme(axis.text.x = element_text(angle = 60, hjust = 1),
          plot.caption = element_text(hjust=0.5,vjust = 0.1, size=9),
          legend.position = "none")
```

```
soc_time_plot = ggplot(screen_data_complete, aes(Time, Tot.Soc.Time, color = ID))+
  geom_line() +
  labs(x = "Day",y ="Total Social Time (min)", caption = "(b) total social time" ) +
  geom_line(data = screen_data_complete, aes(Time, y= Tot.Soc.Time),size = 0.5) +
   theme_minimal() +
    theme(axis.text.x = element_text(angle = 60, hjust = 1),
          plot.caption = element_text(hjust=0.5,vjust = 0.1, size=9),
          legend.position = "none")

pickup_plot = ggplot(screen_data_complete, aes(Time, Pickups, color = ID))+
  geom_line() +
  labs(x = "Day",y ="Total Number of Pickups", caption = "(c) total pickups" ) +
  geom_line(data = screen_data_complete, aes(Time, y= Pickups),size = 0.5) +
   theme_minimal() +
    theme(axis.text.x = element_text(angle = 60, hjust = 1),
          plot.caption = element_text(hjust=0.5,vjust = 0.1, size=9),
          legend.position = "none")

wakeup_plot = ggplot(screen_data_complete, aes(Time, Pickup.1st.minute, color = ID))+
  geom_line() +
  labs(x = "Day",y ="Wake-Up Time", caption = "(d) wake up time" ) +
  geom_line(data = screen_data_complete, aes(Time, y= Pickup.1st.minute),size = 0.5) +
   theme_minimal() +
    theme(axis.text.x = element_text(angle = 60, hjust = 1),
          plot.caption = element_text(hjust=0.5,vjust = 0.1, size=9),
          legend.position = "none")

grid.arrange(scr_time_plot,soc_time_plot,pickup_plot,wakeup_plot, ncol = 2, nrow = 2)
```

```
## Warning: Removed 1 row(s) containing missing values (geom_path).

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```

Lots of data, means harder to see patterns. May be useful to calculate mean.

```
screen_data_complete = screen_data_complete %>% group_by(Time) %>% mutate(
  Avg.Tot.Scr.Time = mean(Tot.Scr.Time),
  Avg.Tot.Soc.Time = mean(Tot.Soc.Time),
  Avg.Pickups = mean(Pickups),
  Avg.Pickup.1st.minute = mean(Pickup.1st.minute))
```

```
# ggplot(screen_data_complete, aes(x = Time, y = Tot.Scr.Time,
#                          color = if_weekend)) +
#         geom_line(aes(color = as.factor(screen_data_complete$ID))) +
#         geom_point() +
#         labs(x = "",y ="Total Screen Time (min)", caption = "(a) total screen time" ) +
#        # ylim(15,702) +
```

