Binary Choice Analysis

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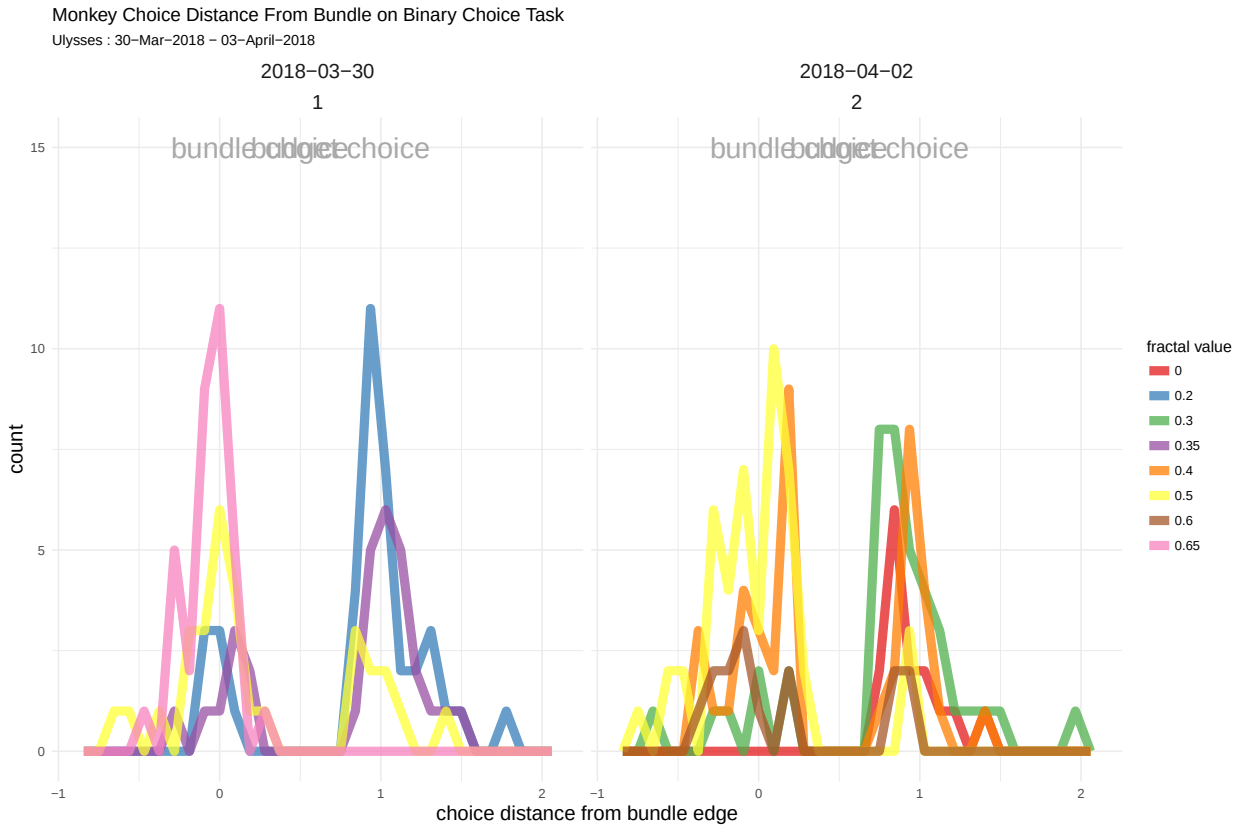
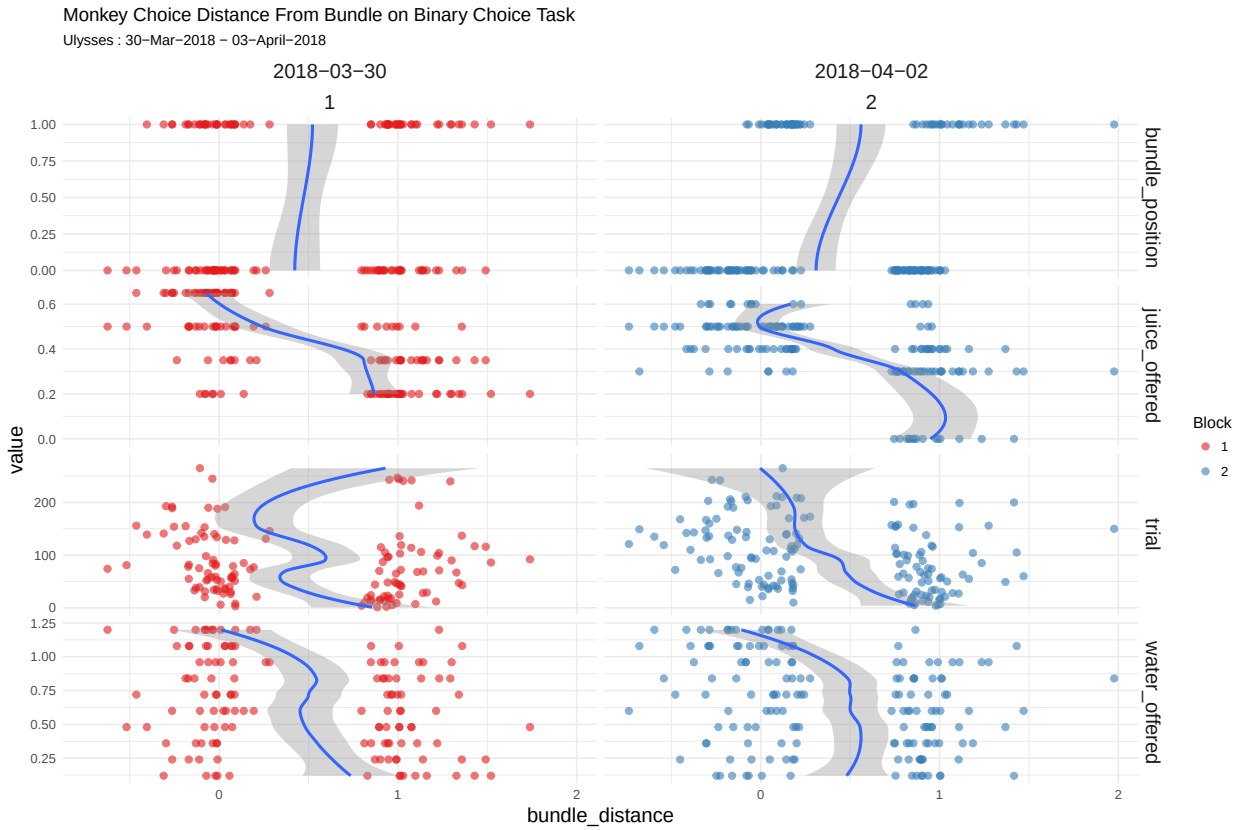
```
monkey <- "Ulysses"
today <- "03-April-2018"
look_back <- "30-Mar-2018"

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
## -2.86408  -0.41222   0.06723   0.42985   2.51665
##
## Coefficients:
##                   Estimate Std. Error z value Pr(>|z|)
## (Intercept)     -552.10820 2175.40028  -0.254   0.7997
## bundle_position    1.04577    0.39179   2.669   0.0076 **
## water_offered      3.88733    0.65896   5.899 3.65e-09 ***
## juice_offered     17.68980    2.20919   8.007 1.17e-15 ***
## trial              0.01640    0.00342   4.795 1.63e-06 ***
## date               