Semantic Networks Analysis

Abhilasha Kumar

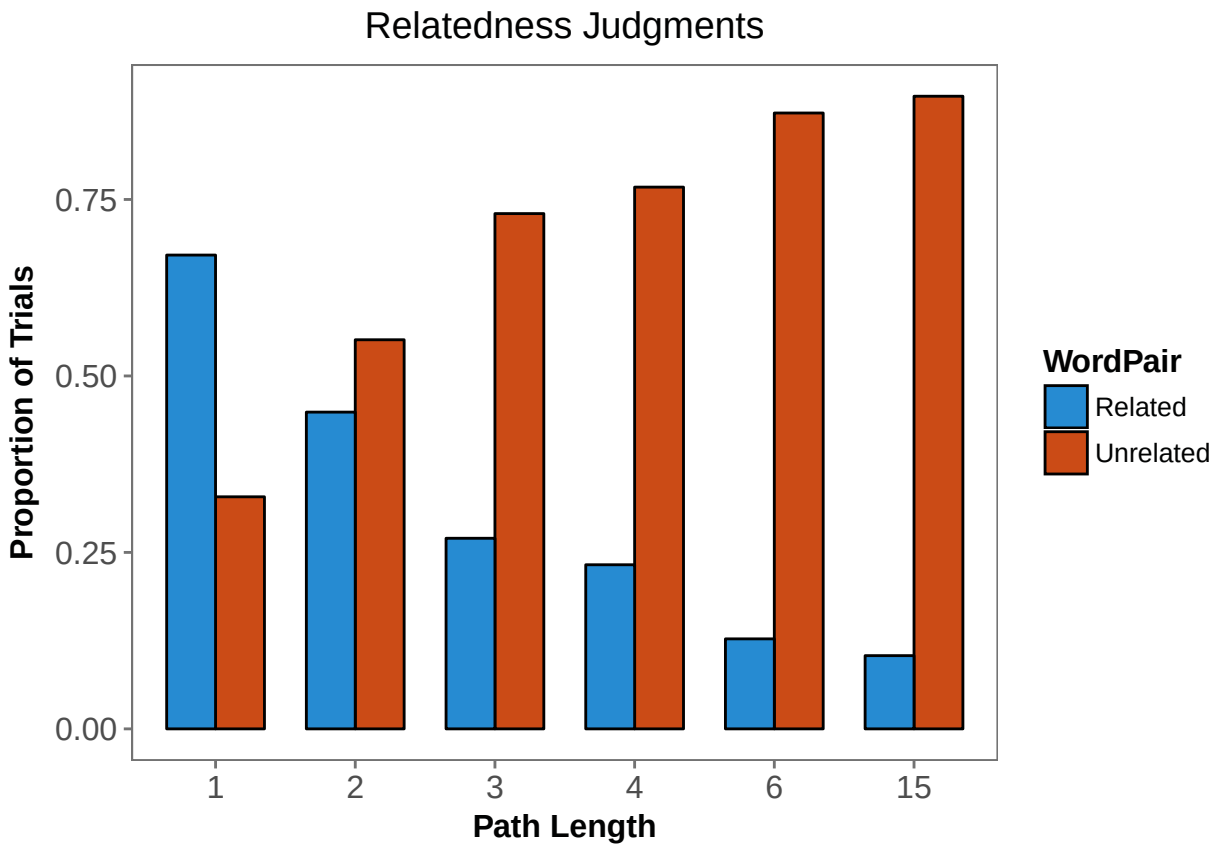
January 16, 2018

Reading the Data

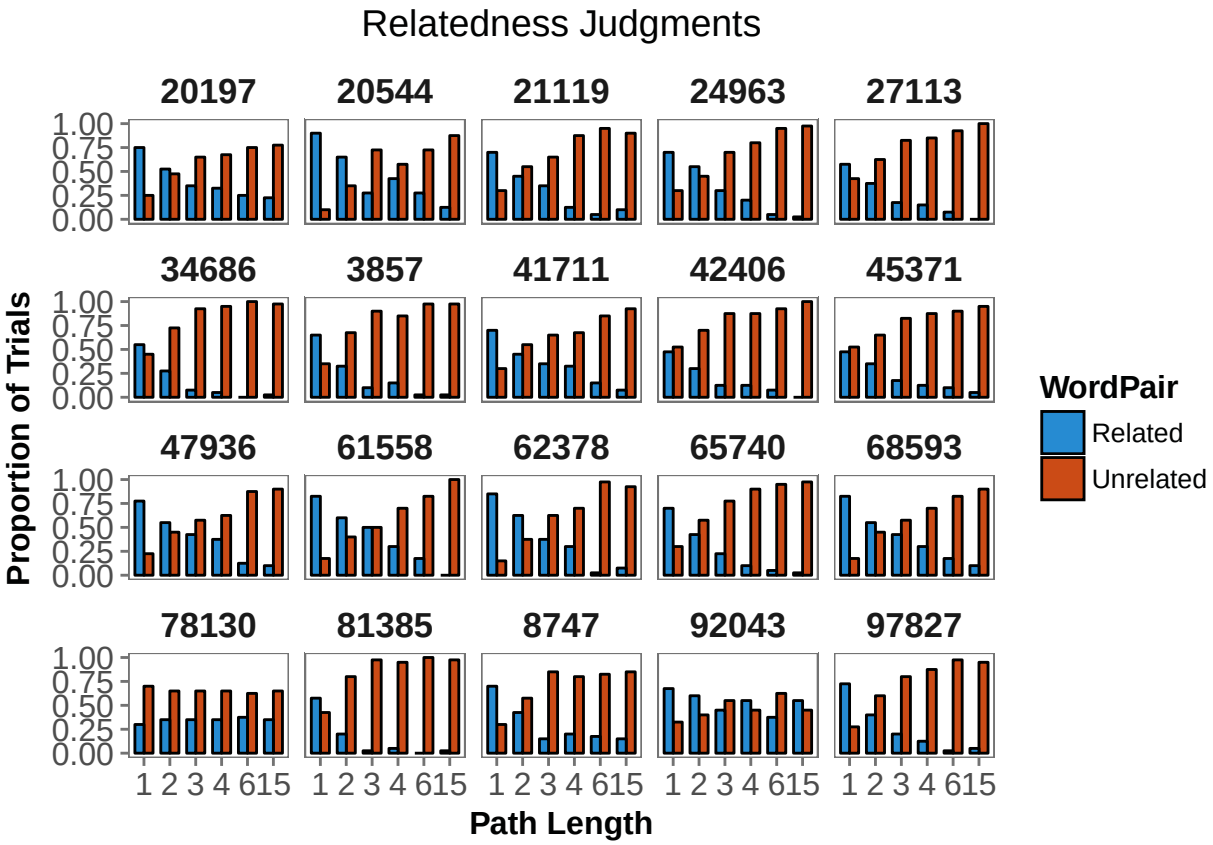
Related-Unrelated Decisions

```
##
## Attaching package: 'dplyr'
## The following objects are masked from 'package:stats':
##
##     filter, lag
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

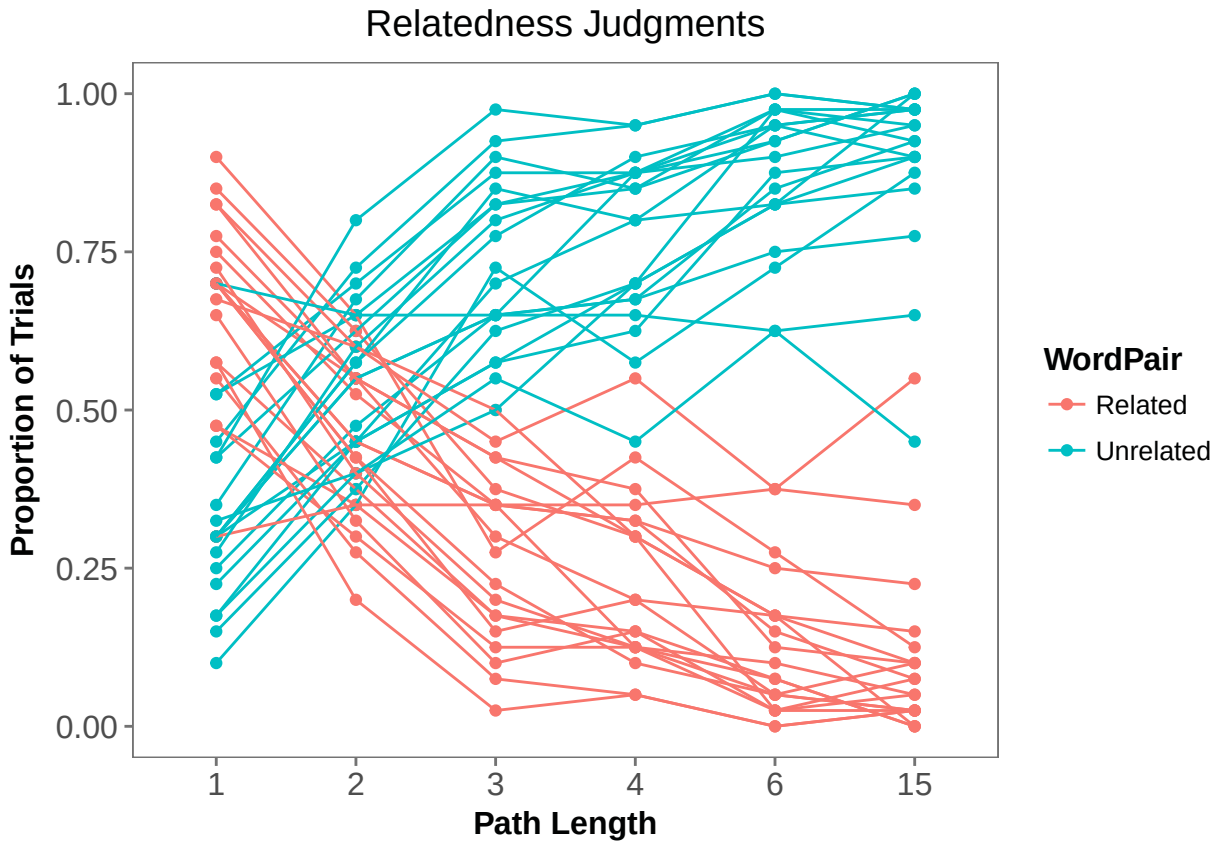
Plotting Proportions



Subject-Wise



Line Plot Subject-Wise



ANOVA

