Binary Choice Analysis

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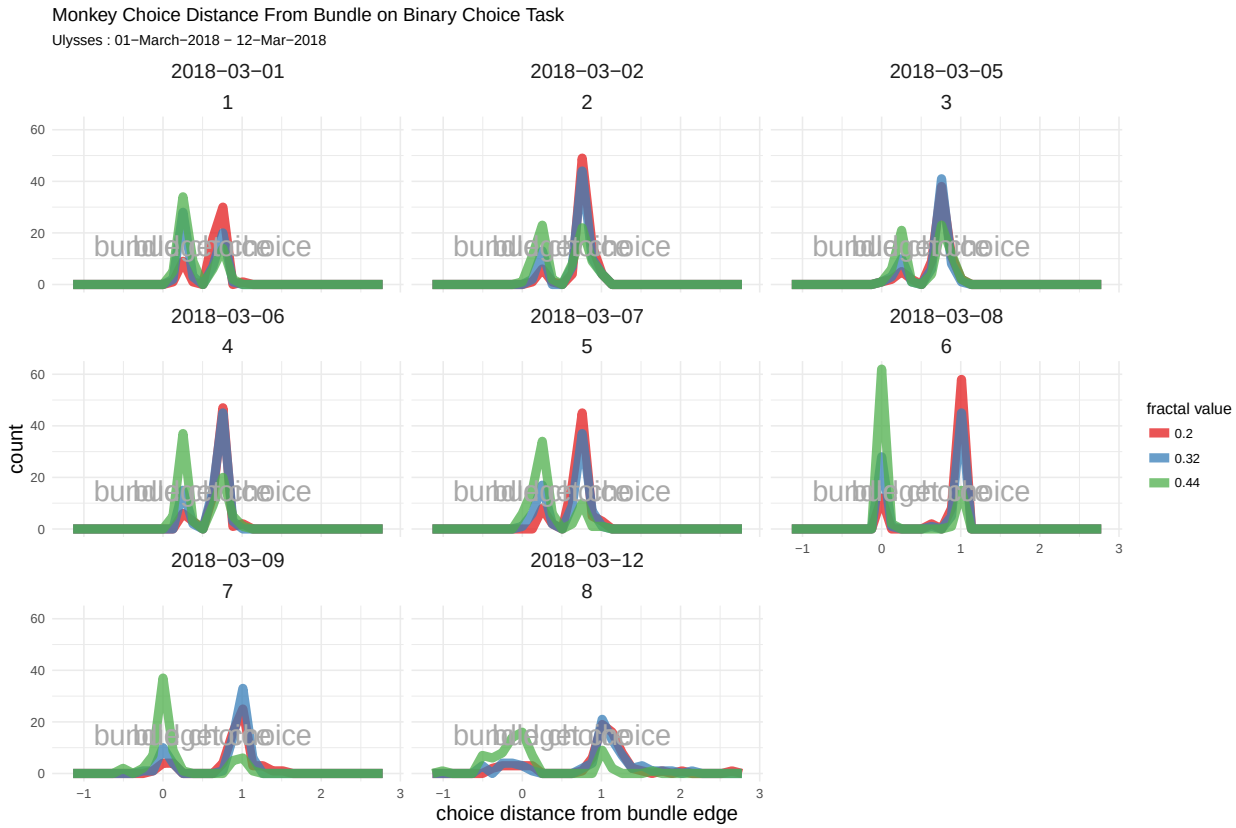
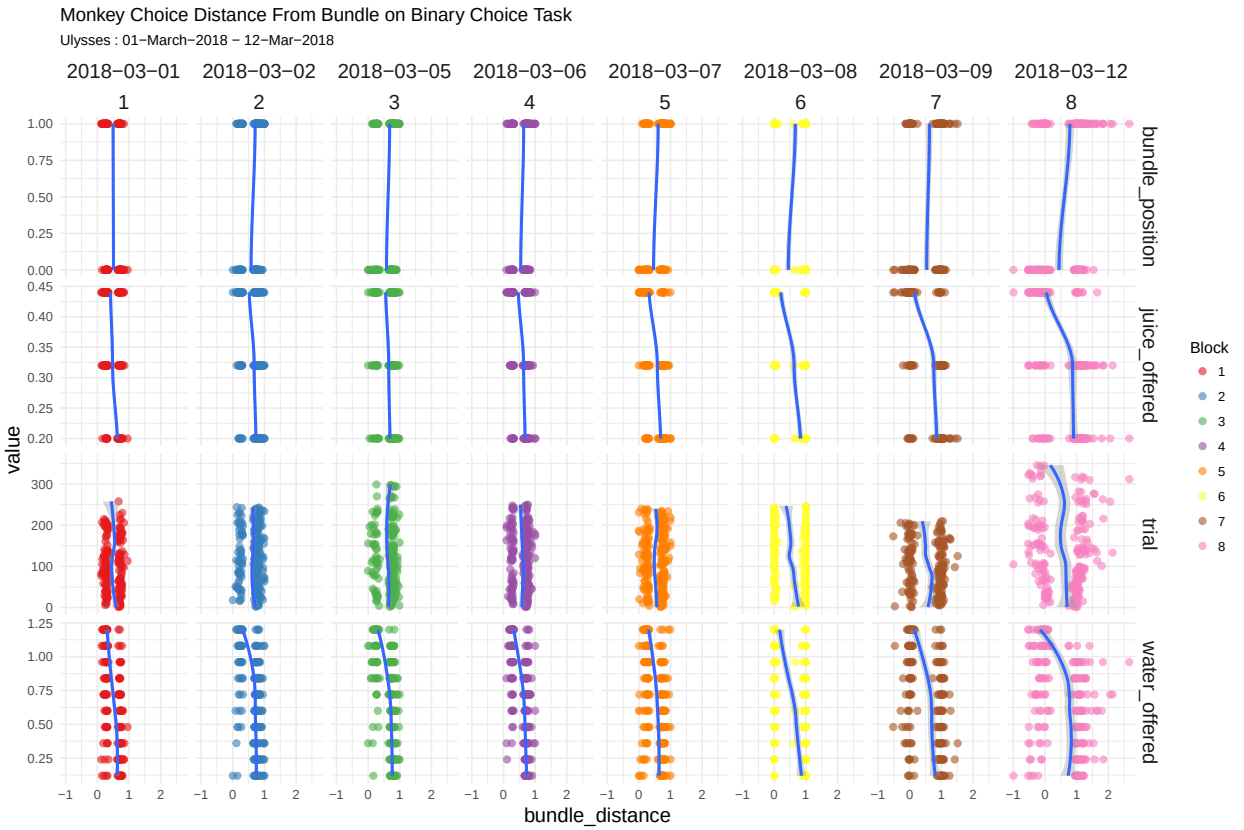
```
monkey <- "Ulysses"
today <- "12-Mar-2018"
look_back <- "01-March-2018"

start_trial <- 0
stop_trial <- 150

merge_days <- TRUE
```

```
p1
```




```
p2
```




```
#generate a model of likelihood to choice for the fractal dependent on it's position,
#value and associated water
model <- glm(data = task_data,
             fractal_choice ~ bundle_position + water_offered + juice_offered + trial + date,
             family = "binomial")

#summarise the parameters
summary(model)
```

```
##
## Call:
## glm(formula = fractal_choice ~ bundle_position + water_offered +
##     juice_offered + trial + date, family = "binomial", data = task_data)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.5800  -0.5327  -0.1557   0.4494   3.2908
##
## Coefficients:
##                   Estimate Std. Error z value Pr(>|z|)
## (Intercept)     -1.184e+03  3.799e+02  -3.115  0.00184 **
## bundle_position -1.353e+00  1.520e-01  -8.901  < 2e-16 ***
## water_offered    5.611e+00  2.984e-01  18.807  < 2e-16 ***
## juice_offered    1.844e+01  1.007e+00  18.309  < 2e-16 ***
## trial            4.282e-03  9.831e-04   4.356 1.32e-05 ***
## date             6.666e-02  2.159e-02   3.088  0.00202 **
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 2321.0  on 1762  degrees of freedom
## Residual deviance: 1241.3  on 1757  degrees of freedom
##   (504 observations deleted due to missingness)
## AIC: 1253.3
##
## Number of Fisher Scoring iterations: 6
```

```
#test for side bias with an exact binomial test
binom.test(c(nrow(task_data %>%
                    .[c(bundle_position != fractal_choice)]),
             nrow(task_data %>%
                    .[c(bundle_position == fractal_choice)])))
```

```
##
##  Exact binomial test
##
## data:  c(nrow(task_data %>% .[c(bundle_position != fractal_choice)]),     nrow(task_data %>% .[c(bun
## number of successes = 1005, number of trials = 1763, p-value =
## 4.408e-09
## alternative hypothesis: true probability of success is not equal to 0.5
## 95 percent confidence interval:
##  0.5465575 0.5933111
## sample estimates:
## probability of success
##               0.570051
```

```
#generate a model of likelihood to choice for the fractal dependent on it's position,
#value and associated water
model <- glm(data = dplyr::filter(task_data, block_no == max(block_no)),
             fractal_choice ~ bundle_position + water_offered + as.factor(juice_offered) + trial + date