0.03069    0.12345   0.249   0.8037
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 400.64  on 289  degrees of freedom
## Residual deviance: 190.34  on 284  degrees of freedom
##   (259 observations deleted due to missingness)
## AIC: 202.34
##
## 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 = 147, number of trials = 290, p-value =
## 0.8602
## alternative hypothesis: true probability of success is not equal to 0.5
## 95 percent confidence interval:
##  0.4478168 0.5658340
## sample estimates:
## probability of success
##              0.5068966
```

```
#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)
```

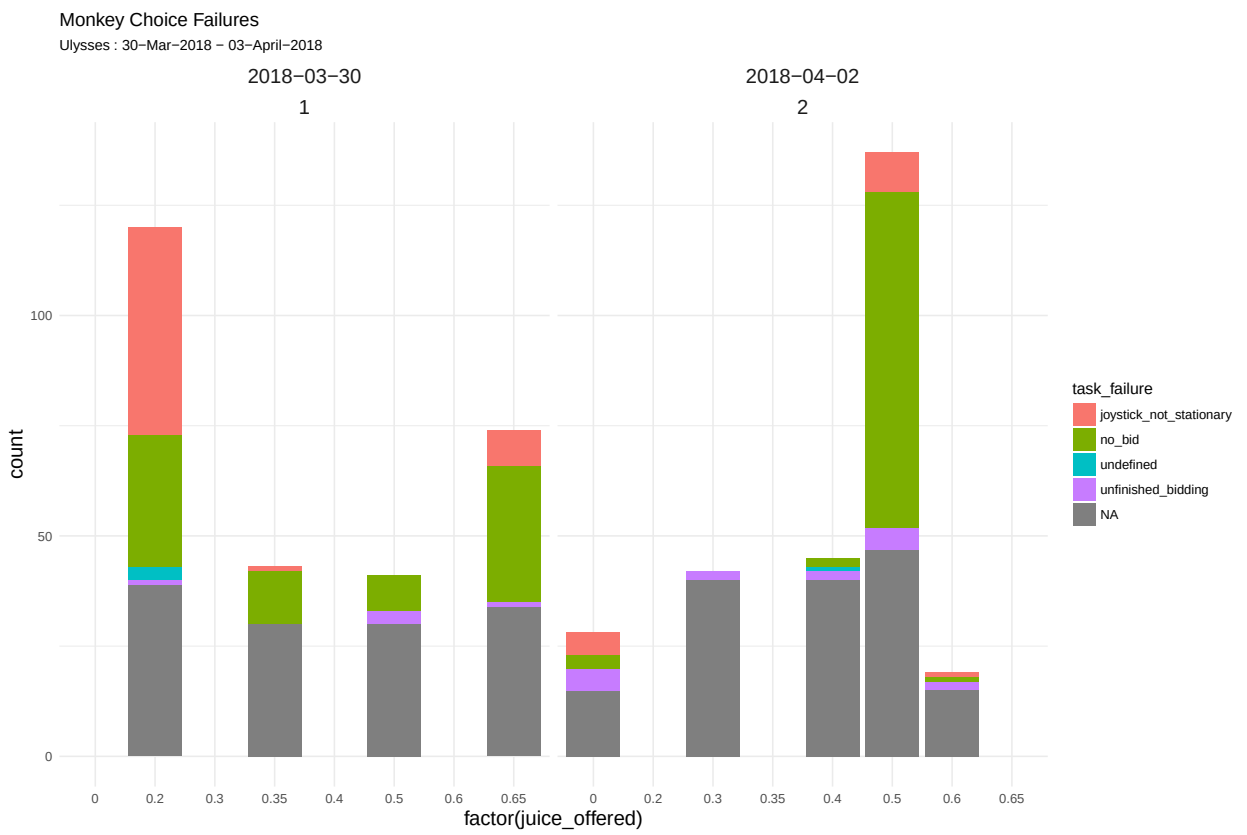
```