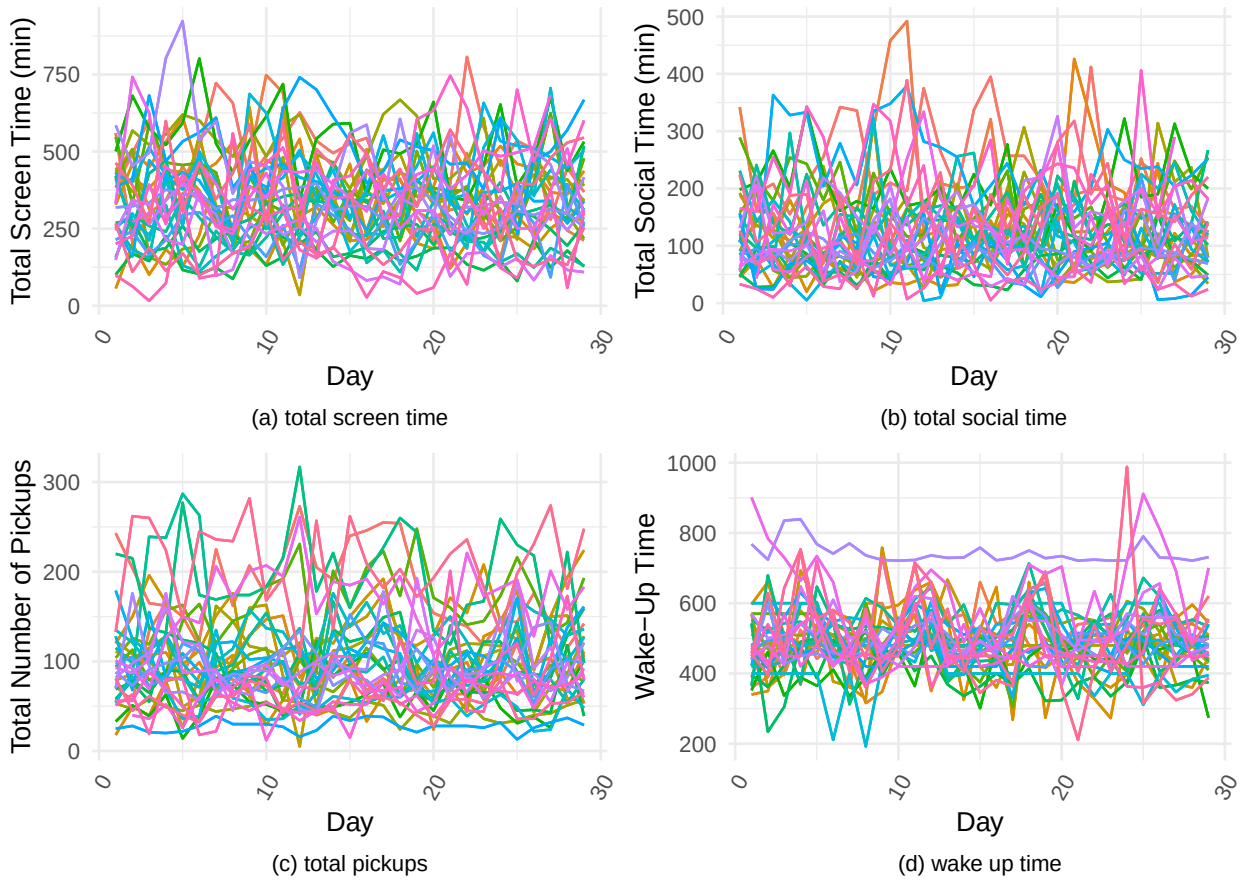


Figure 1: Spaghetti Plot (a) - (d) total screen time vs day, social screen time vs day, number of pickups vs day, wakeup time vs day

```
#       #  scale_color_manual(labels = c("weekdays", "weekends"), values =
#         #                     c("black","red")) +
#     theme_minimal() +
#     theme(axis.text.x = element_text(angle = 60, hjust = 1),
#           axis.title.y = element_text(size = 8, hjust = 1),
#           plot.caption = element_text(hjust=0.5,vjust = 0.1, size=9),
#           legend.title = element_blank())

# https://stackoverflow.com/questions/60436663/spaghetti-plot-using-ggplot-in-r
avg_scr_time_plot = ggplot(screen_data_complete, aes(Time, Avg.Tot.Scr.Time))+
  geom_line() +
  labs(x = "Day",y ="Total Screen Time (min)", caption = "(a) total screen time" ) +
  geom_line(data = screen_data_complete, aes(Time, y= Avg.Tot.Scr.Time),size = 0.5) +
   theme_minimal() +
    theme(axis.text.x = element_text(angle = 60, hjust = 1),
          plot.caption = element_text(hjust=0.5,vjust = 0.1, size=9))


avg_soc_time_plot = ggplot(screen_data_complete, aes(Time, Avg.Tot.Soc.Time))+
  geom_line() +
  labs(x = "Day",y ="Total Social Time (min)", caption = "(b) total social time" ) +
  geom_line(data = screen_data_complete, aes(Time, y= Avg.Tot.Soc.Time),size = 0.5) +
   theme_minimal() +
    theme(axis.text.x = element_text(angle = 60, hjust = 1),
          plot.caption = element_text(hjust=0.5,vjust = 0.1, size=9))

avg_pickup_plot = ggplot(screen_data_complete, aes(Time, Avg.Pickups))+
  geom_line() +
  labs(x = "Day",y ="Total Number of Pickups", caption = "(c) total pickups" ) +
  geom_line(data = screen_data_complete, aes(Time, y= Avg.Pickups),size = 0.5) +
   theme_minimal() +
    theme(axis.text.x = element_text(angle = 60, hjust = 1),
          plot.caption = element_text(hjust=0.5,vjust = 0.1, size=9))

avg_wakeup_plot = ggplot(screen_data_complete, aes(Time, Avg.Pickup.1st.minute))+
  geom_line() +
  labs(x = "Day",y ="Wake-Up Time", caption = "(d) wake up time" ) +
  geom_line(data = screen_data_complete, aes(Time, y= Avg.Pickup.1st.minute),size = 0.5) +
   theme_minimal() +
    theme(axis.text.x = element_text(angle = 60, hjust = 1),
          plot.caption = element_text(hjust=0.5,vjust = 0.1, size=9))

grid.arrange(avg_scr_time_plot,avg_soc_time_plot,avg_pickup_plot,avg_wakeup_plot, ncol = 2, nrow = 2)
```

```
## Warning: Removed 32 row(s) containing missing values (geom_path).

## Warning: Removed 32 row(s) containing missing values (geom_path).

## Warning: Removed 32 row(s) containing missing values (geom_path).

## Warning: Removed 32 row(s) containing missing values (geom_path).

## Warning: Removed 32 row(s) containing missing values (geom_path).
```

```
## Warning: Removed 32 row(s) containing missing values (geom_path).
```

