Spacek et al., 2021, Figure 3

Figure 3c

Feedback effects on firing rate

```
# Random-intercept, random-slope for single neurons,
# random intercept for experiments, nested in series
lmer.3c = lmer(rates ~ feedback + (1 + feedback | uid) + (1 | sid/eid),
               data = tb %>% drop_na(rates))

display(lmer.3c)
```

```
## lmer(formula = rates ~ feedback + (1 + feedback | uid) + (1 |
##     sid/eid), data = tb %>% drop_na(rates))
##             coef.est coef.se
## (Intercept) 14.98     3.24
## feedback    -0.45     1.16
##
## Error terms:
##  Groups   Name        Std.Dev. Corr
##  uid      (Intercept) 14.19
##           feedback     7.61    -0.59
##  eid:sid  (Intercept)  4.45
##  sid      (Intercept)  5.13
##  Residual              8.47
## ---
## number of obs: 17640, groups: uid, 44; eid:sid, 12; sid, 8
## AIC = 125946, DIC = 125942.5
## deviance = 125936.4
```

```
anova(lmer.3c)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##          Sum Sq Mean Sq NumDF  DenDF F value Pr(>F)
## feedback 10.976  10.976     1 43.031   0.153 0.6976
```

Feedback: 14.5 spikes/s
Suppression: 15.0 spikes/s
n = 44 neurons from 4 mice

Figure 3d

Feedback effects on burst ratio

```
# Random-intercept, random-slope for single neurons,
# random intercept for experiments, nested in series
lmer.3d = lmer(burstratios ~ feedback + (1 + feedback | uid) + (1 | sid/eid),
               data = tb %>% drop_na(burstratios))

display(lmer.3d)
```

```
## lmer(formula = burstratios ~ feedback + (1 + feedback | uid) +
##     (1 | sid/eid), data = tb %>% drop_na(burstratios))
##             coef.est coef.se
## (Intercept)  0.15     0.03
## feedback    -0.11     0.02
##
## Error terms:
##  Groups   Name        Std.Dev. Corr
##  uid      (Intercept) 0.18
##           feedback    0.15     -0.99
##  eid:sid  (Intercept) 0.02
##  sid      (Intercept) 0.00
##  Residual             0.13
## ---
## number of obs: 16545, groups: uid, 44; eid:sid, 12; sid, 8
## AIC = -19436.5, DIC = -19479.4
## deviance = -19466.0
```

```
anova(lmer.3d)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##           Sum Sq Mean Sq NumDF DenDF F value    Pr(>F)
## feedback 0.44746 0.44746     1 42.96  25.311 9.163e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Feedback: 0.043
Suppression: 0.15
n = 44 neurons from 4 mice

Figure 3e

Feedback effects on orientation selectivity

```
# Random-intercept for single neurons,
# random intercept for experiments, nested in series
lmer.3e = lmer(osi ~ feedback + (1 | uid) + (1 | sid/eid),
               data = tbeg %>% drop_na(osi))

display(lmer.3e)
```

```
## lmer(formula = osi ~ feedback + (1 | uid) + (1 | sid/eid), data = tbeg %>%
##     drop_na(osi))
##             coef.est coef.se
## (Intercept) 0.12     0.03
## feedback    0.00     0.01
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.07
##  eid:sid  (Intercept) 0.02
##  sid      (Intercept) 0.06
##  Residual             0.04
## ---
## number of obs: 136, groups: uid, 44; eid:sid, 12; sid, 8
## AIC = -329.2, DIC = -368
## deviance = -354.6
```

```
anova(lmer.3e)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##              Sum Sq    Mean Sq NumDF DenDF F value Pr(>F)
## feedback 0.00061045 0.00061045     1 88.65  0.3047 0.5824
```

Feedback: OSI = 0.13
Suppression: OSI = 0.12
n = 44 neurons from 4 mice

Figure 3g

Feedback effects on F1/F0-ratio

```
# Random intercept, random slope for single neurons,
# random intercept for series
lmer.3g = lmer(f1f0 ~ feedback + (1 + feedback | uid) + (1 | sid),
               data = tbeg %>% drop_na(f1f0))

display(lmer.3g)
```

```
## lmer(formula = f1f0 ~ feedback + (1 + feedback | uid) + (1 |
##     sid), data = tbeg %>% drop_na(f1f0))
##             coef.est coef.se
## (Intercept)  1.22     0.07
## feedback    -0.14     0.04
##
## Error terms:
##  Groups   Name        Std.Dev. Corr
##  uid      (Intercept) 0.39
##           feedback    0.05     0.78
##  sid      (Intercept) 0.07
##  Residual             0.20
## ---
## number of obs: 136, groups: uid, 44; sid, 8
## AIC = 87, DIC = 56.1
## deviance = 64.5
```

```
anova(lmer.3g)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##           Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## feedback 0.63715 0.63715     1 43.517  15.589 0.0002836 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Feedback: F_1/F_0-ratio = 1.08
Suppression: F_1/F_0-ratio = 1.22
n = 44 neurons from 4 mice

Figure 3i

Feedback effects on distribution of cycle average phase differences

```
# Of all bursting phis, how many are phase-advanced?
b_adv = sum(tb3i_db$dbphi > 0)
resb = binom.test(b_adv, length(tb3i_db$dbphi), 0.5)
print(resb)
```

```
##
##  Exact binomial test
##
## data:  b_adv and length(tb3i_db$dbphi)
## number of successes = 25, number of trials = 29, p-value = 0.0001037
## alternative hypothesis: true probability of success is not equal to 0.5
## 95 percent confidence interval:
##  0.6833594 0.9611052
## sample estimates:
## probability of success
##               0.862069
```

```
# Of all non-bursting phis, how many are phase-advanced?
nb_adv = sum(tb3i_dnb$dnbphi > 0)
resnb = binom.test(nb_adv, length(tb3i_dnb$dnbphi), 0.5)
print(resnb)
```

```
##
##  Exact binomial test
##
## data:  nb_adv and length(tb3i_dnb$dnbphi)
## number of successes = 11, number of trials = 21, p-value = 1
## alternative hypothesis: true probability of success is not equal to 0.5
## 95 percent confidence interval:
##  0.2978068 0.7428694
## sample estimates:
## probability of success
##              0.5238095
```