

```

library(reshape2)
library(ggplot2)
library(lattice)
library(latticeExtra)
library(plyr)
d <- read.csv("http://www.stat.umn.edu/~rend0020/tmp/example1.csv")
d$Visit <- factor(d$Visit, levels = c("Baseline", "2 mos", "3 mos", "6 mos"),
  labels = c("0", "2", "3", "6"))
str(d)

## 'data.frame': 76 obs. of 12 variables:
## $ Name      : Factor w/ 19 levels "A","B","C","D",...: 16 16 16 16 18 18 18 18 12 12 ...
## $ Visit     : Factor w/ 4 levels "0","2","3","6": 1 2 3 4 1 2 3 4 1 2 ...
## $ Treatment : Factor w/ 2 levels "Botox","Saline": 2 2 2 2 2 2 2 2 2 2 ...
## $ TreatmentLeg: Factor w/ 2 levels "L","R": 2 2 2 2 2 2 2 2 2 2 ...
## $ L.Mean.PVF : num 74.7 68 NA 71.3 72.6 ...
## $ L.Impulse  : num 32 37.8 NA 31.4 23.9 ...
## $ L.Peak.Time : num 300 364 NA 285 320 ...
## $ L.Ttl.Time : num 634 773 NA 636 479 ...
## $ R.Mean.PVF : num 69 64.8 NA 67.1 47 ...
## $ R.Impulse  : num 31 27.3 NA 27.8 14.8 ...
## $ R.Peak.Time : num 272 144 NA 188 260 ...
## $ R.Ttl.Time : num 658 604 NA 615 432 ...

head(d)

##   Name Visit Treatment TreatmentLeg L.Mean.PVF L.Impulse L.Peak.Time
## 1   P     0   Saline           R      74.69     32.02     300.3
## 2   P     2   Saline           R      67.96     37.81     364.0
## 3   P     3   Saline           R           NA           NA           NA
## 4   P     6   Saline           R      71.29     31.44     