             family = "binomial")

#summarise the parameters
summary(model)
```

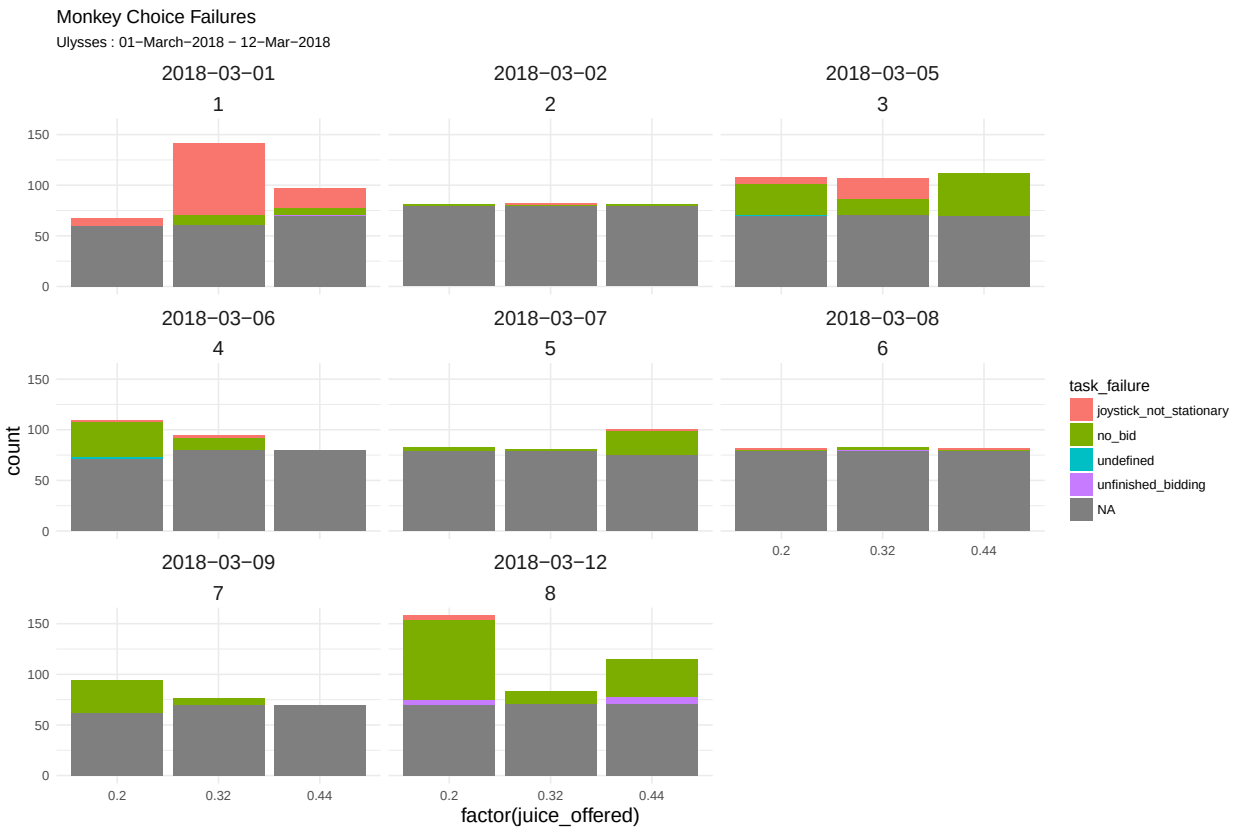
```
##
## Call:
## glm(formula = fractal_choice ~ bundle_position + water_offered +
##     as.factor(juice_offered) + trial + date, family = "binomial",
##     data = dplyr::filter(task_data, block_no == max(block_no)))
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.1196  -0.2495  -0.0340   0.2119   3.3314
##
## Coefficients: (1 not defined because of singularities)
##                                Estimate Std. Error z value Pr(>|z|)
## (Intercept)                  -10.219378   1.789625  -5.710 1.13e-08 ***
## bundle_position               -1.886395   0.586804  -3.215  0.00131 **
## water_offered                  9.047236   1.596060   5.668 1.44e-08 ***
## as.factor(juice_offered)0.32   0.773197   0.631951   1.224  0.22114
```

```