```
relunrel_aov = aov(data = sem_decision, proportion ~ pathlengthfac*Type +
                     Error(subject/(pathlengthfac*Type)))
summary(relunrel_aov)
```

```
##
## Error: subject
##           Df    Sum Sq   Mean Sq F value Pr(>F)
## Residuals 19 4.158e-30 2.188e-31
##
## Error: subject:pathlengthfac
##                Df    Sum Sq   Mean Sq F value Pr(>F)
## pathlengthfac   5 3.330e-30 6.655e-31   1.702  0.142
## Residuals      95 3.716e-29 3.911e-31
##
## Error: subject:Type
##           Df Sum Sq Mean Sq F value Pr(>F)
## Type       1  8.759   8.759   68.57  1e-07 ***
## Residuals 19  2.427   0.128
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
## Error: subject:pathlengthfac:Type
##                     Df Sum Sq Mean Sq F value Pr(>F)
## pathlengthfac:Type   5  9.328  1.8656   109.1 <2e-16 ***
## Residuals           95  1.624  0.0171
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

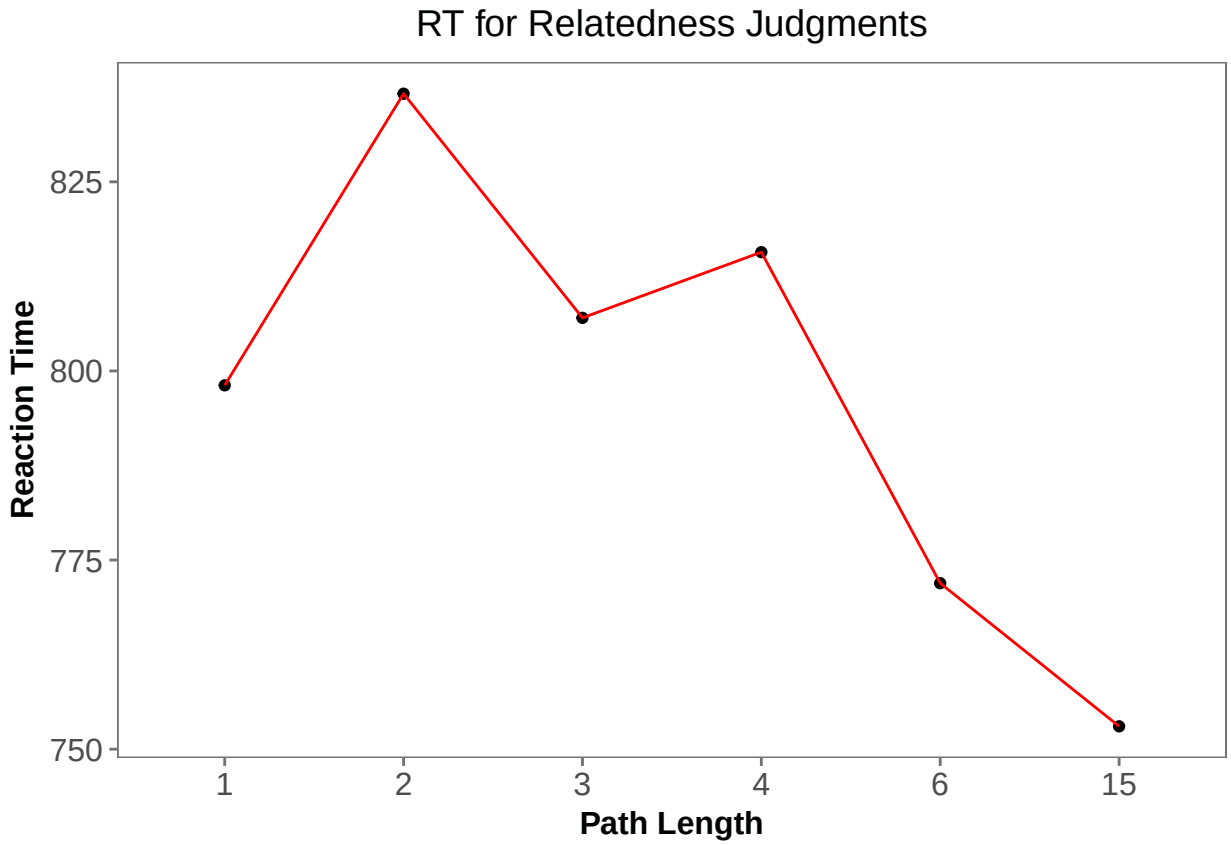
Raw Reaction Time

ANOVA

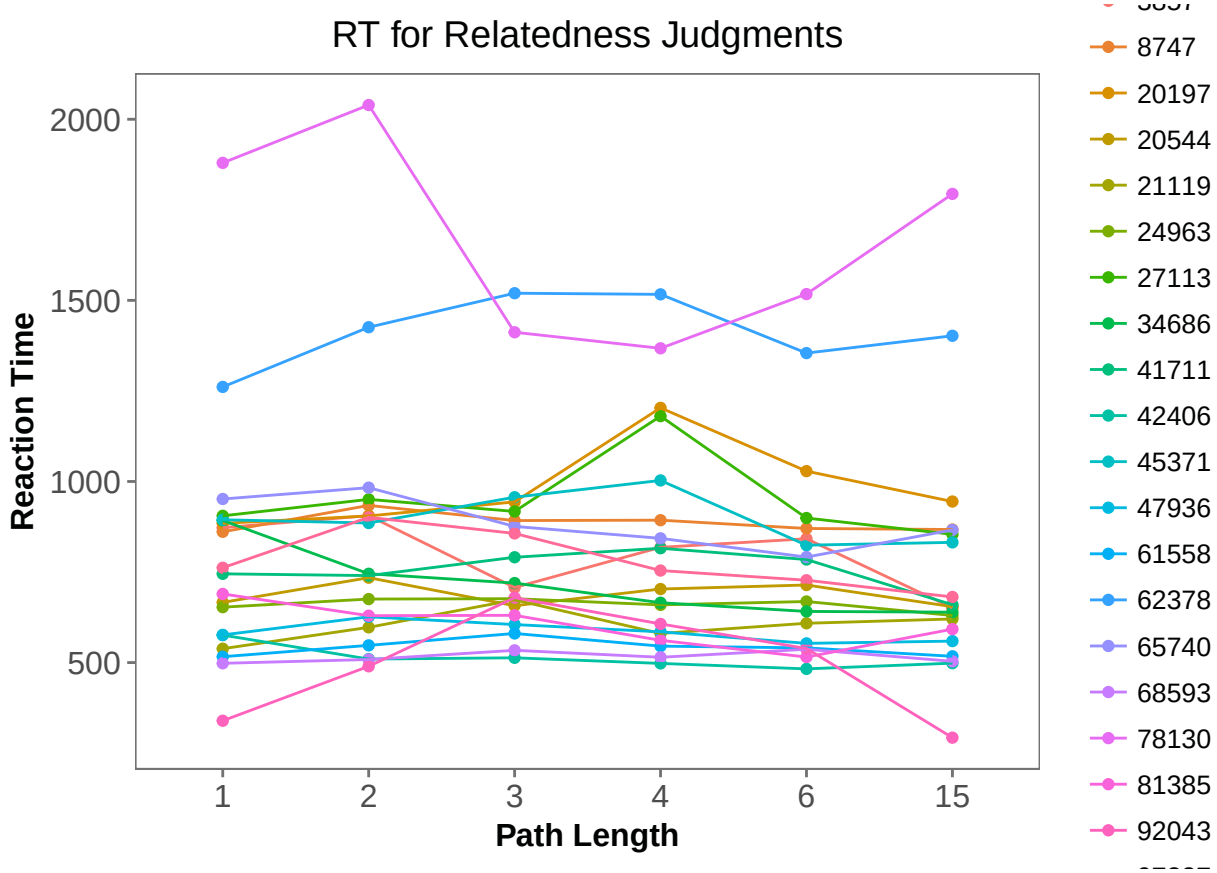
