Binary Choice Analysis

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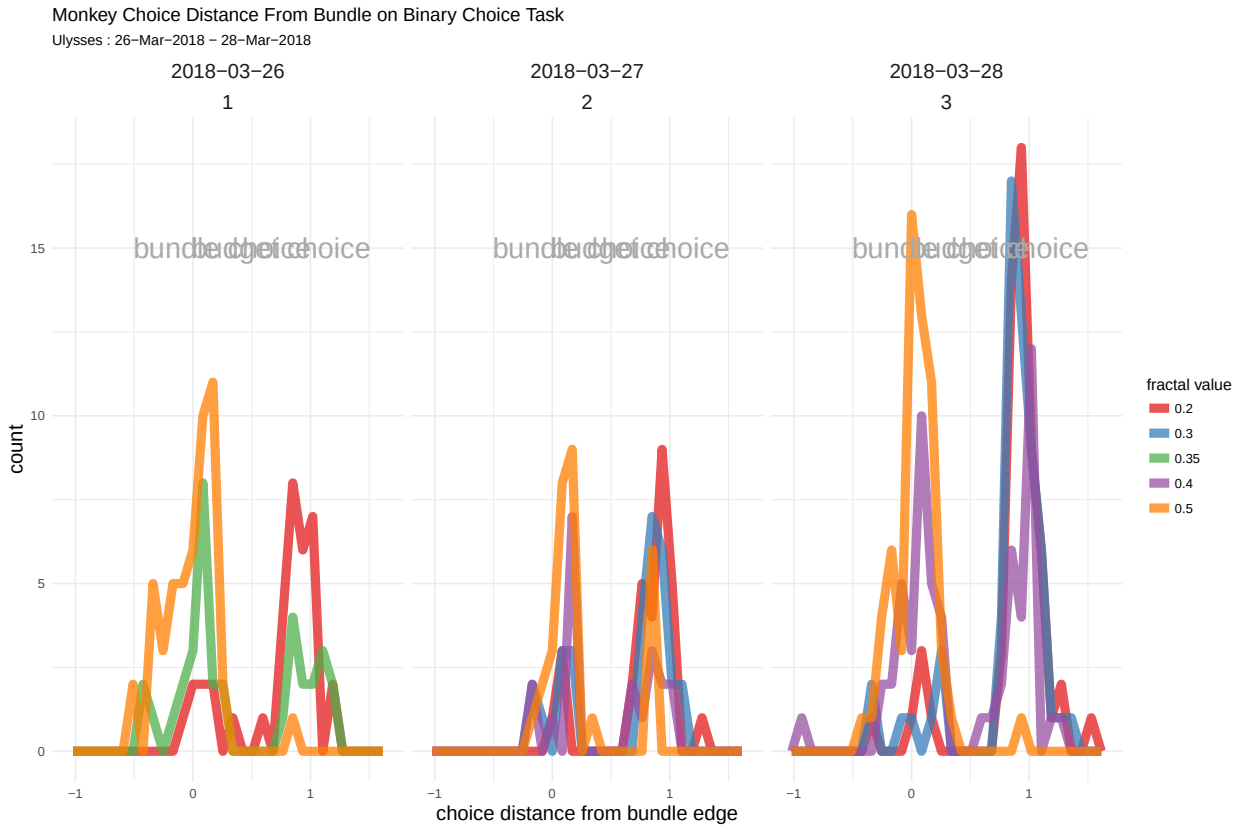
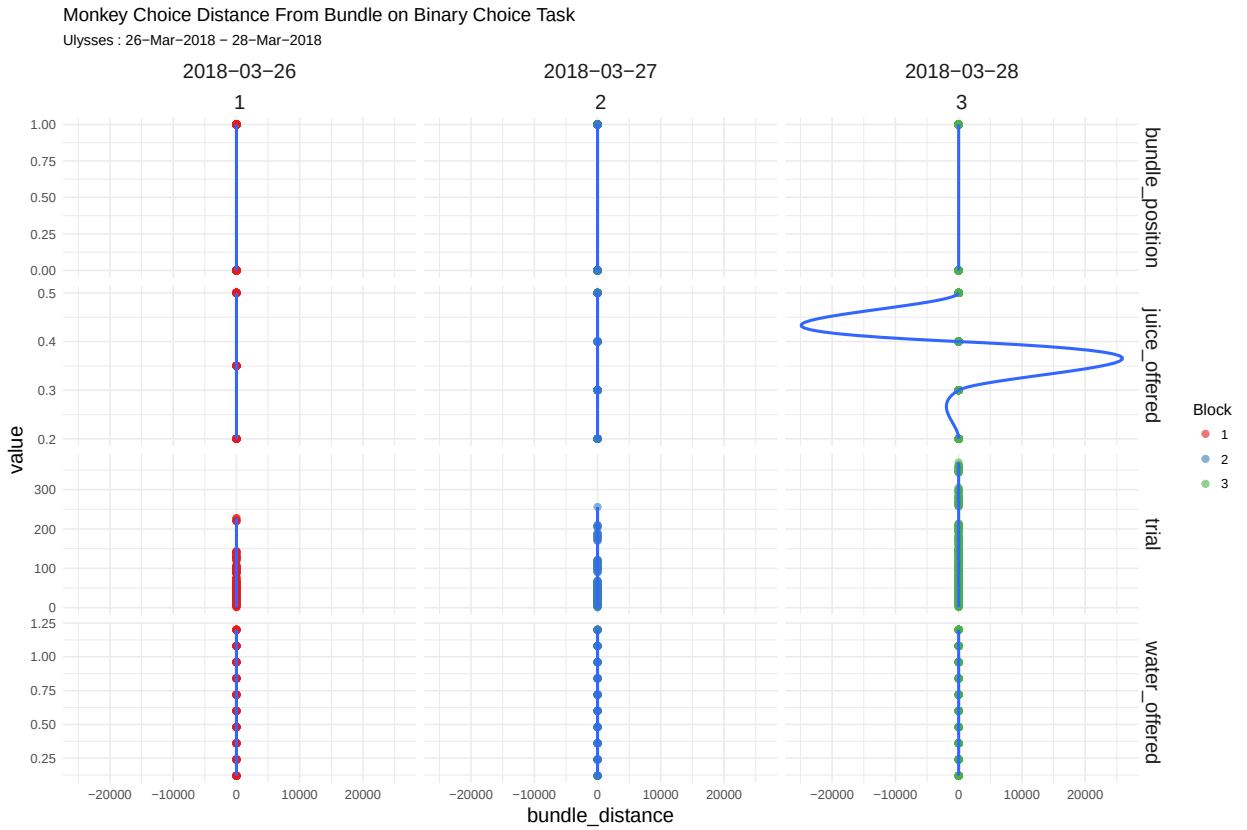
```
monkey <- "Ulysses"
today <- "28-Mar-2018"
look_back <- "26-Mar-2018"

start_trial <- 0
stop_trial <- "all"

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
## -2.80126  -0.42430  -0.05375   0.41198   2.20394
##
## Coefficients:
##                   Estimate Std. Error z value Pr(>|z|)
## (Intercept)      1.255e+04  3.522e+03   3.564 0.000366 ***
## bundle_position -9.137e-02  2.938e-01  -0.311 0.755843
## water_offered    5.041e+00  