285.0
## 5   R     0   Saline           R      72.64     23.90     320.4
## 6   R     2   Saline           R      68.99     24.02     275.5
##   L.Ttl.Time R.Mean.PVF R.Impulse R.Peak.Time R.Ttl.Time
## 1     633.7     68.96     30.97     272.4     658.2
## 2     773.0     64.80     27.30     144.0     604.0
## 3          NA          NA          NA          NA          NA
## 4     636.2     67.06     27.75     188.0     614.6
## 5     478.8     46.96     14.84     259.8     431.8
## 6     480.2     49.79     16.84     289.8     455.8

```

```

d2 <- melt(d)

## Using Name, Visit, Treatment, TreatmentLeg as id variables

# d2b <- melt(d, id.vars=c(1:3,5), measure.vars=c('L.Mean.PVF',
# 'L.Impulse'))
head(d2)

##   Name Visit Treatment TreatmentLeg  variable value
## 1    P     0    Saline             R L.Mean.PVF 74.69
## 2    P     2    Saline             R L.Mean.PVF 67.96
## 3    P     3    Saline             R L.Mean.PVF  NA
## 4    P     6    Saline             R L.Mean.PVF 71.29
## 5    R     0    Saline             R L.Mean.PVF 72.64
## 6    R     2    Saline             R L.Mean.PVF 68.99

d2$Leg <- factor(substring(levels(d2$variable), 1, 1)[d2$variable])
d2$variable <- factor(substring(levels(d2$variable), 3)[d2$variable])
d2$Treated <- factor(ifelse(d2$Leg == d2$TreatmentLeg, "Yes", "No"))
head(d2)

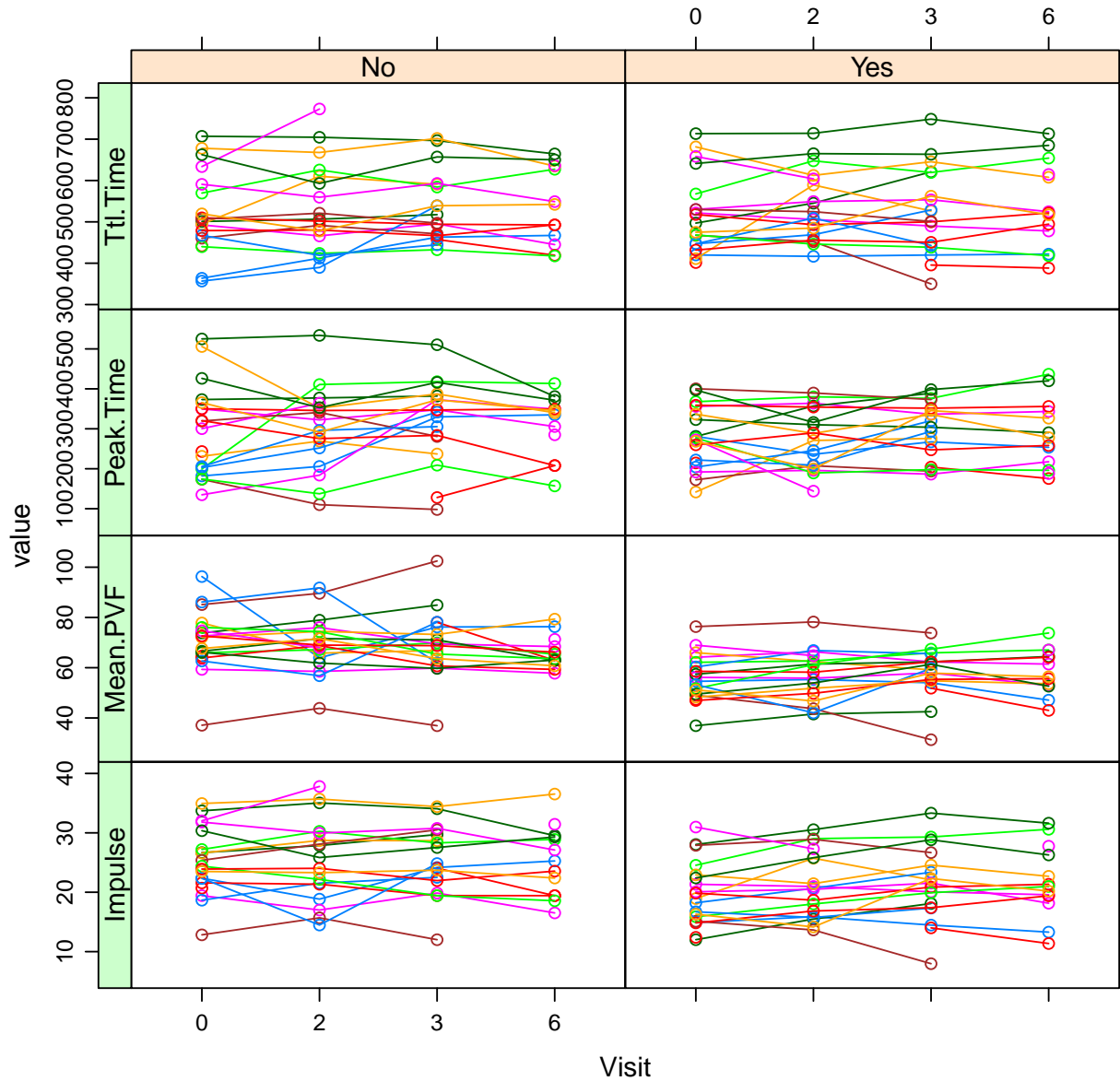