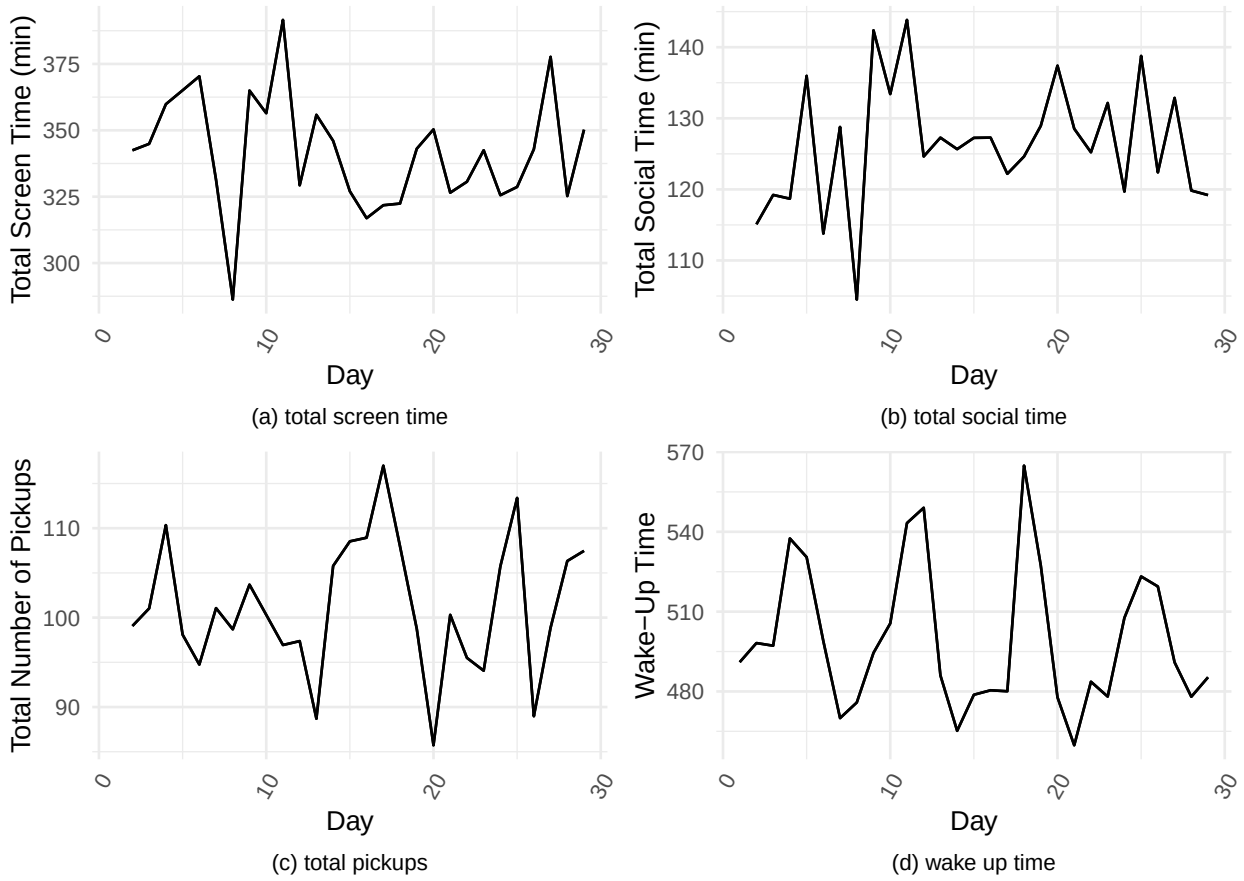


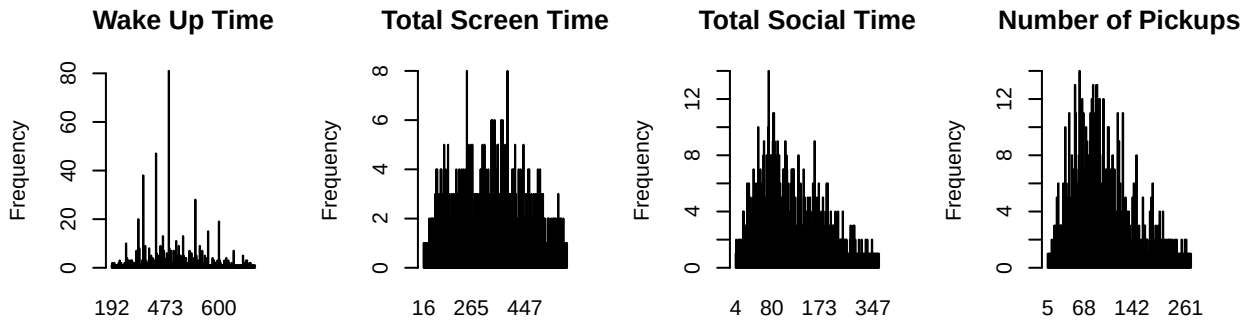
Figure 2: Spaghetti Plot (a) - (d) total screen time vs day, social screen time vs day, number of pickups vs day, wakeup time vs day

ATTEMPT AT ANALYSIS LLM

```
model1 = lm(Pickup.1st.minute ~ Tot.Scr.Time, screen_data_complete)
```

#BAR PLOTS OF EVERYTHING

```
# Overview of the variables
par(mfrow = c(2,4))
barplot(table(screen_data_complete$Pickup.1st.minute), ylab = "Frequency", main = "Wake Up Time")
barplot(table(screen_data_complete$Tot.Scr.Time), ylab = "Frequency", main = "Total Screen Time")
barplot(table(screen_data_complete$Tot.Soc.Time), ylab = "Frequency", main = "Total Social Time")
barplot(table(screen_data_complete$Pickups), ylab = "Frequency", main = "Number of Pickups")
```

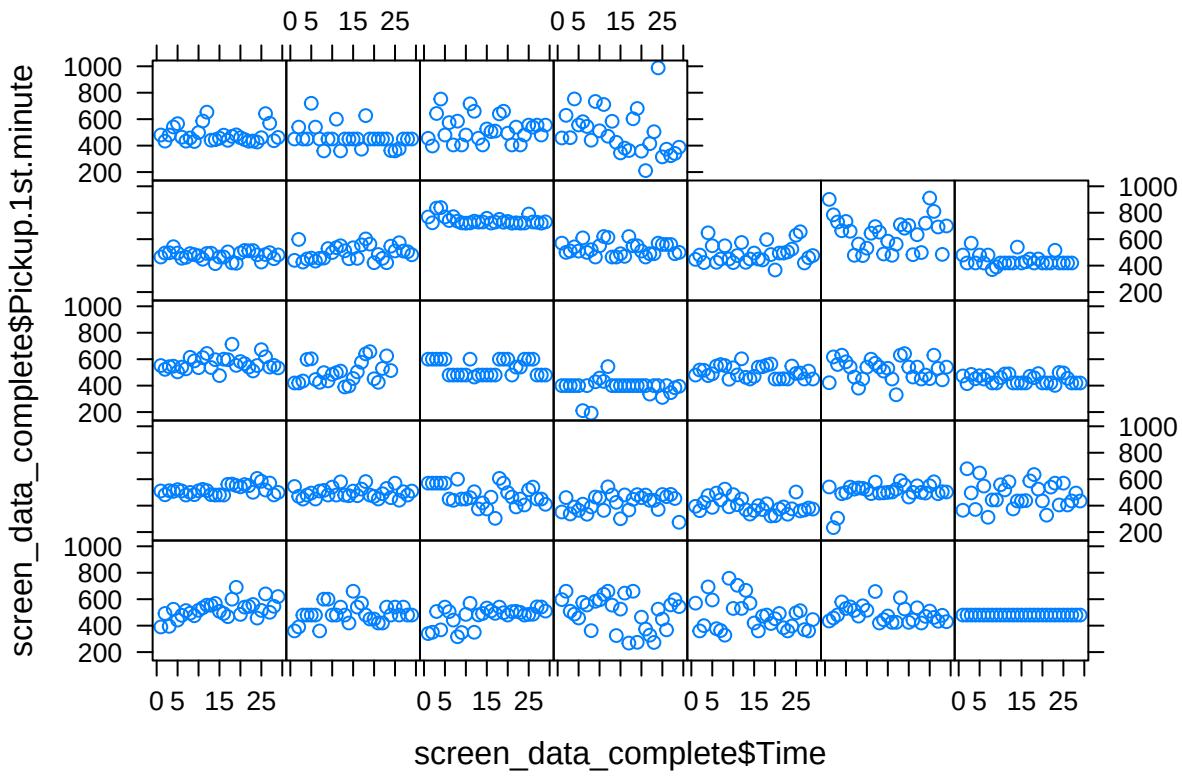


The visual below allows us to see the first pickup time over time by each indivdual