5.956e-01   8.465  < 2e-16 ***
## juice_offered    2.235e+01  2.068e+00  10.808  < 2e-16 ***
## trial           -1.692e-03  1.651e-03  -1.024 0.305702
## date            -7.130e-01  1.999e-01  -3.566 0.000362 ***
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 652.69  on 470  degrees of freedom
## Residual deviance: 300.26  on 465  degrees of freedom
##   (407 observations deleted due to missingness)
## AIC: 312.26
##
## 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 = 238, number of trials = 471, p-value =
## 0.8538
## alternative hypothesis: true probability of success is not equal to 0.5
## 95 percent confidence interval:
##  0.4591825 0.5513662
## sample estimates:
## probability of success
##              0.5053079
```

```
#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)
```

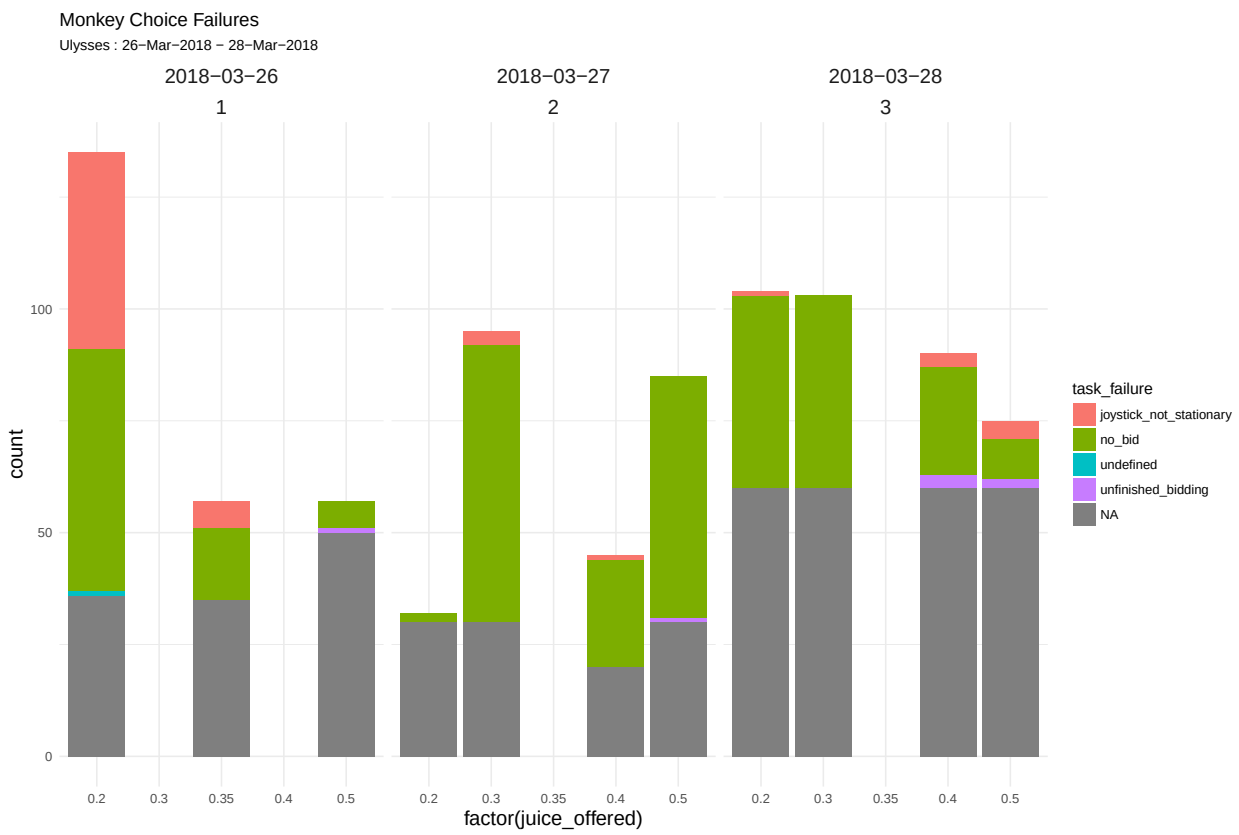
```
##
## Call:
## glm(formula = fractal_choice ~ bundle_position + water_offered +
##     as.factor(juice_offered) + trial + date, family = "binomial",
##     data = dplyr::filter(task_data, block_no == max(block_no)))
##
## Deviance Residuals:
##      Min        1Q    Median        3Q       Max
## -2.55166  -0.37273  -0.08574   0.19553   2.27498