##   Name Visit Treatment TreatmentLeg variable value Leg Treated
## 1    P     0    Saline             R Mean.PVF 74.69  L      No
## 2    P     2    Saline             R Mean.PVF 67.96  L      No
## 3    P     3    Saline             R Mean.PVF  NA    L      No
## 4    P     6    Saline             R Mean.PVF 71.29  L      No
## 5    R     0    Saline             R Mean.PVF 72.64  L      No
## 6    R     2    Saline             R Mean.PVF 68.99  L      No

```

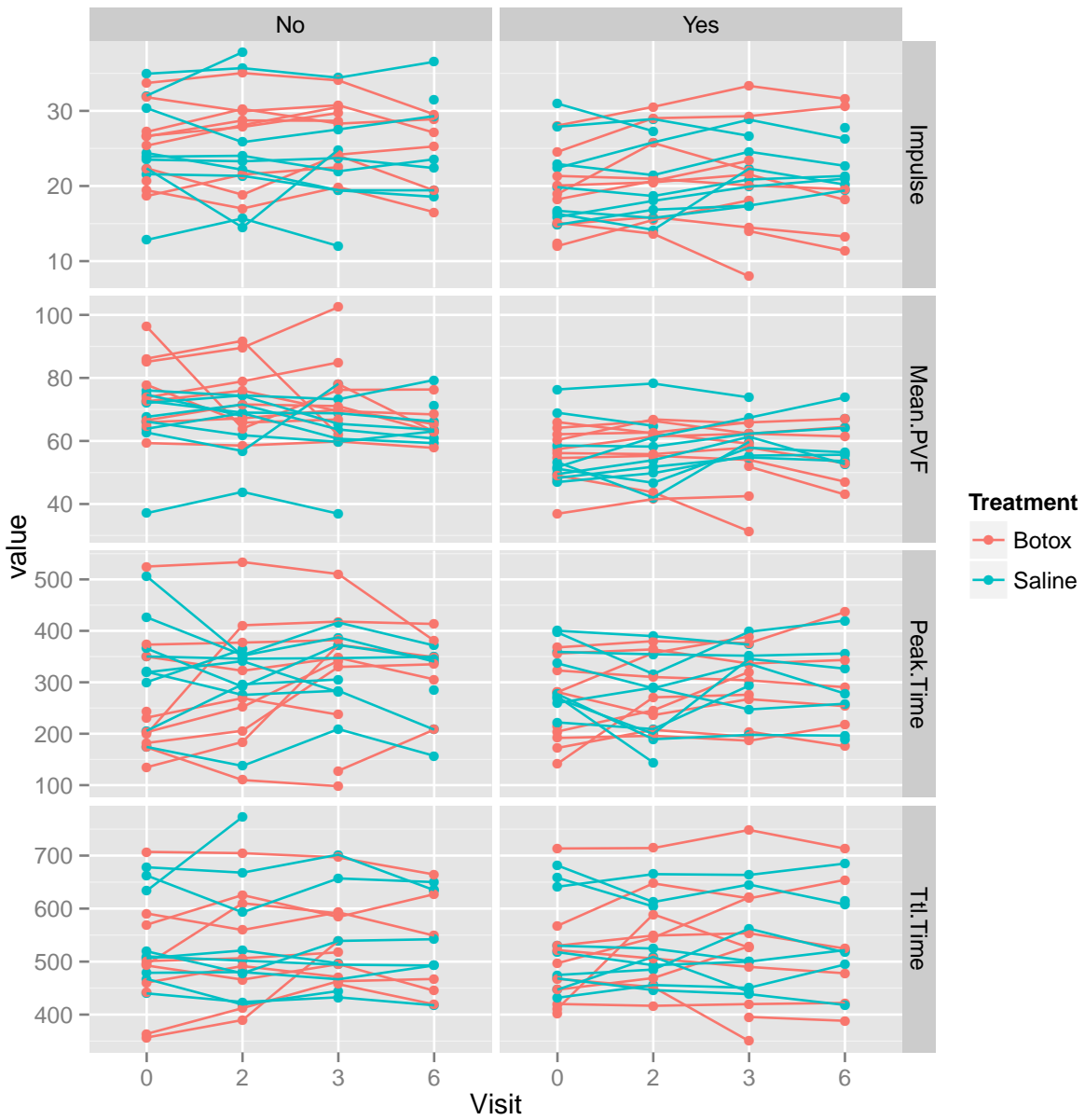
```

p0 <- xyplot(value ~ Visit | variable, data = d2)
p0 <- xyplot(value ~ Visit | Treated * variable, data = d2)
p0 <- useOuterStrips(xyplot(value ~ Visit | Treated * variable, data = d2))
p0 <- combineLimits(useOuterStrips(xyplot(value ~ Visit | Treated * variable,
data = d2, scales = list(y = "free"))))
p <- xyplot(value ~ Visit | Treated * variable, group = Name, data = d2, type = c("p",
"l"), scales = list(y = "free"))
combineLimits(useOuterStrips(p))

```



```
ggplot(d2, aes(x = Visit, y = value, group = Name, color = Treatment)) + geom_point() +  
  geom_line() + facet_grid(variable ~ Treated, scales = "free_y")
```



```

d3 <- dcast(d2, Name + Visit + Treatment + variable ~ Treated)
d3$diff <- d3$Yes - d3$No
head(d3)