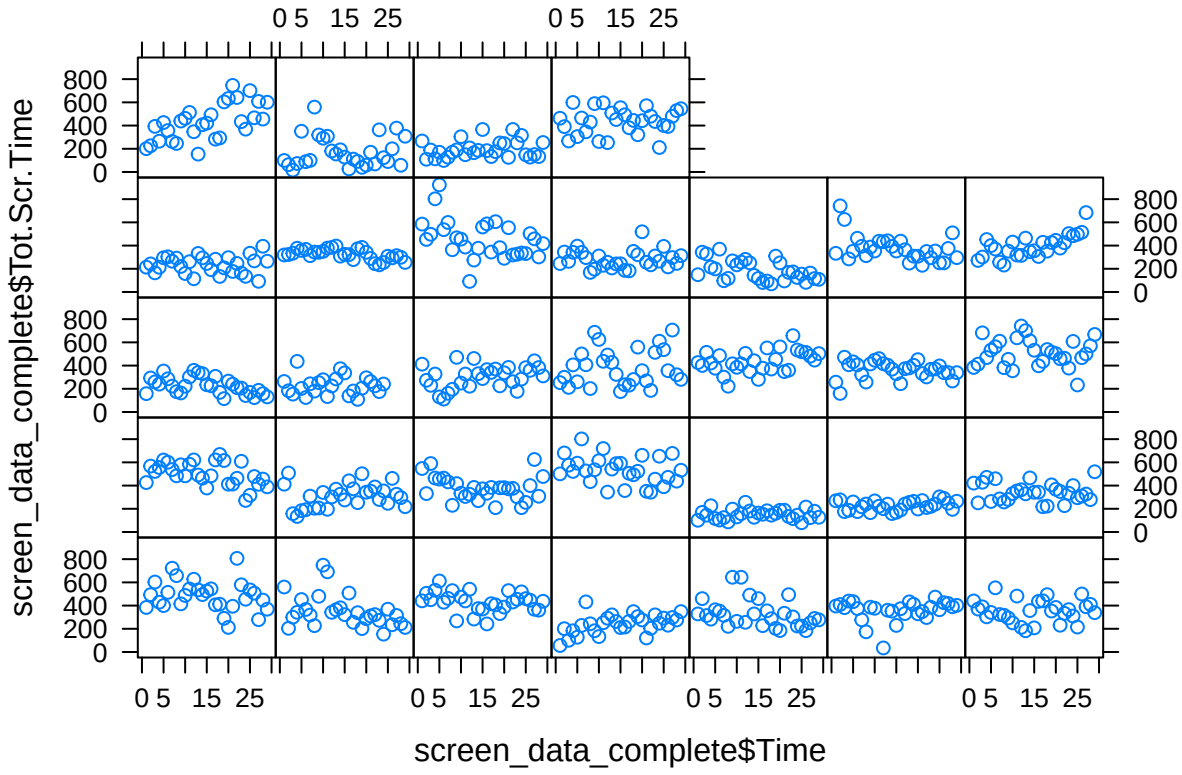
```
library(lattice)
```

```
## Warning: package 'lattice' was built under R version 4.0.5
```

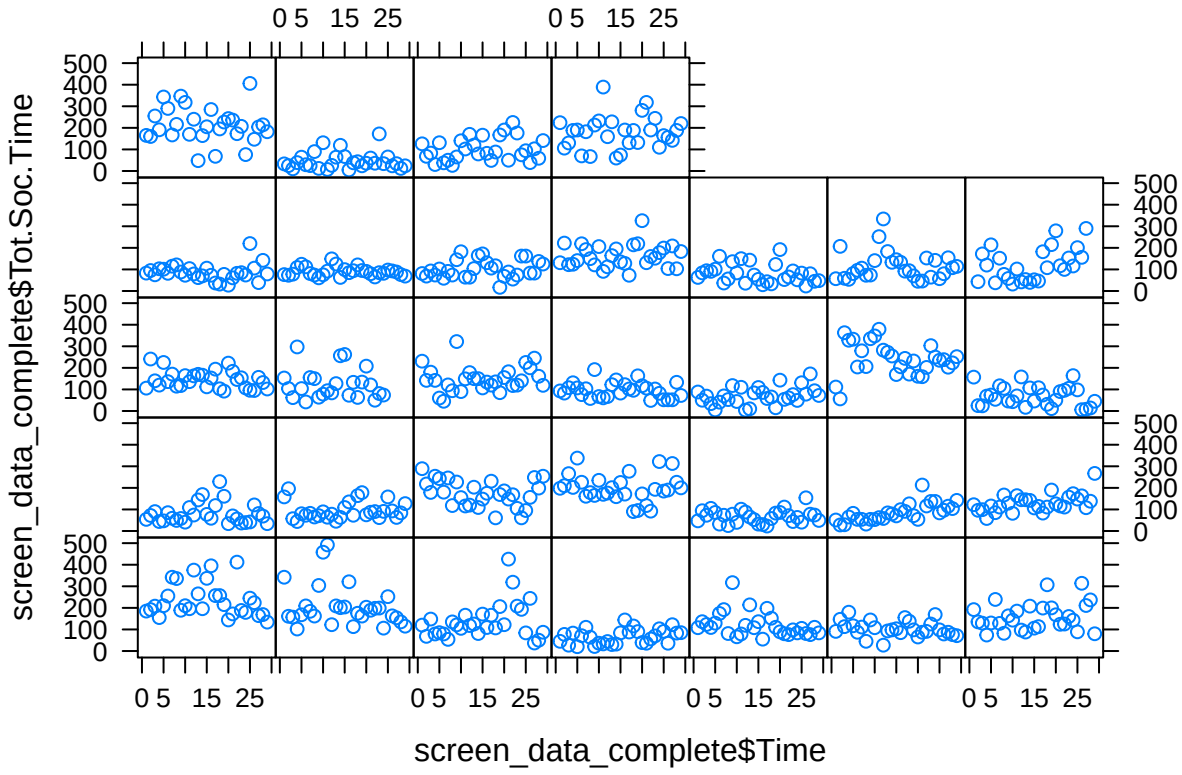
```
xyplot(screen_data_complete$Pickup.1st.minute ~ screen_data_complete$Time| screen_data_complete$ID, str
```