##
## Coefficients: (1 not defined because of singularities)
##                               Estimate Std. Error z value Pr(>|z|)
## (Intercept)                 -6.115285   1.080072  -5.662 1.50e-08 ***
## bundle_position             -0.207546   0.468917  -0.443   0.6581
## water_offered                5.474668   1.012035   5.410 6.32e-08 ***
## as.factor(juice_offered)0.3  0.486762   0.656925   0.741   0.4587
```

```
## as.factor(juice_offered)0.4  3.799636   0.727292   5.224 1.75e-07 ***
## as.factor(juice_offered)0.5  8.936589   1.390984   6.425 1.32e-10 ***
## trial                       -0.005957   0.002327  -2.560   0.0105 *
## 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: 328.95  on 239  degrees of freedom
## Residual deviance: 123.12  on 233  degrees of freedom
##   (132 observations deleted due to missingness)
## AIC: 137.12
##
## Number of Fisher Scoring iterations: 7
```

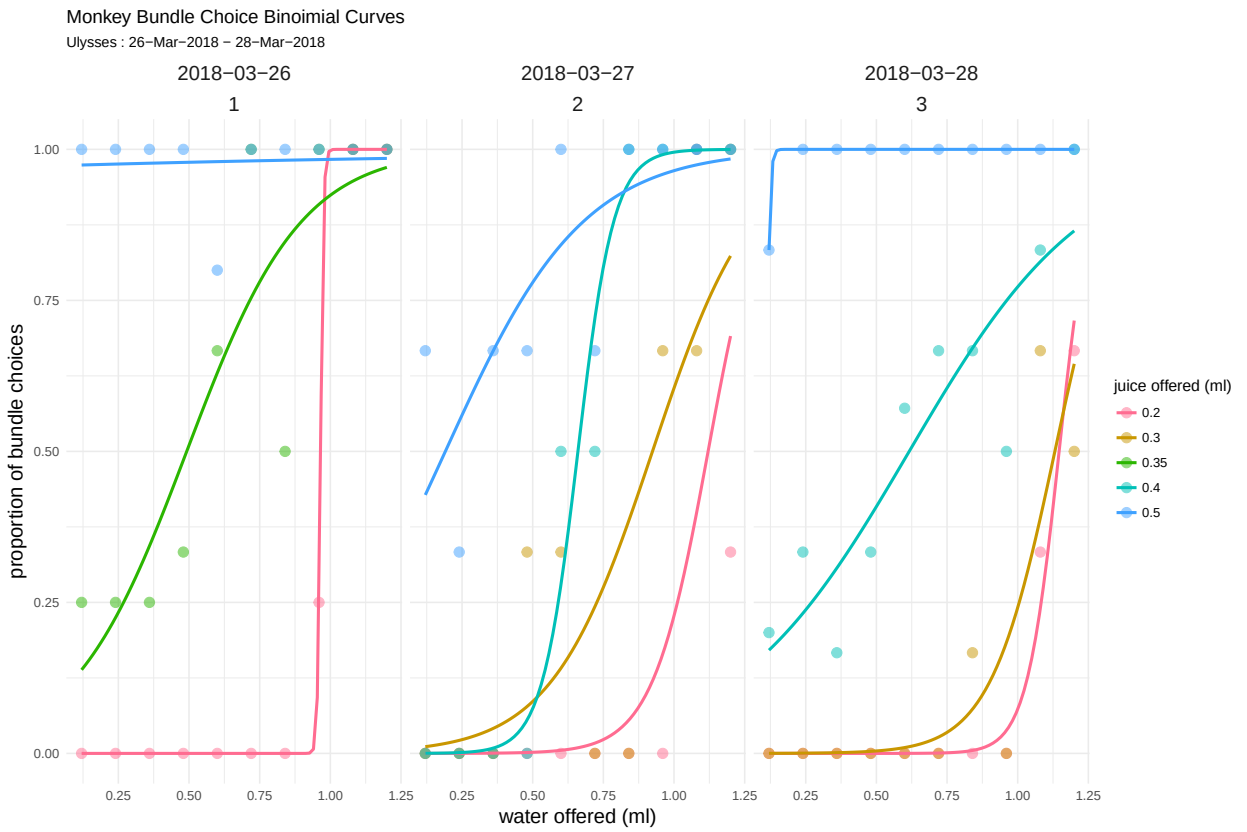
```
#test for side bias with an exact binomial test
binom.test(c(nrow(task_data %>%
                    .[c(bundle_position != fractal_choice & block_no == max(block_no))]),
             nrow(task_data %>%
                    .[c(bundle_position == fractal_choice & block_no == max(block_no))])))