```
sem_rt$pathlengthfac = ordered(as.factor(as.character(sem_rt$pathlength)),
                               levels = c("1", "2", "3", "4", "6", "15"))
sem_rt$subject = as.factor(sem_rt$subject)
rt_aov = aov(data = sem_rt, rt ~ pathlengthfac +
                     Error(subject/(pathlengthfac)))
summary(rt_aov)
```

```
##
## Error: subject
##           Df   Sum Sq Mean Sq F value Pr(>F)
## Residuals 19 10213162  537535
##
## Error: subject:pathlengthfac
##               Df Sum Sq Mean Sq F value Pr(>F)
## pathlengthfac  5  91732   18346   2.097 0.0724 .
## Residuals     95 831163    8749
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Plotting RTs

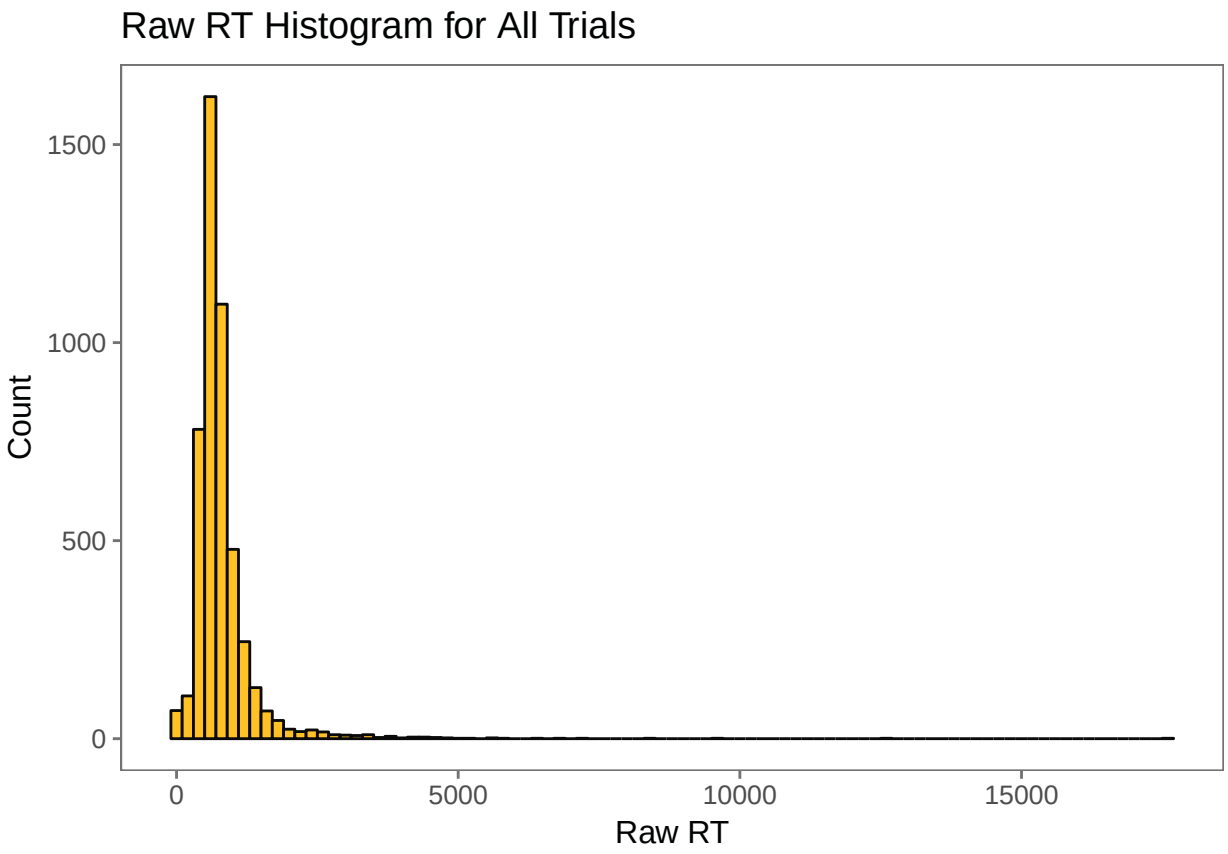


Subject-Wise

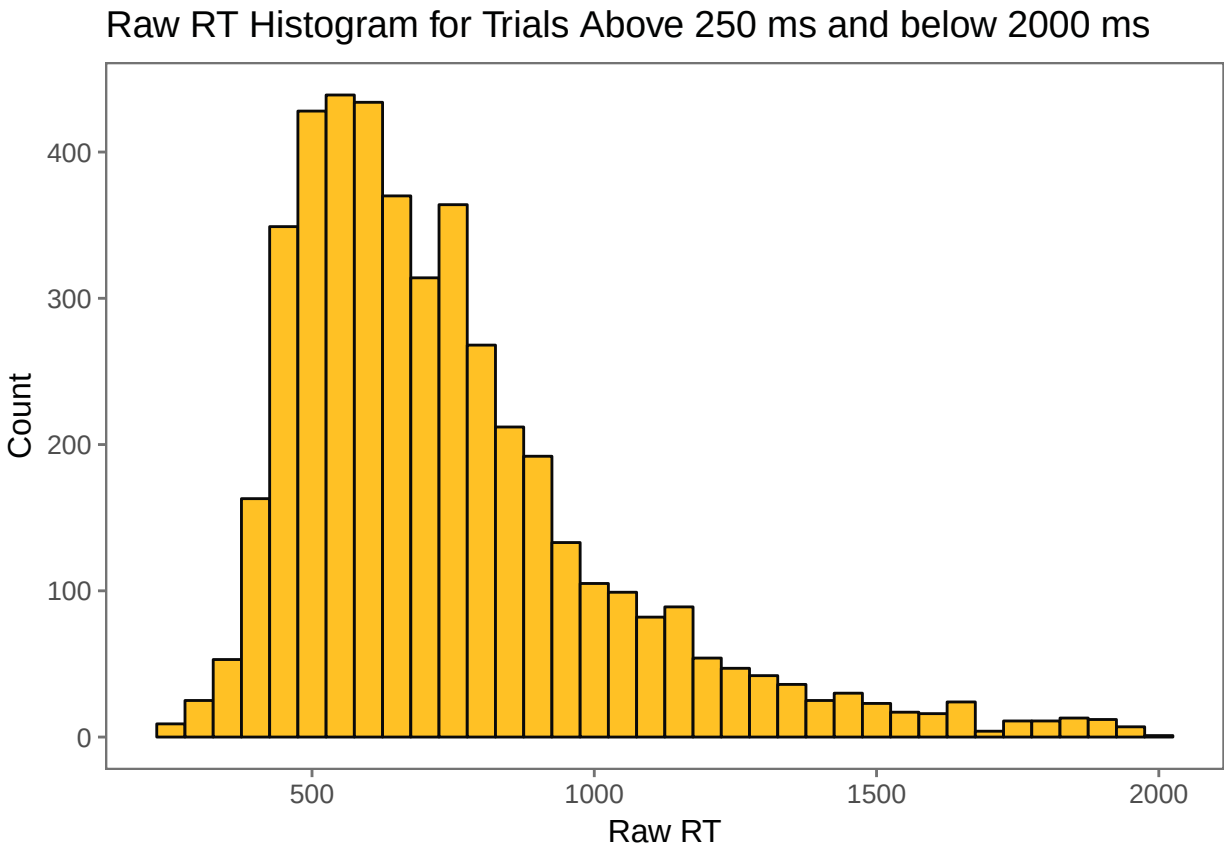


z-scored Reaction Time

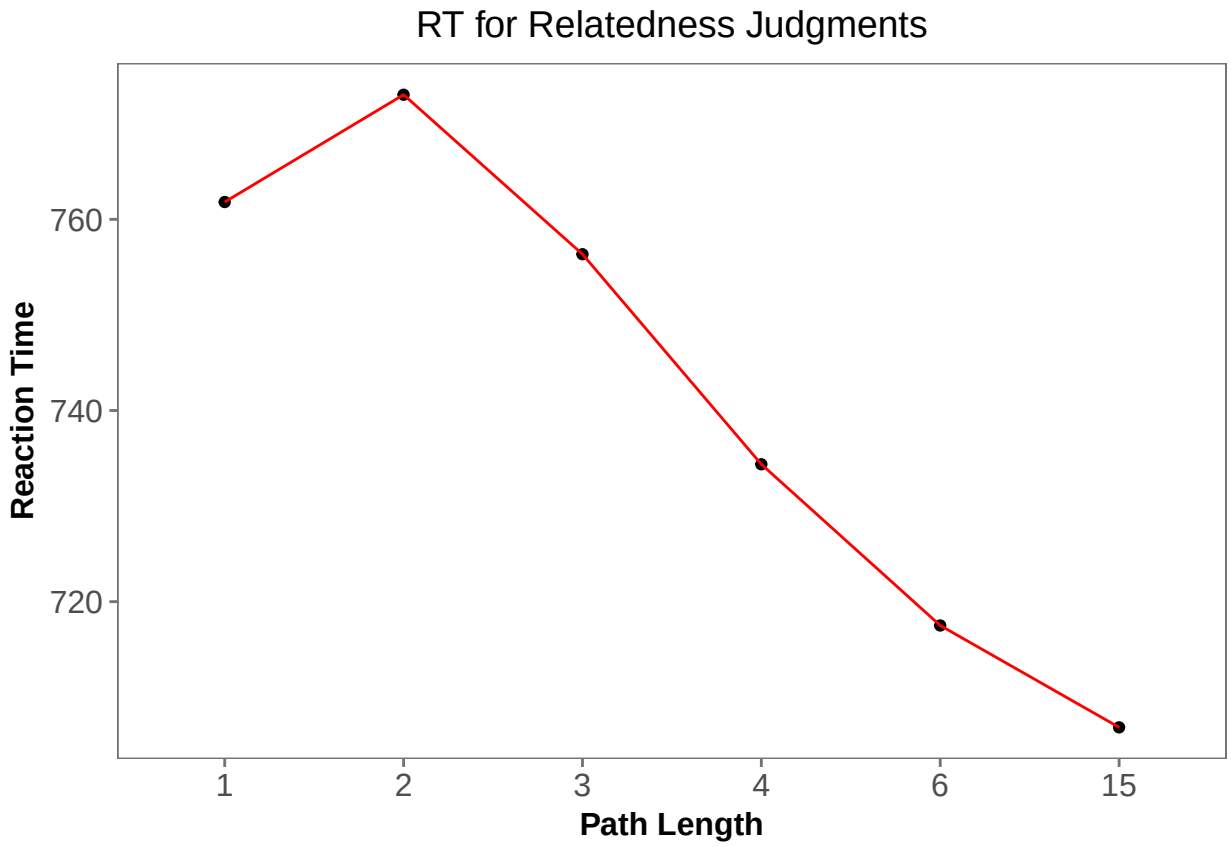
Histogram of RT



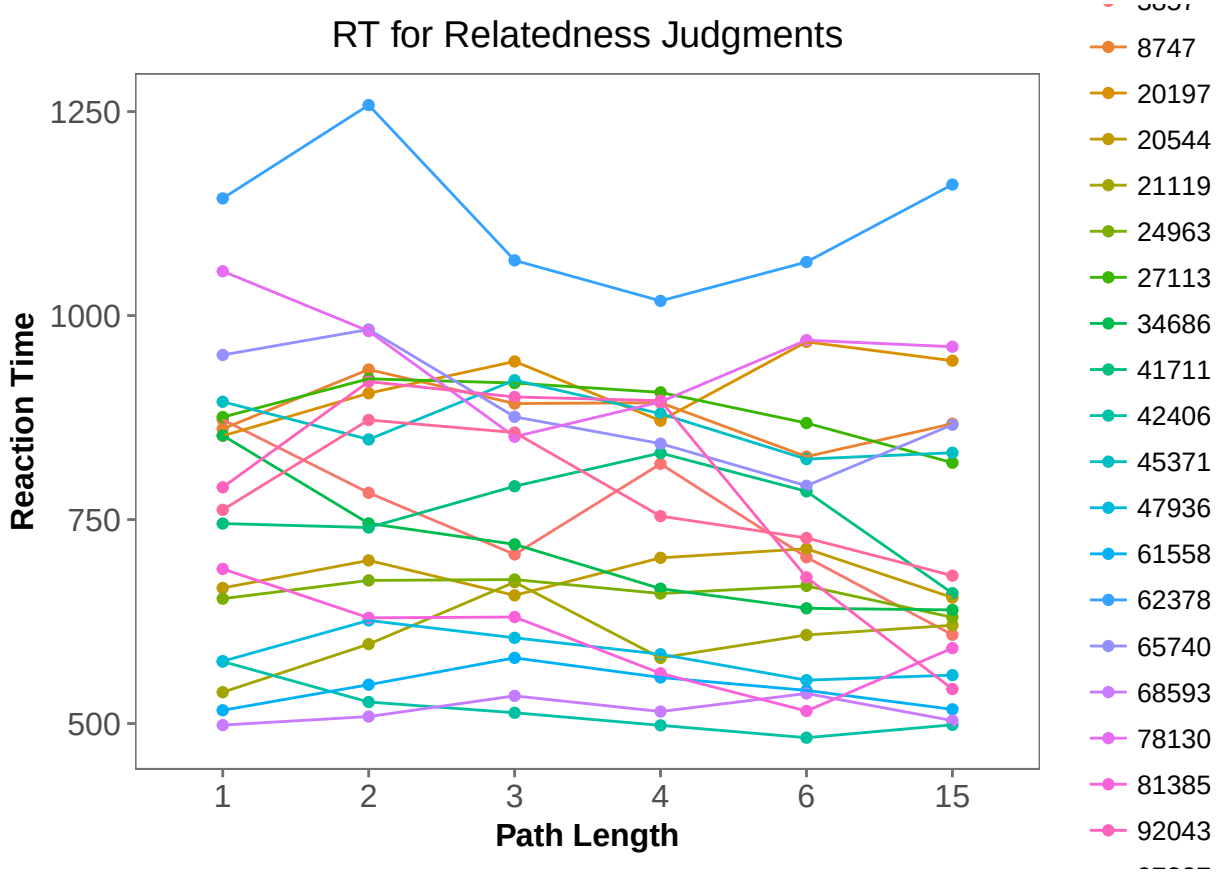
First Trim


Raw RT Histogram for Trials Above 250 ms and below 2000 ms
Count
400
300
200
100
0
500
1000
1500