##   Name Visit Treatment  variable    No    Yes   diff
## 1    A     0     Botox  Impulse  22.36  14.90  -7.456
## 2    A     0     Botox Mean.PVF  96.28  54.57 -41.710
## 3    A     0     Botox Peak.Time 182.00 281.00  99.000
## 4    A     0     Botox Ttl.Time 363.67 420.00  56.333
## 5    A     2     Botox  Impulse  18.84  15.88  -2.966
## 6    A     2     Botox Mean.PVF  63.94  55.30  -8.640

d4 <- dcast(d3, Name + Treatment + variable ~ Visit, value.var = "diff")
d4$Diff2 <- d4$`2` - d4$`0`
d4$Diff3 <- d4$`3` - d4$`0`
d4$Diff6 <- d4$`6` - d4$`0`
head(d4)

##   Name Treatment  variable      0      2      3      6  Diff2  Diff3
## 1    A     Botox  Impulse  -7.456 -2.966 -9.704 -11.982  4.490  -2.248
## 2    A     Botox Mean.PVF -41.710 -8.640 -22.214 -29.246 33.070  19.496
## 3    A     Botox Peak.Time  99.000 30.400 -62.600 -81.400 -68.600 -161.600
## 4    A     Botox Ttl.Time  56.333  4.400 -43.200 -45.200 -51.933 -99.533
## 5    B     Botox  Impulse   1.912  3.964  0.212  3.053  2.052  -1.700
## 6    B     Botox Mean.PVF   4.826  7.828  2.490  3.643  3.002  -2.336
##      Diff6
## 1    -4.526
## 2    12.464
## 3   -180.400
## 4   -101.533
## 5     1.141
## 6    -1.183

d5 <- melt(d4, id.vars = c("Name", "Treatment", "variable"), measure.vars = c("Diff2",
  "Diff3", "Diff6"))
names(d5)[4] <- "time"
head(d5)

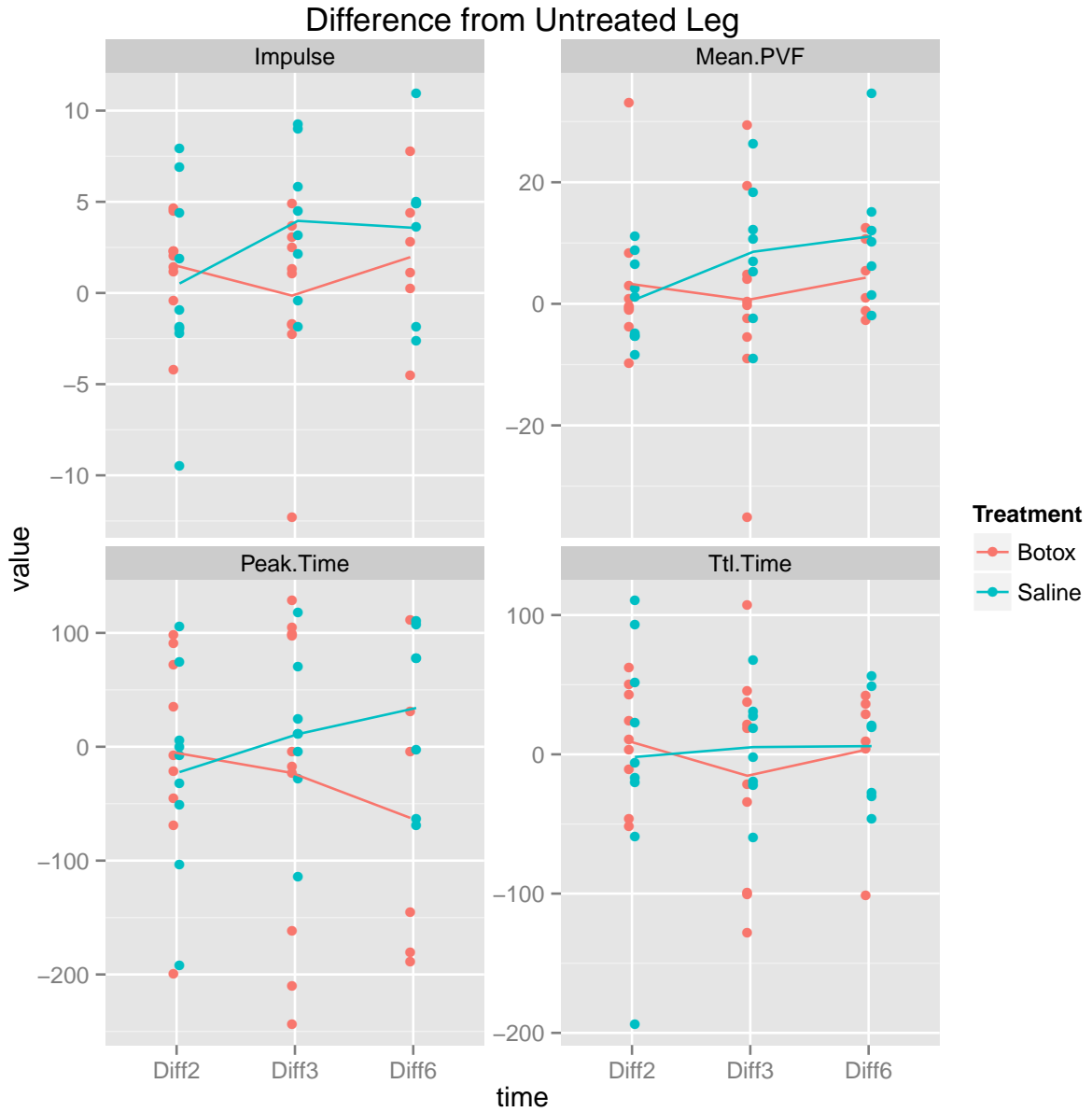