```

```
##
##  Exact binomial test
##
## data:  c(nrow(task_data %>% .[c(bundle_position != fractal_choice &     block_no == max(block_no))])
## number of successes = 118, number of trials = 240, p-value =
## 0.8465
## alternative hypothesis: true probability of success is not equal to 0.5
## 95 percent confidence interval:
##  0.4267816 0.5567601
## sample estimates:
## probability of success
##              0.4916667
```

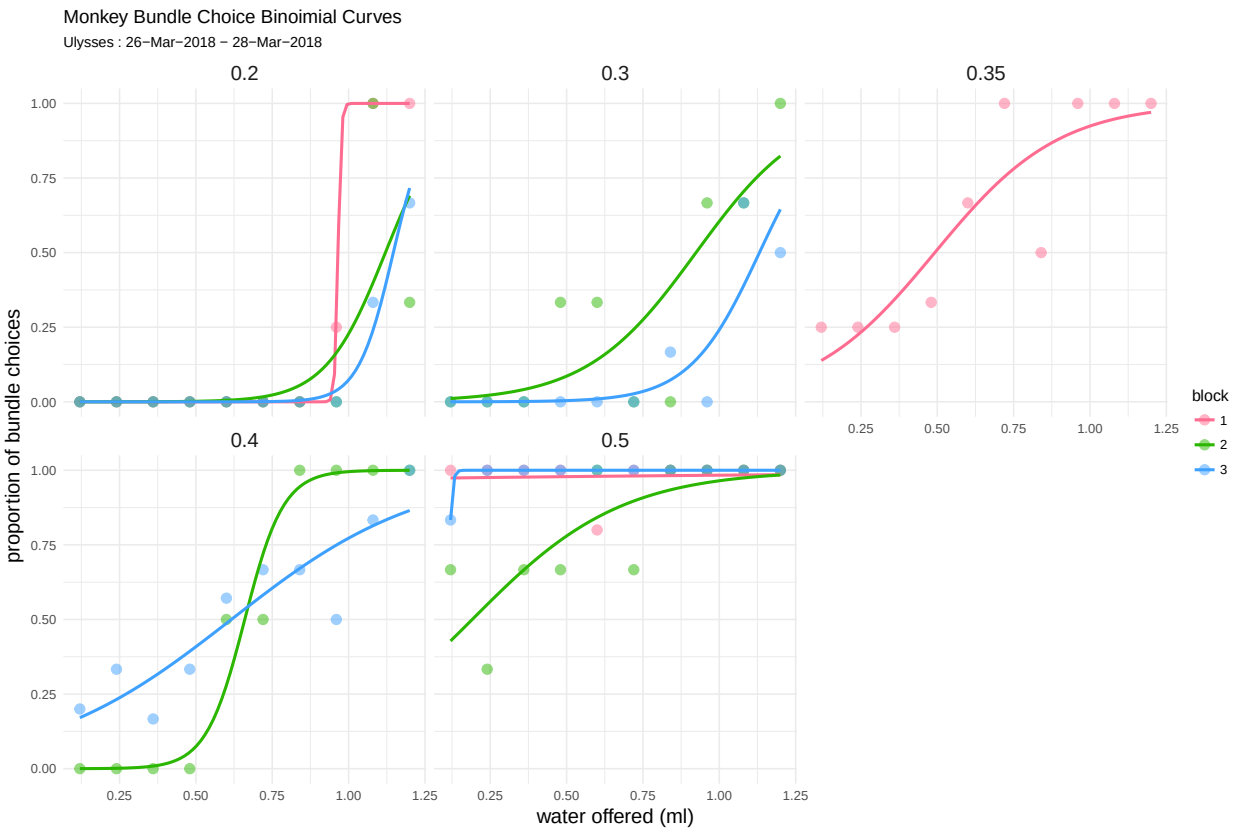
```
p3
```


Monkey Choice Failures
Ulysses : 26−Mar−2018 − 28−Mar−2018
2018−03−26
1
2018−03−27