2000
Raw RT

Raw RT aggregates After Trimming

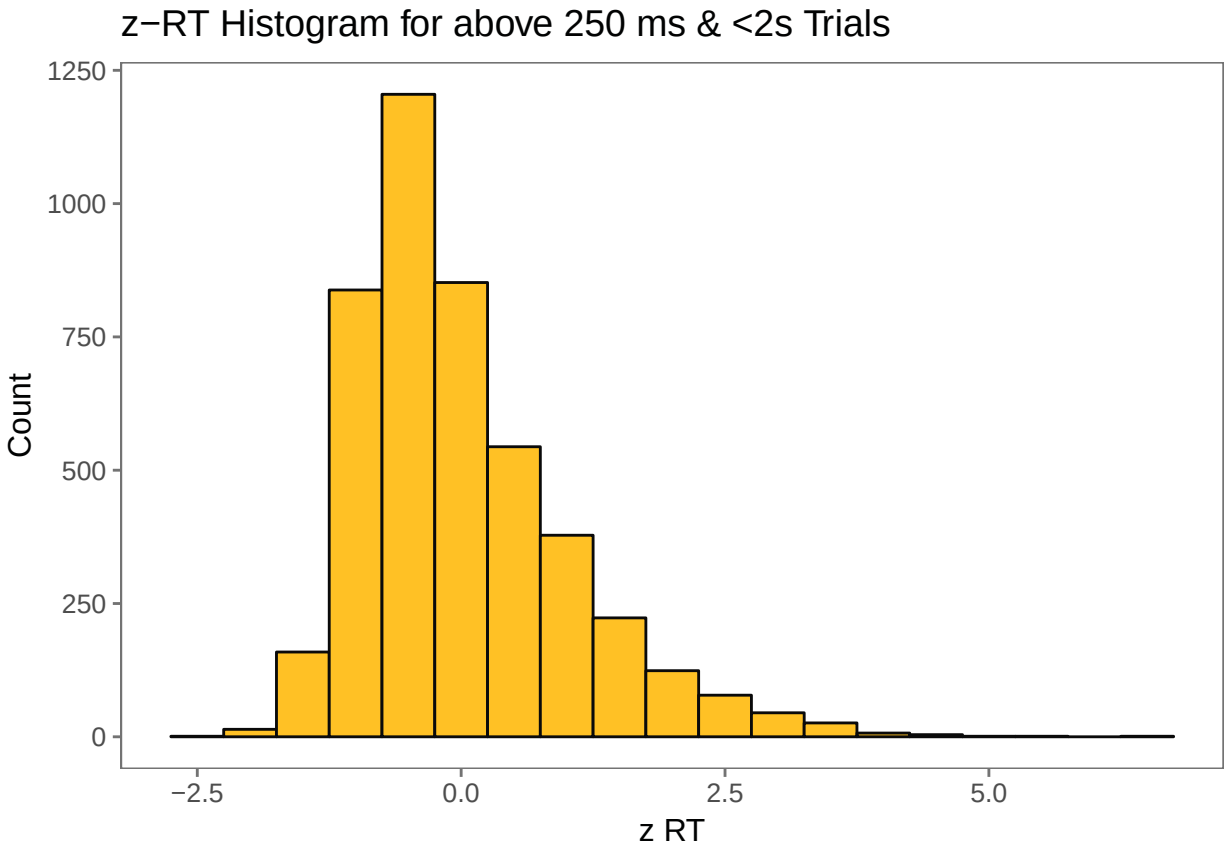


Subject Raw RT again

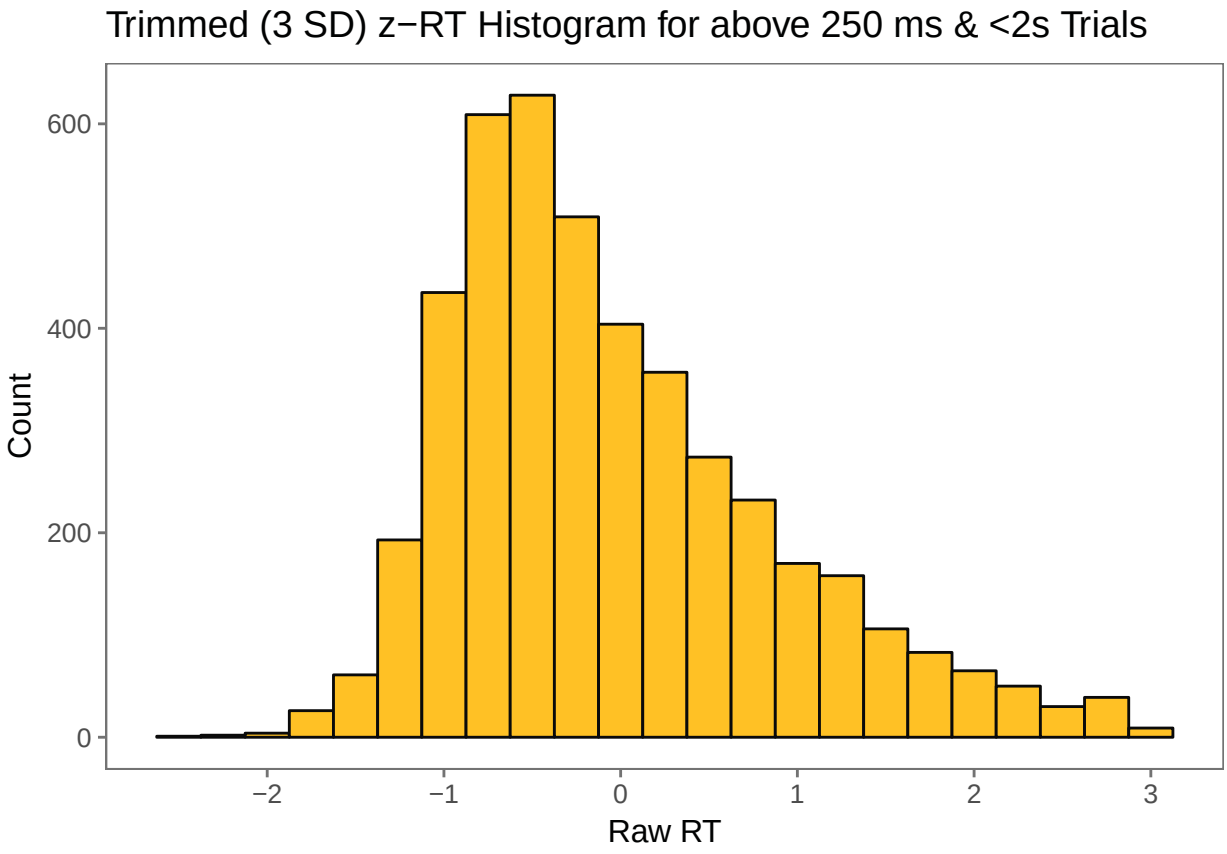


Making the z-scores

z-RT Distribution



Trimming z-RT



Repeating z-scoring

Aggregating zRT

ANOVA

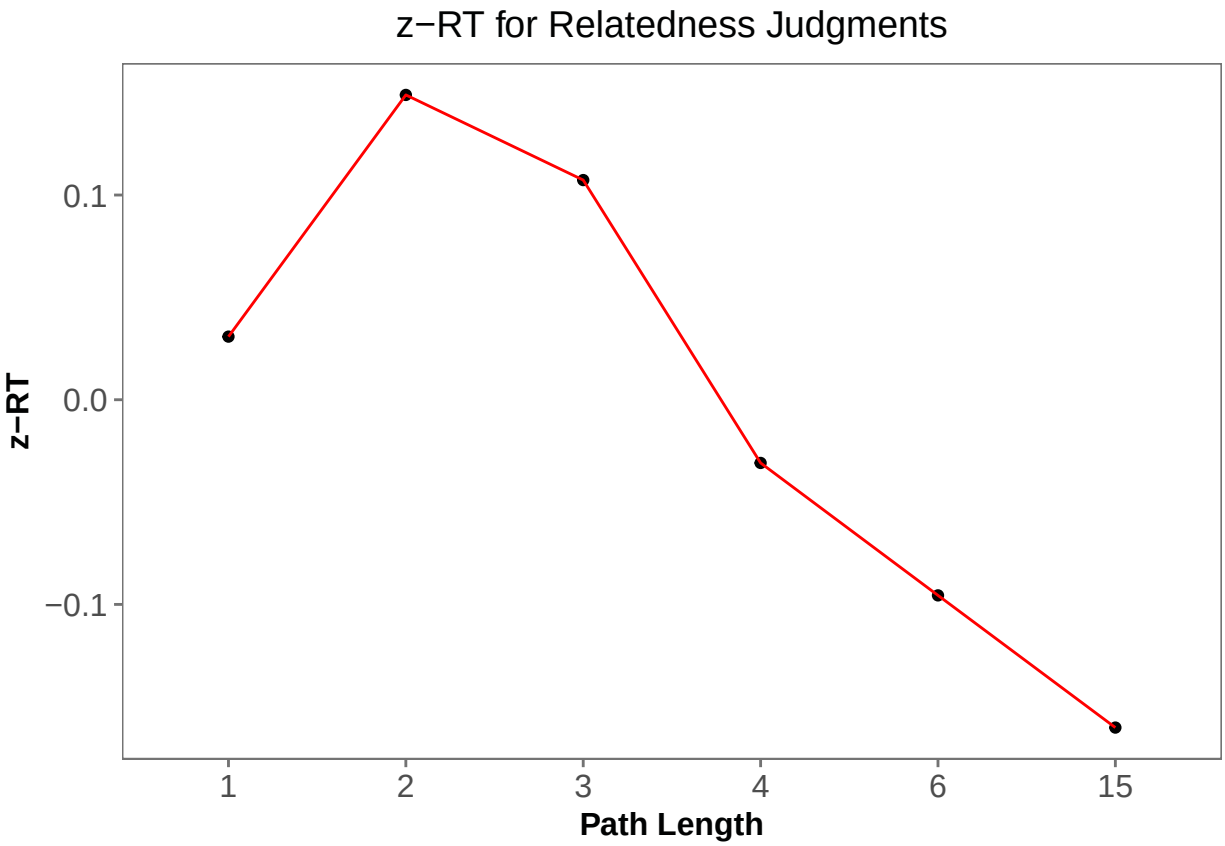
```
z_sem_rt$pathlengthfac = ordered(as.factor(as.character(z_sem_rt$pathlength)),
                                 levels = c("1", "2", "3", "4", "6", "15"))
z_sem_rt$subject = as.factor(z_sem_rt$subject)