##
## Call:
## glm(formula = fractal_choice ~ bundle_position + water_offered +
##     as.factor(juice_offered) + trial + date, family = "binomial",
##     data = dplyr::filter(task_data, block_no == max(block_no)))
##
## Deviance Residuals:
##      Min        1Q    Median        3Q       Max
## -2.46219  -0.26865   0.03381   0.35023   2.07437
##
## Coefficients: (1 not defined because of singularities)
##                                Estimate Std. Error z value Pr(>|z|)
## (Intercept)                  -2.657e+01  1.295e+03  -0.021   0.9836
## bundle_position               1.542e+00  6.362e-01   2.424   0.0154 *
## water_offered                 4.399e+00  1.057e+00   4.161 3.17e-05 ***
## as.factor(juice_offered)0.3   1.807e+01  1.295e+03   0.014   0.9889
```

```
## as.factor(juice_offered)0.4  2.126e+01  1.295e+03   0.016   0.9869
## as.factor(juice_offered)0.5  2.425e+01  1.295e+03   0.019   0.9851
## as.factor(juice_offered)0.6  2.267e+01  1.295e+03   0.018   0.9860
## trial                        2.632e-02  6.632e-03   3.968 7.23e-05 ***
## 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: 216.571  on 156  degrees of freedom
## Residual deviance:  83.649  on 149  degrees of freedom
##   (114 observations deleted due to missingness)
## AIC: 99.649
##
## Number of Fisher Scoring iterations: 17
```

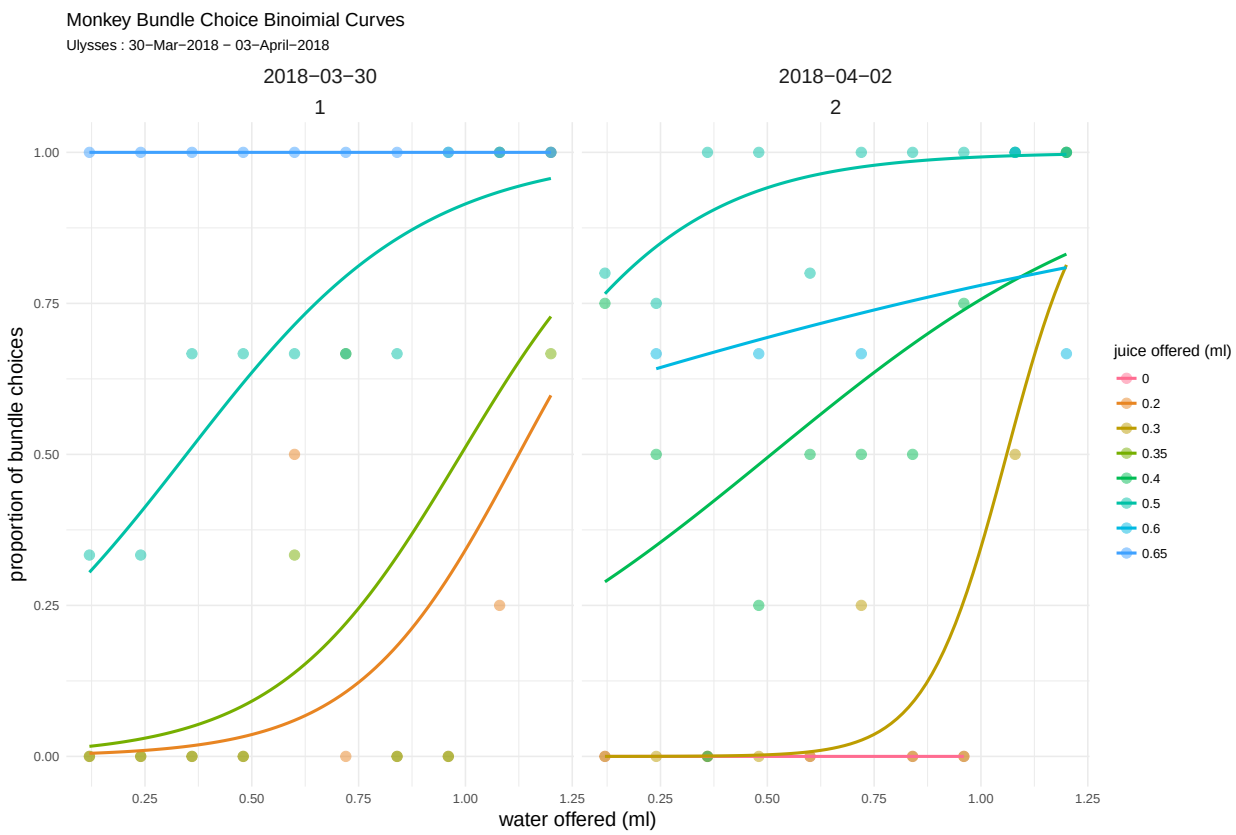
```
#test for side bias with an exact binomial test
binom.test(c(nrow(task_data %>%
                    .[c(bundle_position != fractal_choice & block_no == max(block_no))]),