## as.factor(juice_offered)0.44   7.398787   1.263819   5.854 4.79e-09 ***
## trial                          0.010238   0.003031   3.378  0.00073 ***
## date                                 NA         NA      NA       NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 287.75  on 211  degrees of freedom
## Residual deviance: 102.44  on 206  degrees of freedom
##   (144 observations deleted due to missingness)
## AIC: 114.44
##
## Number of Fisher Scoring iterations: 7
```

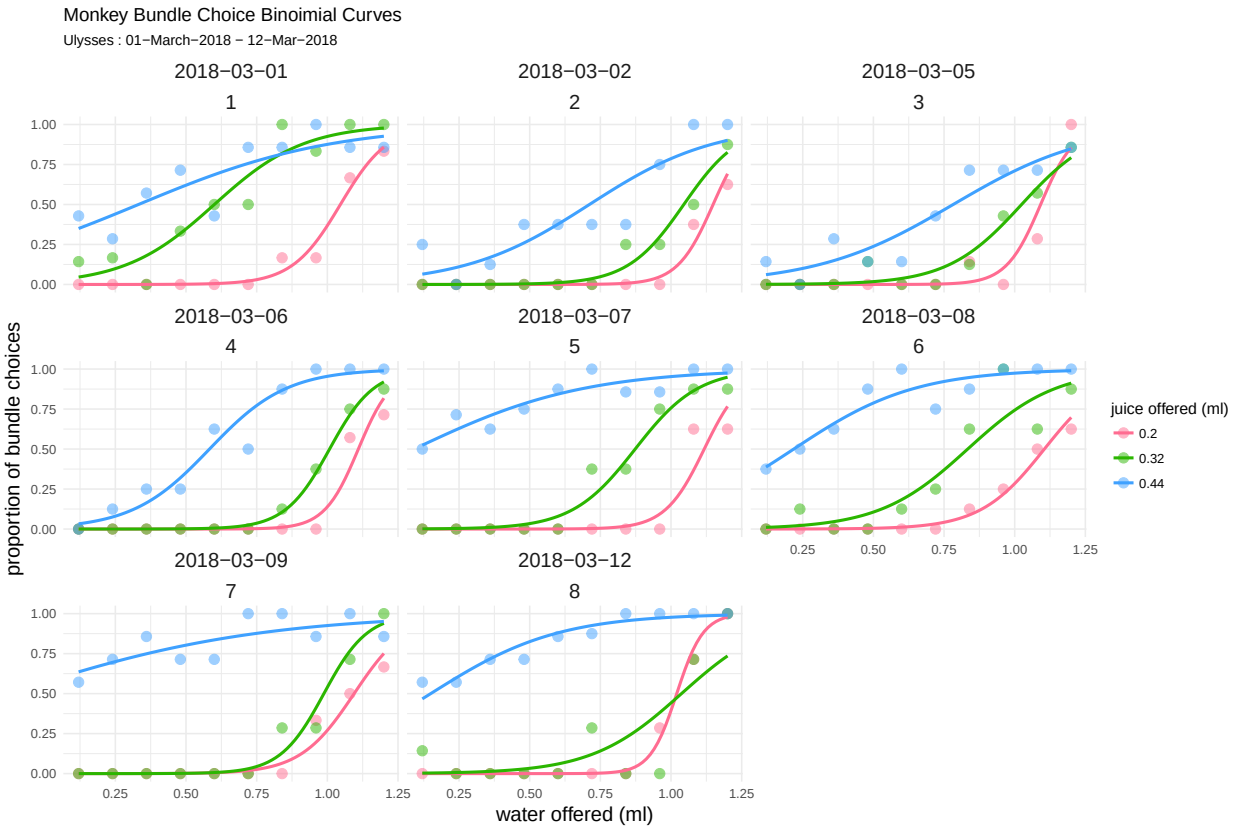
```
#test for side bias with an exact binomial test
binom.test(c(nrow(task_data %>%
                    .[c(bundle_position != fractal_choice & block_no == max(block_no))]),
             nrow(task_data %>%
                    .[c(bundle_position == fractal_choice & block_no == max(block_no))])))
```

```