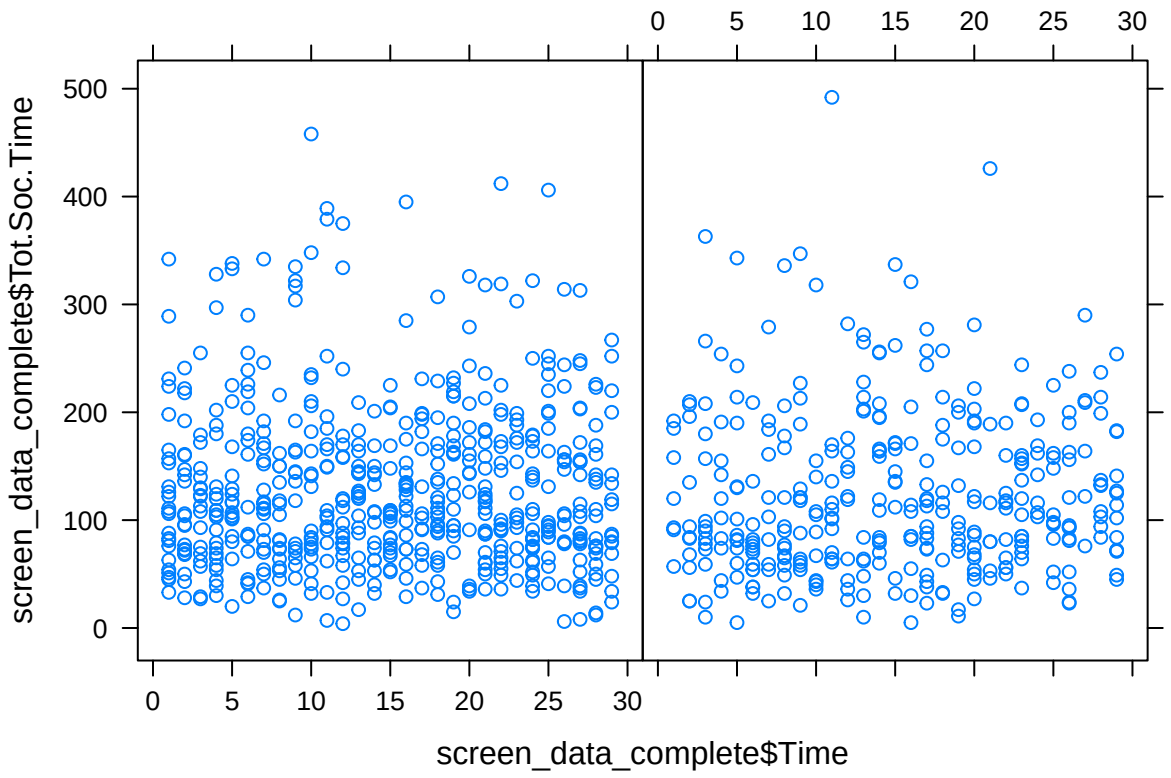

```
xyplot(screen_data_complete$Tot.Scr.Time ~ screen_data_complete$Time| screen_data_complete$ID, strip=FA
```




```
xyplot(screen_data_complete$Tot.Soc.Time ~ screen_data_complete$Time| screen_data_complete$ID, strip=FA
```




```
xyplot(screen_data_complete$Tot.Soc.Time ~ screen_data_complete$Time| baseline_data$sex, strip=FALSE)
```




```
mean(screen_data_complete$Pickup.1st.minute)
```

```
## [1] 499.2304
```

```
var(screen_data_complete$Pickup.1st.minute)
```

```
## [1] 9562.578
```

```
with(screen_data_complete, tapply(Pickup.1st.minute, list(subject = ID), mean))
```

```
## subject
##        1        2        3        4        5        6        7        8
## 520.6552 488.2759 472.6552 496.9655 478.0690 488.1071 480.0000 519.6552
##        9       10       11       12       13       14       15       16
## 497.5172 479.2069 421.0690 399.8966 503.1034 483.0690 567.8276 497.4583
##       17       18       19       20       21       22       23       24
## 533.2759 387.5172 501.2414 519.3448 447.4828 477.4138 497.2069 743.1724
##       25       26       27       28       29       30       31       32
## 528.1034 492.0345 643.4483 439.8148 483.0690 459.2759 526.3448 498.3103
```

```
with(screen_data_complete, tapply(Pickup.1st.minute, list(subject = ID), var))
```

```
## subject
##          1          2          3          4          5          6          7
##  4322.7340  4814.7783  5053.1626 15878.1773 14041.5665  3823.7288     0.0000
##          8          9         10         11         12         13         14
##  1259.8768  1489.3300  6004.9557  4195.9236  2975.1675  5199.3103  9305.7808
##         15         16         17         18         19         20         21
##  2650.2192  6509.6504  3496.9212  4122.2586  2054.6182  6235.8768   965.9015
```

```
##         22         23         24         25         26         27         28
##   975.3227  2907.1700   999.5764  2411.7389  5311.1773 15481.2562  1984.4644
##         29         30         31         32
##  3932.2808  6560.9926  9585.7340 27879.8645
```

```
library(lme4)
```

```
## Warning: package 'lme4' was built under R version 4.0.5
```

```
## Loading required package: Matrix
```

```
## Warning: package 'Matrix' was built under R version 4.0.4
```

```
mmod <- lmer(Pickup.1st.minute ~ Tot.Scr.Time + (1|ID),screen_data_complete)

summary(mmod)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Pickup.1st.minute ~ Tot.Scr.Time + (1 | ID)
##    Data: screen_data_complete
##
## REML criterion at convergence: 10652.4
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.7770 -0.5486 -0.0522  0.5066  6.4398
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 3978     63.07
##  Residual             5715     75.60
## Number of obs: 919, groups:  ID, 32
##
## Fixed effects:
##               Estimate Std. Error t value
## (Intercept)  503.44918   14.06448  35.796
## Tot.Scr.Time  -0.01291    0.02404  -0.537
##
## Correlation of Fixed Effects:
##             (Intr)
## Tot.Scr.Tim -0.583
```