##   Name Treatment  variable  time  value
## 1    A     Botox  Impulse Diff2  4.490
## 2    A     Botox Mean.PVF Diff2 33.070
## 3    A     Botox Peak.Time Diff2 -68.600
## 4    A     Botox Ttl.Time Diff2 -51.933
## 5    B     Botox  Impulse Diff2  2.052
## 6    B     Botox Mean.PVF Diff2  3.002

```

```

ggplot(d5, aes(time, value, color = Treatment, group = Treatment)) + geom_point(position = position_dodge(0.1)) +
  stat_summary(fun.y = mean, geom = "line", position = position_dodge(0.1)) +
  ggtitle("Difference from Untreated Leg") + facet_wrap(~variable, scales = "free_y")

```



```

tt <- function(x) {
  xx <- t.test(value ~ Treatment, data = x)
  unlist(xx[c("estimate", "conf.int", "p.value")])
}
a1 <- ddply(d5, ~variable + time, tt)
head(a1)

##   variable  time estimate.mean in group Botox
## 1 Impulse Diff2                1.5332
## 2 Impulse Diff3               -0.1449
## 3 Impulse Diff6                1.9652
## 4 Mean.PVF Diff2                3.3055
## 5 Mean.PVF Diff3                0.6355
## 6 Mean.PVF Diff6                4.3012
##   estimate.mean in group Saline conf.int1 conf.int2 p.value
## 1                0.5204    -3.374    5.3997 0.62321
## 2                3.9544    -8.574    0.3753 0.06994
## 3                3.5633    -6.949    3.7527 0.52432
## 4                0.7028    -7.549   12.7541 0.58863
## 5                8.5679   -22.141    6.2761 0.25321
## 6               11.1212   -18.510    4.8703 0.22077

```