##
##  Exact binomial test
##
## data:  c(nrow(task_data %>% .[c(bundle_position != fractal_choice &     block_no == max(block_no))])
## number of successes = 121, number of trials = 212, p-value =
## 0.04615
## alternative hypothesis: true probability of success is not equal to 0.5
## 95 percent confidence interval:
##  0.5011715 0.6383310
## sample estimates:
## probability of success
##              0.5707547
```

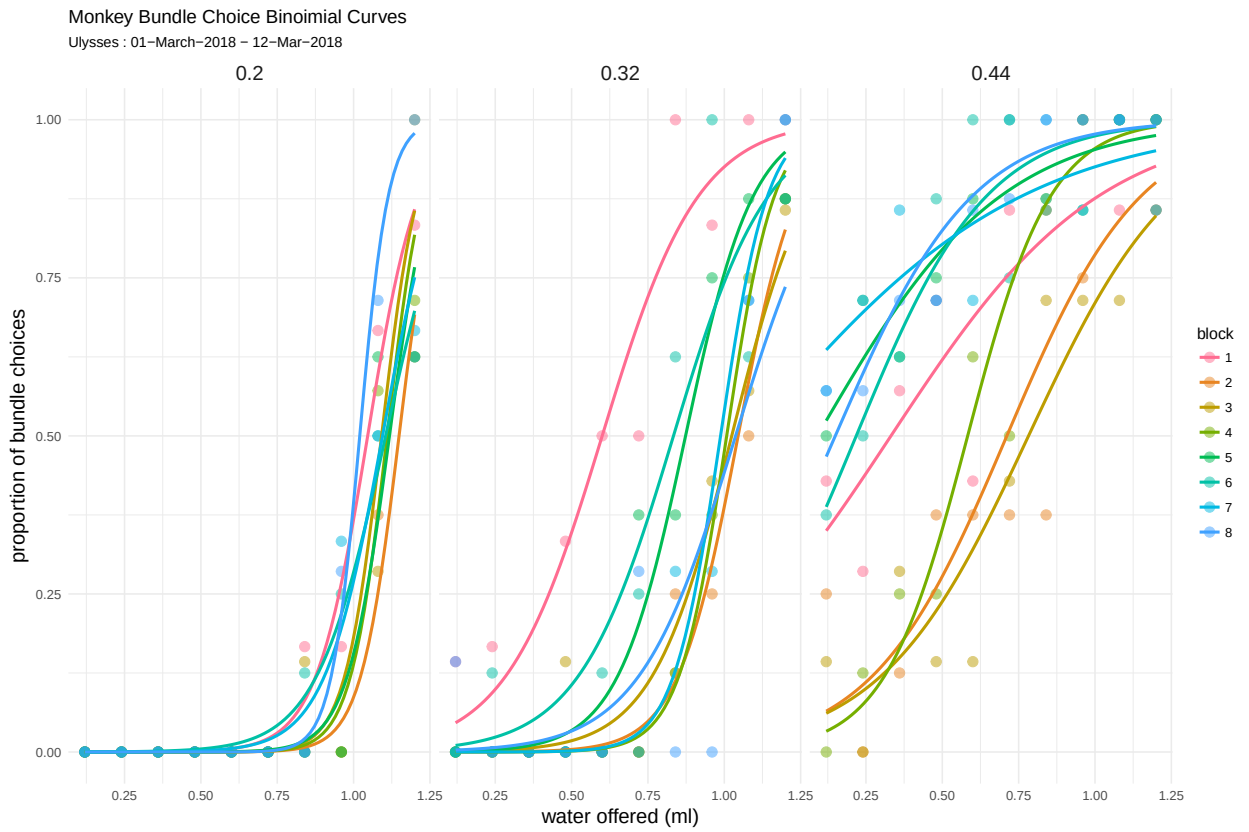
```
p3
```


Monkey Choice Failures
Ulysses : 01−March−2018 − 12−Mar−2018
2018−03−01
1
2018−03−02
2
2018−03−05
3
2018−03−06
4
2018−03−07
5
2018−03−08
6
2018−03−09
7
2018−03−12
8
count
150
100
50
0
0.2
0.32
0.44
factor(juice_offered)
task_failure
joystick_not_stationary
no_bid
undefined
unfinished_bidding
NA

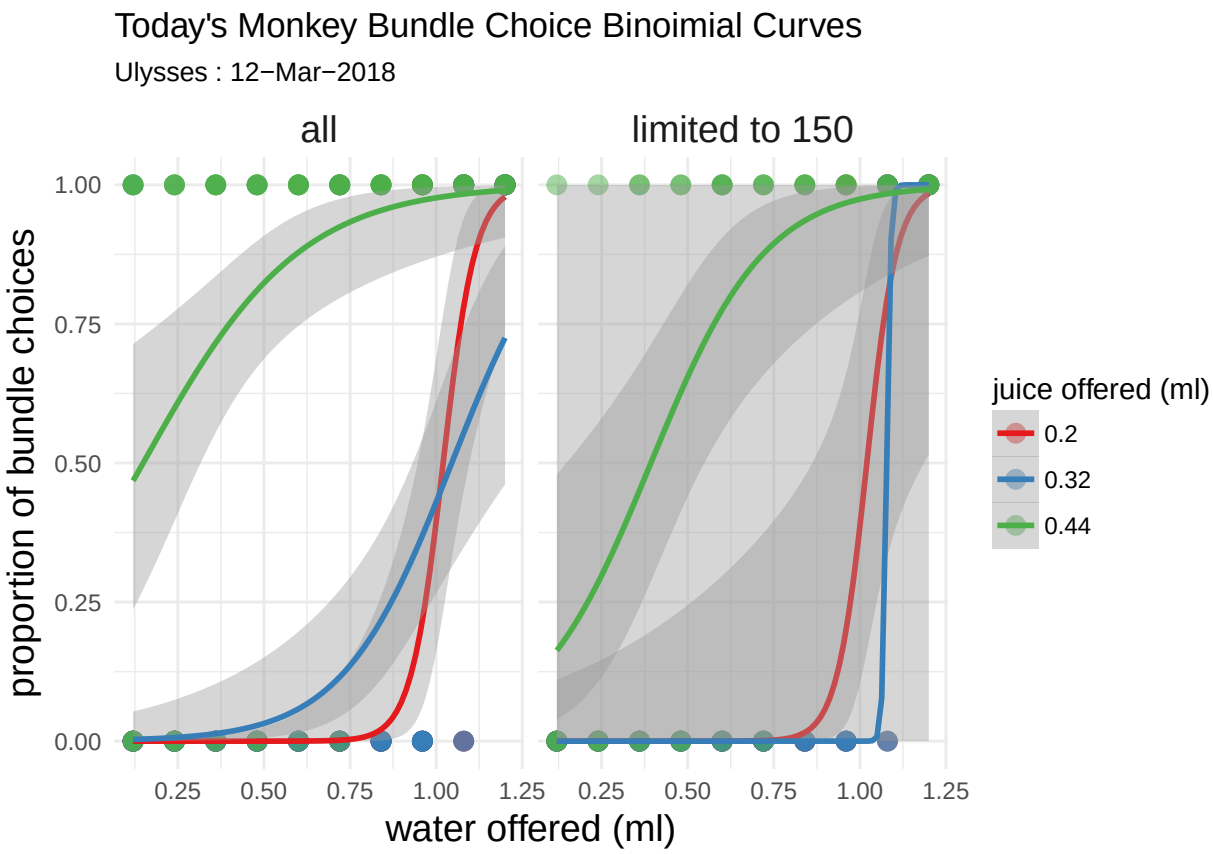
```
p4
```


Monkey Bundle Choice Binoimial Curves
Ulysses : 01−March−2018 − 12−Mar−2018
2018−03−01