2
2018−03−28
3
count
100
50
0
0.2
0.3
0.35
0.4
0.5
factor(juice_offered)
task_failure
joystick_not_stationary
no_bid
undefined
unfinished_bidding
NA

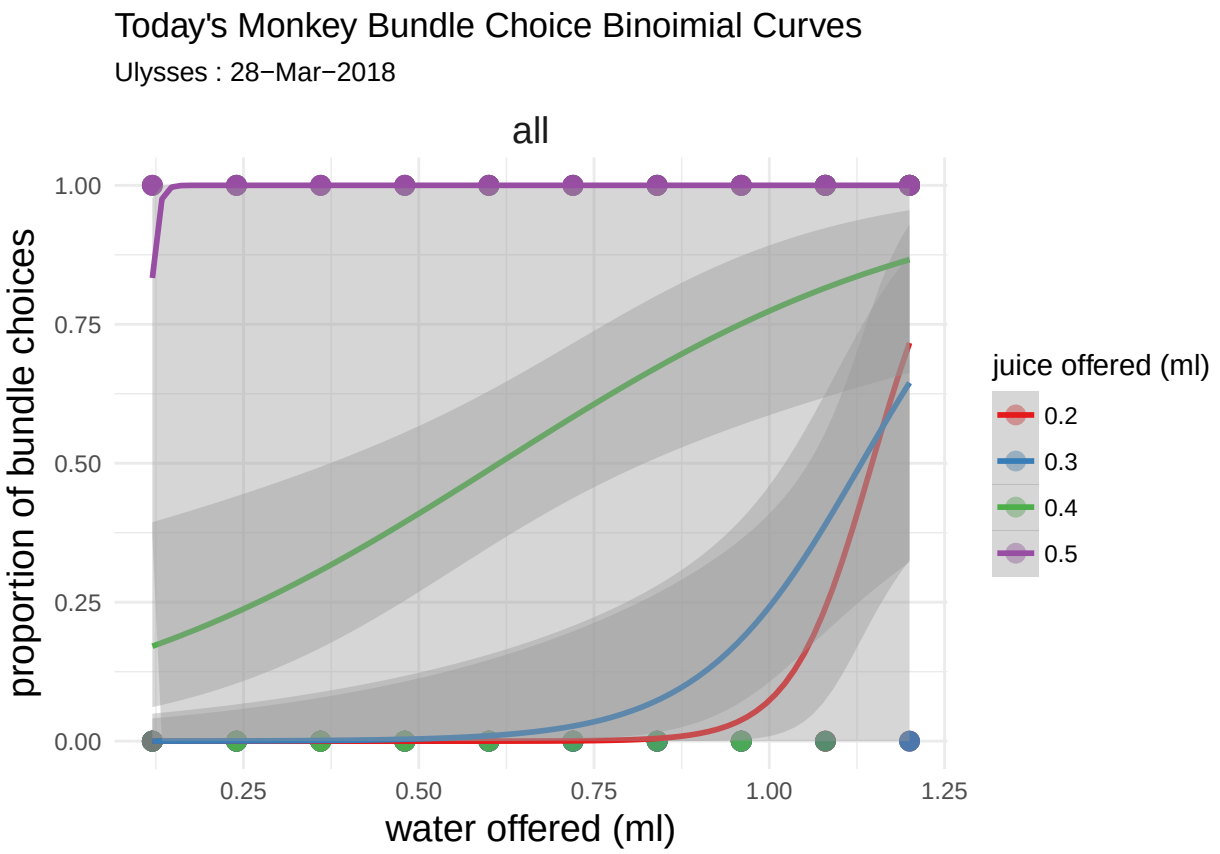
```
p4
```


Monkey Bundle Choice Binoimial Curves
Ulysses : 26−Mar−2018 − 28−Mar−2018
2018−03−26
1
2018−03−27
2
2018−03−28
3
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
0.3
0.35
0.4
0.5

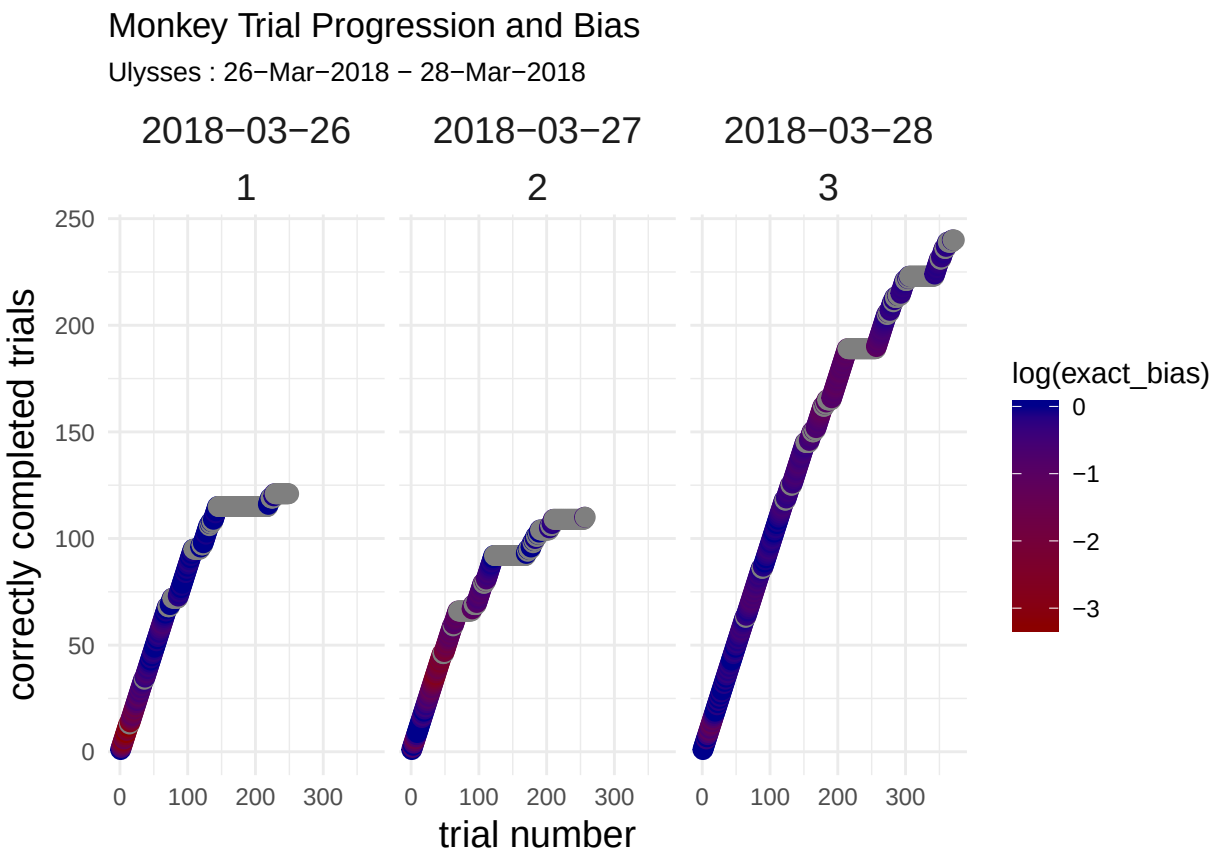
p5


Monkey Bundle Choice Binoimial Curves
Ulysses : 26−Mar−2018 − 28−Mar−2018
0.2
0.3
0.35
0.4
0.5
proportion of bundle choices
water offered (ml)
block
1
2
3