Overall:

```
soc_lmm <- lmer(Pickup.1st.minute ~ Tot.Soc.Time + (1|ID),screen_data_complete)

summary(soc_lmm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Pickup.1st.minute ~ Tot.Soc.Time + (1 | ID)
##    Data: screen_data_complete
##
## REML criterion at convergence: 10651.3
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.8338 -0.5474 -0.0508  0.4972  6.4915
##
```

```
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 3956     62.89
##  Residual             5717     75.61
## Number of obs: 919, groups:  ID, 32
##
## Fixed effects:
##               Estimate Std. Error t value
## (Intercept)  496.80227   12.68237  39.173
## Tot.Soc.Time   0.01773    0.04404   0.403
##
## Correlation of Fixed Effects:
##             (Intr)
## Tot.Soc.Tim -0.439
```

```
pickups_lmm <- lmer(Pickup.1st.minute ~ Pickups + (1|ID),screen_data_complete)

summary(pickups_lmm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Pickup.1st.minute ~ Pickups + (1 | ID)
##    Data: screen_data_complete
##
## REML criterion at convergence: 10645.4
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.7767 -0.5620 -0.0331  0.4978  6.3446
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 4284     65.45
##  Residual             5670     75.30
## Number of obs: 919, groups:  ID, 32
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept) 516.03637   14.01198  36.828
## Pickups      -0.16863    0.07444  -2.265
##
## Correlation of Fixed Effects:
##         (Intr)
## Pickups -0.535
```

```
lmm <- lmer(Pickup.1st.minute ~ Tot.Scr.Time + Tot.Soc.Time + Pickups + (1|ID),screen_data_complete)

summary(lmm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Pickup.1st.minute ~ Tot.Scr.Time + Tot.Soc.Time + Pickups + (1 |
##     ID)
##    Data: screen_data_complete
##
## REML criterion at convergence: 10654.1
##
```

```
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.8242 -0.5631 -0.0381  0.5072  6.3135
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 4308     65.64
##  Residual             5675     75.33
## Number of obs: 919, groups:  ID, 32
##
## Fixed effects:
##               Estimate Std. Error t value
## (Intercept)  518.13865   16.08946  32.204
## Tot.Scr.Time  -0.02273    0.02734  -0.831
## Tot.Soc.Time   0.04908    0.05032   0.975
## Pickups       -0.17410    0.07496  -2.322
##
## Correlation of Fixed Effects:
##             (Intr) Tt.Scr.T Tt.Sc.Tm
## Tot.Scr.Tim -0.389
## Tot.Soc.Tim -0.074 -0.476
## Pickups     -0.429 -0.005   -0.097
```

School-Days:

```
weekday_data = screen_data_complete %>% filter(if_weekend == 0)
soc_weekday_lmm <- lmer(Pickup.1st.minute ~ Tot.Soc.Time + (1|ID),weekday_data)

summary(soc_weekday_lmm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Pickup.1st.minute ~ Tot.Soc.Time + (1 | ID)
##    Data: weekday_data
##
## REML criterion at convergence: 6217
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.8158 -0.4433 -0.0040  0.4601  7.0918
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 3523     59.35
##  Residual             5196     72.08
## Number of obs: 539, groups:  ID, 32
##
## Fixed effects:
##               Estimate Std. Error t value
## (Intercept)  478.34139   13.04665   36.66
## Tot.Soc.Time   0.04452    0.05707    0.78
##
## Correlation of Fixed Effects:
##             (Intr)
## Tot.Soc.Tim -0.545
```

```r
mmod2 <- lmer(Pickup.1st.minute ~ Tot.Scr.Time + (1|ID),weekday_data)

summary(mmod2)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Pickup.1st.minute ~ Tot.Scr.Time + (1 | ID)
##    Data: weekday_data
##
## REML criterion at convergence: 6218.5
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.6872 -0.4455 -0.0062  0.4871  7.0055
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 3562     59.68
##  Residual             5196     72.08
## Number of obs: 539, groups:  ID, 32
##
## Fixed effects:
##               Estimate Std. Error t value
## (Intercept)  489.66264   15.11421  32.397
## Tot.Scr.Time  -0.01733    0.03110  -0.557
##
## Correlation of Fixed Effects:
##             (Intr)
## Tot.Scr.Tim -0.686
```

```r
weekday_pickups_lmm <- lmer(Pickup.1st.minute ~ Pickups + (1|ID), weekday_data)

summary(weekday_pickups_lmm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Pickup.1st.minute ~ Pickups + (1 | ID)
##    Data: weekday_data
##
## REML criterion at convergence: 6203.5
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.7143 -0.4511 -0.0410  0.4863  6.8120
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 4247     65.17
##  Residual             5018     70.84
## Number of obs: 539, groups:  ID, 32
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept) 521.9787    15.7378  33.167
## Pickups      -0.3714     0.1002  -3.707
##
```

```
## Correlation of Fixed Effects:
##         (Intr)
## Pickups -0.653
```

```
weekday_lmm <- lmer(Pickup.1st.minute ~ Tot.Scr.Time + Tot.Soc.Time + Pickups + (1|ID),weekday_data)

summary(weekday_lmm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Pickup.1st.minute ~ Tot.Scr.Time + Tot.Soc.Time + Pickups + (1 |
##     ID)
##    Data: weekday_data
##
## REML criterion at convergence: 6209.4
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.8295 -0.4655 -0.0529  0.4811  6.7527
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 4352     65.97
##  Residual             5003     70.73
## Number of obs: 539, groups:  ID, 32
##
## Fixed effects:
##               Estimate Std. Error t value
## (Intercept)  525.38322   18.80722  27.935
## Tot.Scr.Time  -0.04422    0.03542  -1.249
## Tot.Soc.Time   0.10280    0.06515   1.578
## Pickups       -0.38566    0.10058  -3.834
##
## Correlation of Fixed Effects:
##             (Intr) Tt.Scr.T Tt.Sc.Tm
## Tot.Scr.Tim -0.427
## Tot.Soc.Tim -0.075 -0.495
## Pickups     -0.527  0.022   -0.083
```