z_rt_aov = aov(data = z_sem_rt, zRT_trim ~ pathlengthfac +
                       Error(subject/(pathlengthfac)))
summary(z_rt_aov)
```

```
##
## Error: subject
##           Df   Sum Sq   Mean Sq F value Pr(>F)
## Residuals 19 0.003357 0.0001767
##
## Error: subject:pathlengthfac
##               Df Sum Sq Mean Sq F value   Pr(>F)
## pathlengthfac  5  1.492 0.29848   7.018 1.28e-05 ***
## Residuals     95  4.040 0.04253
```

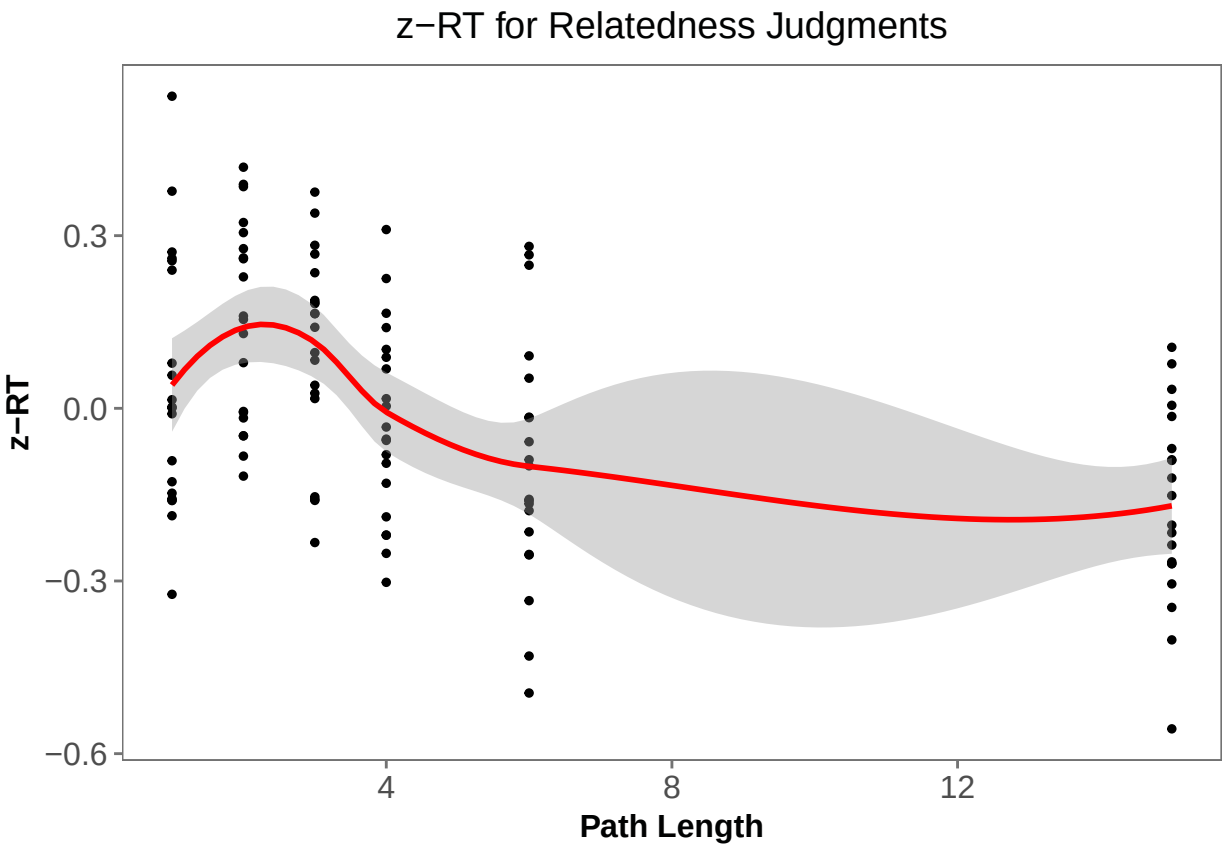
```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Plotting RTs