1
2018−03−02
2
2018−03−05
3
2018−03−06
4
2018−03−07
5
2018−03−08
6
2018−03−09
7
2018−03−12
8
proportion of bundle choices
water offered (ml)
juice offered (ml)
0.2
0.32
0.44

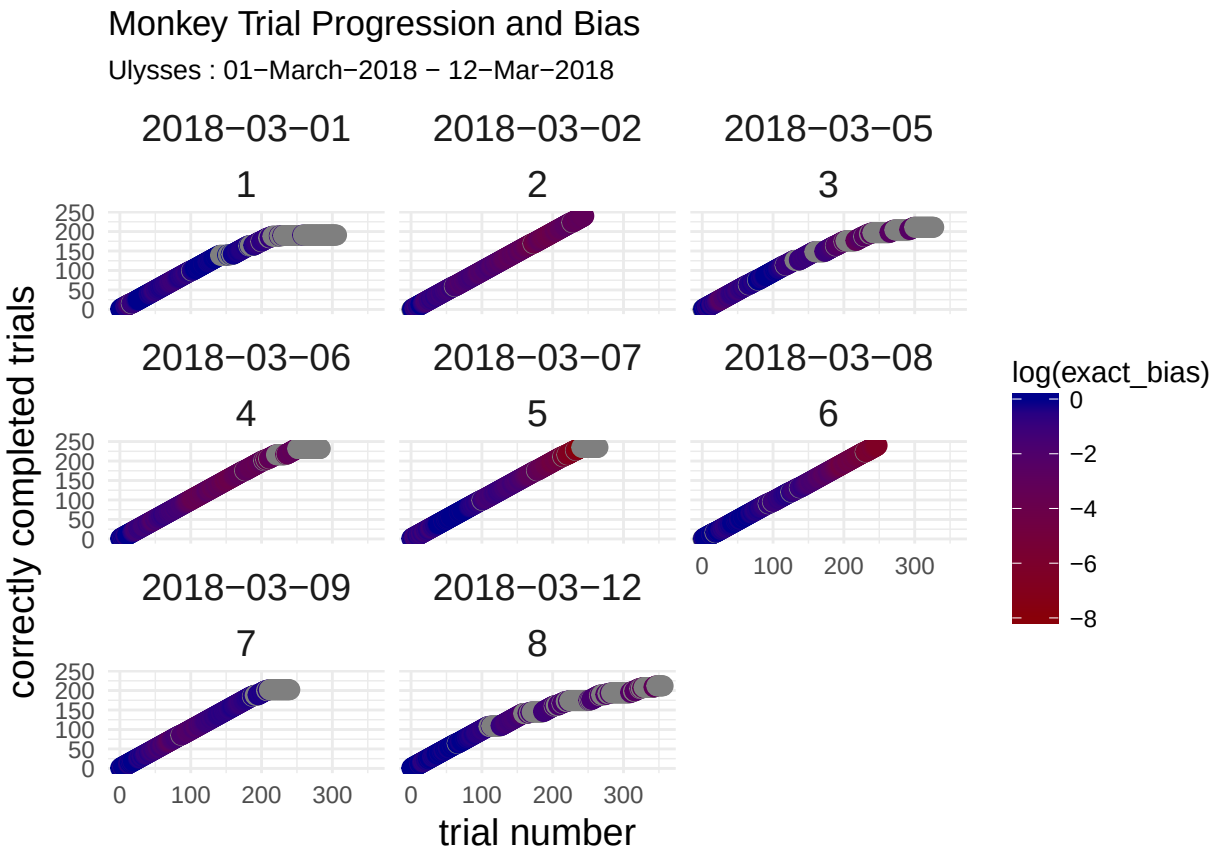
p5


Monkey Bundle Choice Binoimial Curves
Ulysses : 01−March−2018 − 12−Mar−2018
0.2
0.32
0.44
proportion of bundle choices
water offered (ml)
block
1
2
3
4
5
6
7
8

p6


Today's Monkey Bundle Choice Binoimial Curves
Ulysses : 12−Mar−2018
all
limited to 150
proportion of bundle choices
1.00
0.75
0.50
0.25
0.00
0.25
0.50
0.75
1.00
1.25
water offered (ml)
juice offered (ml)
0.2
0.32
0.44

```
p7
```


Monkey Trial Progression and Bias
Ulysses : 01−March−2018 − 12−Mar−2018
2018−03−01
1
2018−03−02
2
2018−03−05
3
2018−03−06
4
2018−03−07
5
2018−03−08
6
2018−03−09
7
2018−03−12
8
correctly completed trials
trial number
log(exact_bias)
0
−2
−4
−6
−8