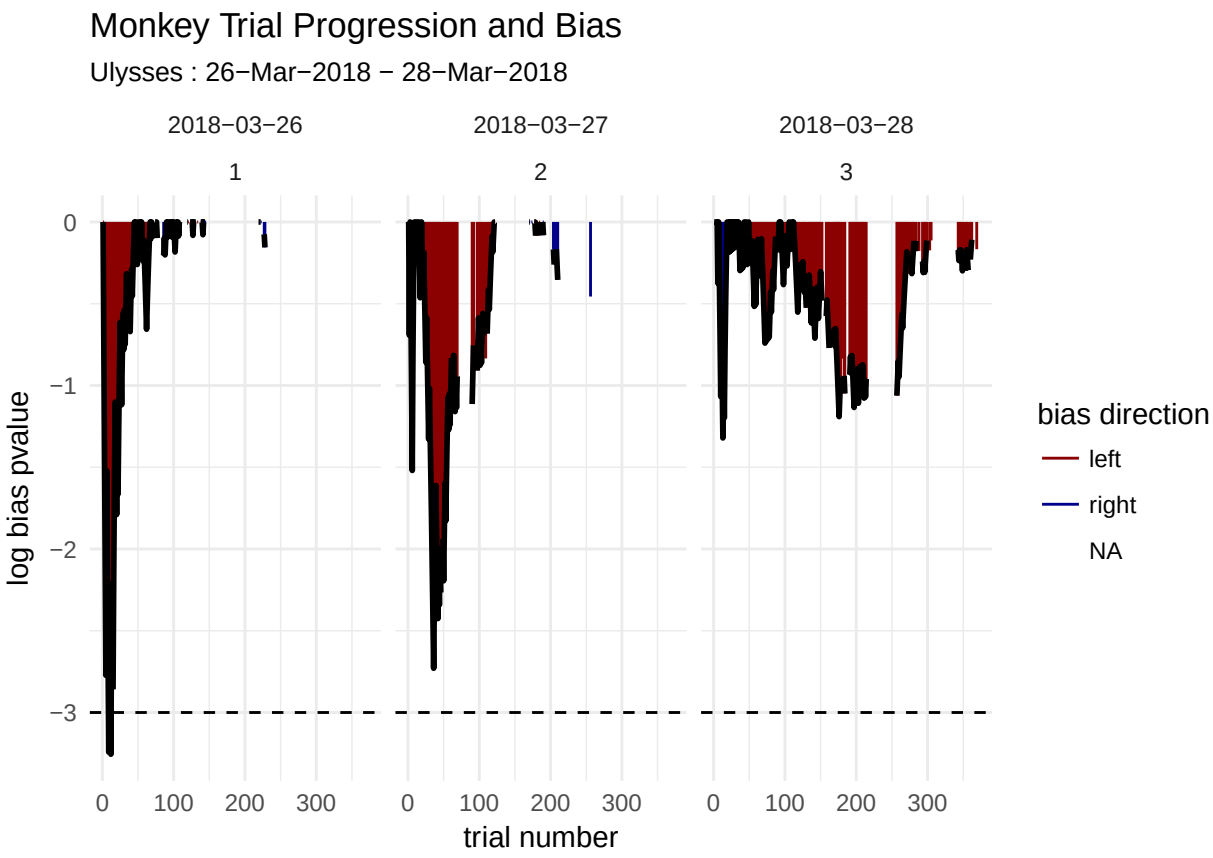
p6


Today's Monkey Bundle Choice Binoimial Curves
Ulysses : 28−Mar−2018
all
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
0.3
0.4
0.5

```
p7
```


Monkey Trial Progression and Bias
Ulysses : 26−Mar−2018 − 28−Mar−2018
2018−03−26
2018−03−27
2018−03−28
1
2
3
correctly completed trials
250
200
150
100
50
0
0
100
200
300
trial number
log(exact_bias)
0
−1
−2
−3

```
p8
```


Monkey Trial Progression and Bias
Ulysses : 26−Mar−2018 − 28−Mar−2018
2018−03−26
2018−03−27
2018−03−28
1
2
3
0
−1
−2
−3
log bias pvalue
0
100
200
300
trial number
bias direction
left
right
NA