Non-School Days:

```
weekend_data = screen_data_complete %>% filter(if_weekend == 1)
soc_weekend_lmm <- lmer(Pickup.1st.minute ~ Tot.Soc.Time + (1|ID),weekend_data)

summary(soc_weekend_lmm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Pickup.1st.minute ~ Tot.Soc.Time + (1 | ID)
##    Data: weekend_data
##
## REML criterion at convergence: 4421.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.2213 -0.5734 -0.0414  0.5996  3.1361
##
## Random effects:
```

```
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 4835     69.54
##  Residual             5458     73.88
## Number of obs: 380, groups:  ID, 32
##
## Fixed effects:
##               Estimate Std. Error t value
## (Intercept)  526.26886   15.25458  34.499
## Tot.Soc.Time  -0.04219    0.06356  -0.664
##
## Correlation of Fixed Effects:
##             (Intr)
## Tot.Soc.Tim -0.537
```

```
mmod3 <- lmer(Pickup.1st.minute ~ Tot.Scr.Time + (1|ID),weekend_data)

summary(mmod3)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Pickup.1st.minute ~ Tot.Scr.Time + (1 | ID)
##    Data: weekend_data
##
## REML criterion at convergence: 4422.6
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.2229 -0.5685 -0.0506  0.6059  3.1611
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 4796     69.26
##  Residual             5465     73.93
## Number of obs: 380, groups:  ID, 32
##
## Fixed effects:
##               Estimate Std. Error t value
## (Intercept)  526.70415   17.75467  29.666
## Tot.Scr.Time  -0.01669    0.03489  -0.478
##
## Correlation of Fixed Effects:
##             (Intr)
## Tot.Scr.Tim -0.692
```

```
weekend_pickups_lmm <- lmer(Pickup.1st.minute ~ Pickups + (1|ID), weekend_data)

summary(weekend_pickups_lmm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Pickup.1st.minute ~ Pickups + (1 | ID)
##    Data: weekend_data
##
## REML criterion at convergence: 4418.5
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
```

```
## -3.2721 -0.5640 -0.0486  0.5934  3.1189
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 4554     67.48
##  Residual             5459     73.88
## Number of obs: 380, groups:  ID, 32
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept) 505.7923    16.1727  31.274
## Pickups       0.1531     0.1043   1.468
##
## Correlation of Fixed Effects:
##         (Intr)
## Pickups -0.633
```

```
weekend_lmm <- lmer(Pickup.1st.minute ~ Tot.Scr.Time + Tot.Soc.Time + Pickups + (1|ID),weekend_data)

summary(weekend_lmm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Pickup.1st.minute ~ Tot.Scr.Time + Tot.Soc.Time + Pickups + (1 |
##     ID)
##    Data: weekend_data
##
## REML criterion at convergence: 4425.9
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.2542 -0.5583 -0.0511  0.5855  3.1465
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 4587     67.73
##  Residual             5473     73.98
## Number of obs: 380, groups:  ID, 32
##
## Fixed effects:
##                Estimate Std. Error t value
## (Intercept)  513.898015  19.887540  25.840
## Tot.Scr.Time  -0.008723   0.039301  -0.222
## Tot.Soc.Time  -0.051266   0.072368  -0.708
## Pickups        0.169185   0.105917   1.597
##
## Correlation of Fixed Effects:
##             (Intr) Tt.Scr.T Tt.Sc.Tm
## Tot.Scr.Tim -0.475
## Tot.Soc.Tim -0.079 -0.456
## Pickups     -0.447 -0.014   -0.141
```

SIMPLE LINEAR ANALYSIS

Overall:

```r
soc_lmm <- lm(Pickup.1st.minute ~ Tot.Soc.Time,screen_data_complete)

summary(soc_lmm)
```

```
##
## Call:
## lm(formula = Pickup.1st.minute ~ Tot.Soc.Time, data = screen_data_complete)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -304.50  -55.81  -16.74   46.44  489.41
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  494.17315    6.27707  78.727   <2e-16 ***
## Tot.Soc.Time   0.04015    0.04257   0.943    0.346
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 97.85 on 917 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.0009693,  Adjusted R-squared:  -0.0001201
## F-statistic: 0.8897 on 1 and 917 DF,  p-value: 0.3458
```

```r
pickups_lmm <- lm(Pickup.1st.minute ~ Pickups,screen_data_complete)

summary(pickups_lmm)
```

```
##
## Call:
## lm(formula = Pickup.1st.minute ~ Pickups, data = screen_data_complete)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -310.40  -56.98  -13.66   47.21  482.97
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 480.46447    6.85909   70.05  < 2e-16 ***
## Pickups       0.18608    0.06003    3.10  0.00199 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 97.38 on 917 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.01037,    Adjusted R-squared:  0.009292
## F-statistic:  9.61 on 1 and 917 DF,  p-value: 0.001994
```

```r
m1 <- lm(Pickup.1st.minute ~ Tot.Scr.Time + Tot.Soc.Time + Pickups,screen_data_complete)

summary(m1)
```

```
##
## Call:
## lm(formula = Pickup.1st.minute ~ Tot.Scr.Time + Tot.Soc.Time +
```

```
##     Pickups, data = screen_data_complete)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -312.92  -57.08  -13.30   47.60  484.93
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)  475.829394  10.060834  47.295  < 2e-16 ***
## Tot.Scr.Time   0.015640   0.024832   0.630  0.52896
## Tot.Soc.Time  -0.005534   0.048859  -0.113  0.90984
## Pickups        0.186005   0.062164   2.992  0.00284 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 97.47 on 915 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.01084,    Adjusted R-squared:  0.007594
## F-statistic: 3.342 on 3 and 915 DF,  p-value: 0.01877
```