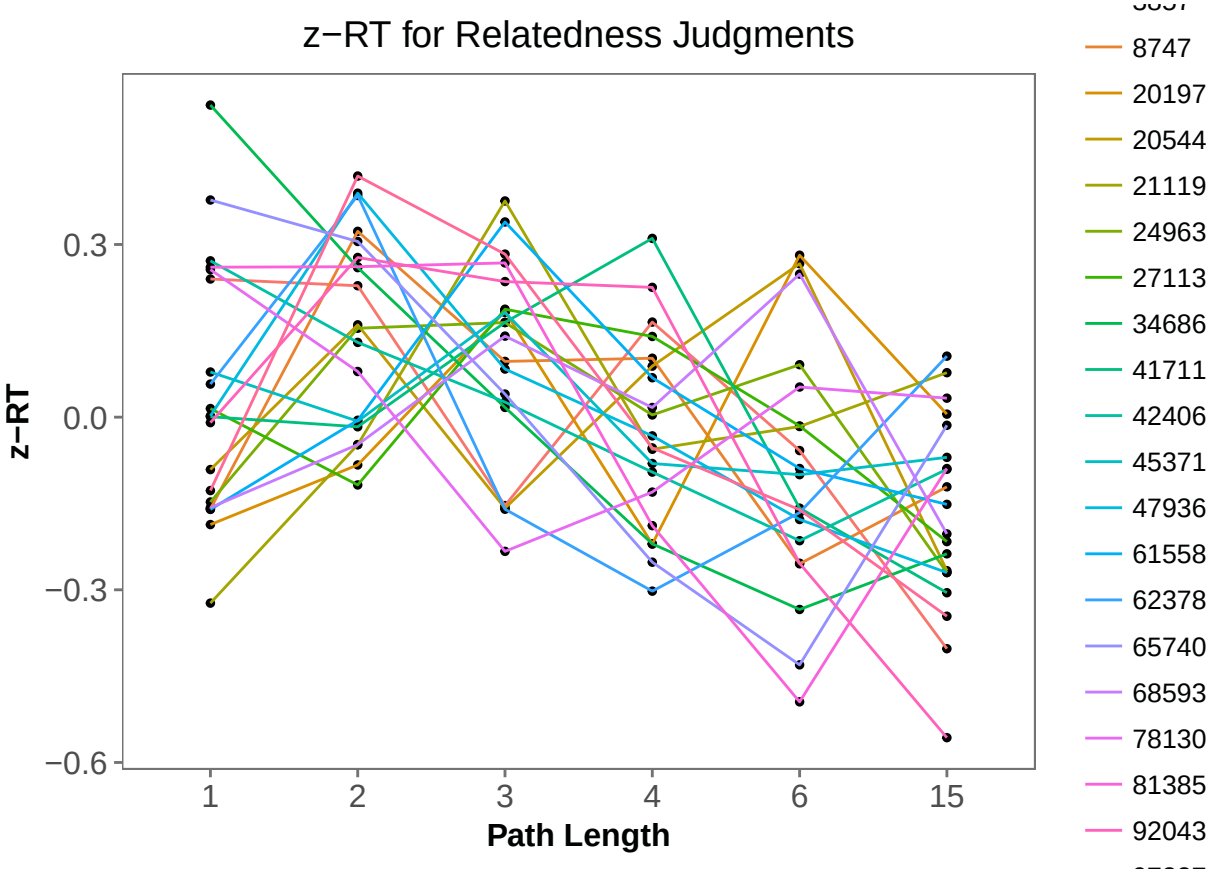


Quadratic Trend

```
z_sem_rt %>%
  ggplot(aes(x = pathlength, y = zRT_trim))+
  geom_point(color = "black", size = 1)+
  geom_smooth(method = "loess", color = "red")+
   #geom_errorbar(aes(ymin=Trials - ci, ymax=Trials + ci),
  #           width=.2, color = "gray26",
   #          position = position_dodge(0.7))+
 theme_few()+
 # scale_x_continuous(breaks = c(1,2,3,4,5,6,10,15,20))+
    xlab("Path Length") + ylab("z-RT") +
 ggtitle("z-RT for Relatedness Judgments")  +
 # facet_wrap(~subject)+
   theme(axis.text = element_text(size = rel(1)),
         axis.title = element_text(face = "bold", size = rel(1)),
         legend.title = element_text(face = "bold", size = rel(1)),
        plot.title = element_text(hjust = .5),
        strip.text.x = element_text(face = "bold", size = rel(1.4)))
```


z−RT for Relatedness Judgments
0.3
0.0
−0.3
−0.6
z−RT
4
8
12
Path Length

Subject-Wise



Regressions

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

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: rt ~ 1 + (1 | subject)
##    Data: sem
##
## REML criterion at convergence: 74311.4
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.7700 -0.3339 -0.1147  0.1521 28.8328
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  subject  (Intercept)  88318   297.2
##  Residual             305062   552.3
## Number of obs: 4800, groups:  subject, 20
##
## Fixed effects:
##             Estimate Std. Error t value
```

```
## (Intercept)   797.07      66.93   11.91
```

```
## [1] 0.2245106
```

```
## Warning: NAs introduced by coercion
```

```
## Warning: NAs introduced by coercion
```

```
## Warning: NAs introduced by coercion
```

```
## Warning: NAs introduced by coercion
```

```
## Warning: NAs introduced by coercion
```

```
## Warning: NAs introduced by coercion
```

```
## Warning: NAs introduced by coercion
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: zRT_trim ~ pathlengthfac + (1 | subject)
##    Data: new_sem_z
##
## REML criterion at convergence: 12570.3
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.5976 -0.7370 -0.2157  0.5595  3.6323
##
## Random effects:
##  Groups   Name        Variance  Std.Dev.
##  subject  (Intercept) 3.104e-32 1.762e-16
##  Residual             9.851e-01 9.925e-01
## Number of obs: 4445, groups:  subject, 20
##
## Fixed effects:
##                Estimate Std. Error t value
## (Intercept)     0.14891    0.03663   4.065
## pathlengthfac1 -0.11808    0.05169  -2.285
## pathlengthfac3 -0.04160    0.05153  -0.807
## pathlengthfac4 -0.17979    0.05181  -3.470
## pathlengthfac5 -0.24449    0.05163  -4.735
## pathlengthfac6 -0.30908    0.05167  -5.982
##
## Correlation of Fixed Effects:
##             (Intr) pthln1 pthln3 pthln4 pthln5
## pthlngthfc1 -0.709
## pthlngthfc3 -0.711  0.504
## pthlngthfc4 -0.707  0.501  0.503
## pthlngthfc5 -0.709  0.503  0.504  0.502
## pthlngthfc6 -0.709  0.503  0.504  0.501  0.503
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: rt ~ pathlengthfac + (pathlengthfac | subject)
##    Data: sem
##
## REML criterion at convergence: 74218.1
```

```
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.2746 -0.3265 -0.1081  0.1550 28.4882
##
## Random effects:
##  Groups   Name           Variance Std.Dev. Corr
##  subject  (Intercept)    103398   321.56
##           pathlengthfac2   1574    39.67    0.82
##           pathlengthfac3  16164   127.14   -0.67 -0.13
##           pathlengthfac4  25041   158.24   -0.46  0.13  0.97
##           pathlengthfac5  10178   100.89   -0.64 -0.10  1.00  0.97
##           pathlengthfac6   1772    42.10    0.09  0.64  0.68  0.85  0.71
##  Residual                300580   548.25
## Number of obs: 4800, groups:  subject, 20
##
## Fixed effects:
##                Estimate Std. Error t value
## (Intercept)     798.099     74.469  10.717
## pathlengthfac2   38.555     28.812   1.338
## pathlengthfac3    8.919     39.493   0.226
## pathlengthfac4   17.606     44.760   0.393
## pathlengthfac5  -26.163     35.502  -0.737
## pathlengthfac6  -45.083     28.984  -1.555
##
## Correlation of Fixed Effects:
##             (Intr) pthln2 pthln3 pthln4 pthln5
## pthlngthfc2  0.070
## pthlngthfc3 -0.594  0.301
## pthlngthfc4 -0.461  0.322  0.762
## pthlngthfc5 -0.538  0.348  0.725  0.726
## pthlngthfc6 -0.147  0.514  0.487  0.507  0.511
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: zRT_trim ~ pathlength + (1 | subject)
##    Data: new_sem_z
##
## REML criterion at convergence: 12576.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.6410 -0.7267 -0.2113  0.5628  3.6608
##
## Random effects:
##  Groups   Name        Variance  Std.Dev.
##  subject  (Intercept) 3.114e-32 1.765e-16
##  Residual             9.883e-01 9.941e-01
## Number of obs: 4445, groups:  subject, 20
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)  0.096877   0.022245   4.355
## pathlength  -0.018731   0.003192  -5.869
##
```

```
## Correlation of Fixed Effects:
##             (Intr)
## pathlength -0.742
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: zRT_trim ~ pathlength + I((pathlength)^2) + (1 | subject)
##    Data: new_sem_z
##
## REML criterion at convergence: 12585.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.6778 -0.7286 -0.2136  0.5582  3.6670
##
## Random effects:
##  Groups   Name        Variance  Std.Dev.
##  subject  (Intercept) 3.113e-32 1.764e-16
##  Residual             9.878e-01 9.939e-01
## Number of obs: 4445, groups:  subject, 20
##
## Fixed effects:
##                      Estimate Std. Error t value
## (Intercept)         0.1583255  0.0412449   3.839
## pathlength         -0.0458356  0.0156500  -2.929
## I((pathlength)^2)   0.0016209  0.0009162   1.769
##
## Correlation of Fixed Effects:
##             (Intr) pthlng
## pathlength  -0.906
## I((pthl)^2)  0.842 -0.979
```

‘‘‘