School-Days:

```
weekday_data = screen_data_complete %>% filter(if_weekend == 0)
soc_weekday_lm <- lm(Pickup.1st.minute ~ Tot.Soc.Time,weekday_data)

summary(soc_weekday_lm)
```

```
##
## Call:
## lm(formula = Pickup.1st.minute ~ Tot.Soc.Time, data = weekday_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -289.50  -52.63   -5.11   42.12  504.48
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  479.24538    7.87073  60.890   <2e-16 ***
## Tot.Soc.Time   0.03888    0.05436   0.715    0.475
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 92.93 on 537 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.0009518,  Adjusted R-squared:  -0.0009086
## F-statistic: 0.5116 on 1 and 537 DF,  p-value: 0.4747
```

```
lmod2 <- lm(Pickup.1st.minute ~ Tot.Scr.Time,weekday_data)

summary(lmod2)
```

```
##
## Call:
## lm(formula = Pickup.1st.minute ~ Tot.Scr.Time, data = weekday_data)
##
## Residuals:
```

```
##     Min      1Q  Median      3Q     Max
## -287.74  -55.04   -5.73   44.18  507.97
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  473.04821   10.32075  45.835   <2e-16 ***
## Tot.Scr.Time   0.03311    0.02852   1.161    0.246
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 92.86 on 537 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.002503,   Adjusted R-squared:  0.0006456
## F-statistic: 1.348 on 1 and 537 DF,  p-value: 0.2462
```

```
weekday_pickups_lm <- lm(Pickup.1st.minute ~ Pickups, weekday_data)

summary(weekday_pickups_lm)
```

```
##
## Call:
## lm(formula = Pickup.1st.minute ~ Pickups, data = weekday_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -288.69  -53.39   -5.19   41.09  501.64
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 476.09924    9.01908  52.788   <2e-16 ***
## Pickups       0.07774    0.07861   0.989    0.323
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 92.89 on 537 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.001818,   Adjusted R-squared:  -4.094e-05
## F-statistic: 0.978 on 1 and 537 DF,  p-value: 0.3231
```

```
weekday_lm <- lm(Pickup.1st.minute ~ Tot.Scr.Time + Tot.Soc.Time + Pickups,weekday_data)

summary(weekday_lm)
```

```
##
## Call:
## lm(formula = Pickup.1st.minute ~ Tot.Scr.Time + Tot.Soc.Time +
##     Pickups, data = weekday_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -288.40  -53.90   -6.16   42.66  505.63
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  4.669e+02  1.259e+01  37.070   <2e-16 ***
```

```
## Tot.Scr.Time 3.045e-02  3.239e-02   0.940    0.347
## Tot.Soc.Time 3.591e-05  6.320e-02   0.001    1.000
## Pickups      6.884e-02  8.107e-02   0.849    0.396
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 92.97 on 535 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.003913,   Adjusted R-squared:  -0.001672
## F-statistic: 0.7006 on 3 and 535 DF,  p-value: 0.552
```

Non-School Days:

```
weekend_data = screen_data_complete %>% filter(if_weekend == 1)
soc_weekend_lm <- lm(Pickup.1st.minute ~ Tot.Soc.Time,weekend_data)

summary(soc_weekend_lm)
```

```
##
## Call:
## lm(formula = Pickup.1st.minute ~ Tot.Soc.Time, data = weekend_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -308.34  -67.75  -20.43   57.36  392.17
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  517.31735    9.93082  52.092   <2e-16 ***
## Tot.Soc.Time   0.02662    0.06569   0.405    0.686
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 100.8 on 378 degrees of freedom
## Multiple R-squared:  0.0004343,  Adjusted R-squared:  -0.00221
## F-statistic: 0.1642 on 1 and 378 DF,  p-value: 0.6855
```

```
lmod3 <- lm(Pickup.1st.minute ~ Tot.Scr.Time,weekend_data)

summary(lmod3)
```

```
##
## Call:
## lm(formula = Pickup.1st.minute ~ Tot.Scr.Time, data = weekend_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -306.83  -66.60  -22.37   58.05  388.22
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  527.76895   13.21815  39.928   <2e-16 ***
## Tot.Scr.Time  -0.01988    0.03446  -0.577    0.564
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
## Residual standard error: 100.8 on 378 degrees of freedom
## Multiple R-squared:  0.0008794,  Adjusted R-squared:  -0.001764
## F-statistic: 0.3327 on 1 and 378 DF,  p-value: 0.5644
```

```
weekend_pickups_lm <- lm(Pickup.1st.minute ~ Pickups, weekend_data)

summary(weekend_pickups_lm)
```

```
##
## Call:
## lm(formula = Pickup.1st.minute ~ Pickups, data = weekend_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -300.48  -60.72  -17.97   55.46  358.76
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 487.35823   10.13521  48.086  < 2e-16 ***
## Pickups       0.33969    0.08922   3.807 0.000164 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 98.99 on 378 degrees of freedom
## Multiple R-squared:  0.03693,    Adjusted R-squared:  0.03438
## F-statistic:  14.5 on 1 and 378 DF,  p-value: 0.0001639
```

```
weekend_lm <- lm(Pickup.1st.minute ~ Tot.Scr.Time + Tot.Soc.Time + Pickups,weekend_data)

summary(weekend_lm)
```

```
##
## Call:
## lm(formula = Pickup.1st.minute ~ Tot.Scr.Time + Tot.Soc.Time +
##     Pickups, data = weekend_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -300.07  -64.44  -16.28   55.68  354.49
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  494.29459   15.84995  31.186  < 2e-16 ***
## Tot.Scr.Time  -0.01161    0.03739  -0.311 0.756322
## Tot.Soc.Time  -0.02973    0.07376  -0.403 0.687107
## Pickups        0.34986    0.09340   3.746 0.000208 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 99.2 on 376 degrees of freedom
## Multiple R-squared:  0.03807,    Adjusted R-squared:  0.03039
## F-statistic:  4.96 on 3 and 376 DF,  p-value: 0.002181
```