             nrow(task_data %>%
                    .[c(bundle_position == fractal_choice & block_no == max(block_no))])))
```

```
##
##  Exact binomial test
##
## data:  c(nrow(task_data %>% .[c(bundle_position != fractal_choice &     block_no == max(block_no))])
## number of successes = 77, number of trials = 157, p-value = 0.8732
## alternative hypothesis: true probability of success is not equal to 0.5
## 95 percent confidence interval:
##  0.4099059 0.5713532
## sample estimates:
## probability of success
##              0.4904459
```

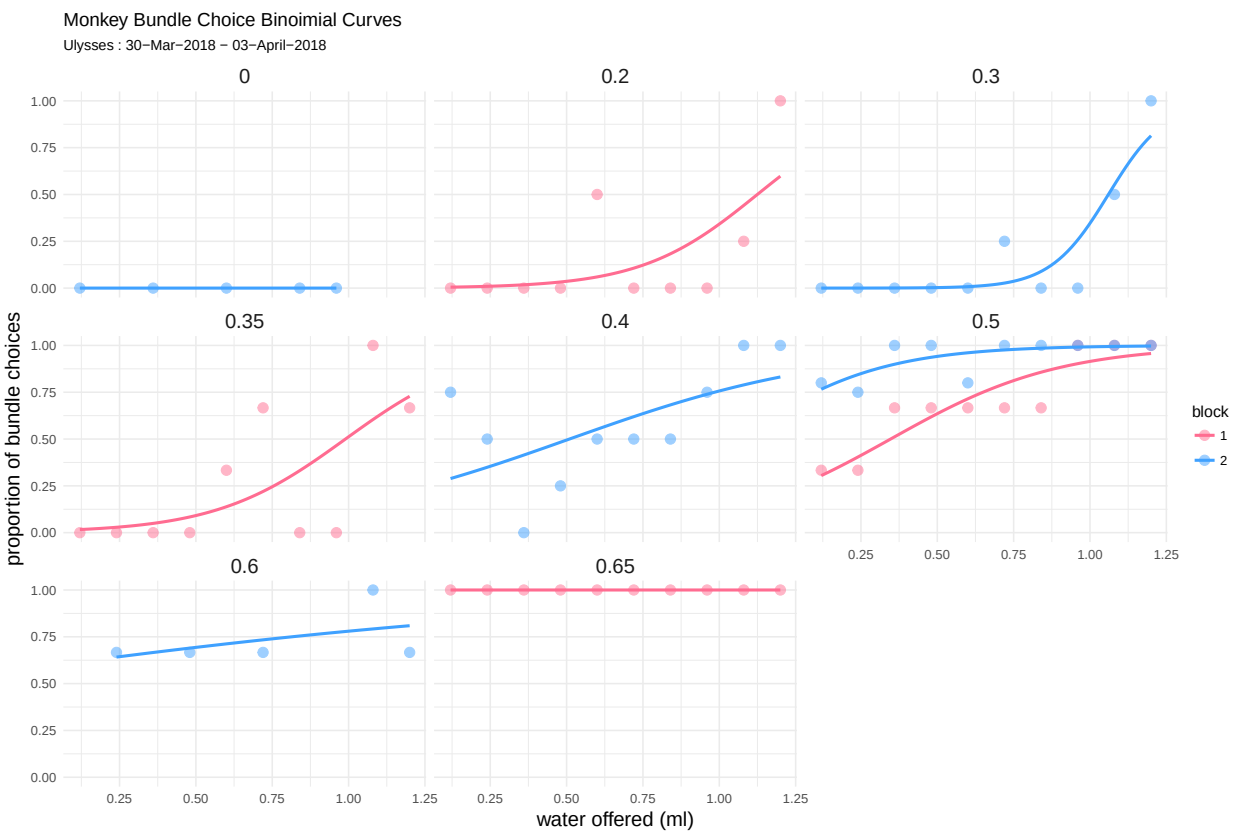
```
p3
```


Monkey Choice Failures
Ulysses : 30−Mar−2018 − 03−April−2018
2018−03−30
1
2018−04−02
2
count
100
50
0
0
0.2
0.3
0.35
0.4
0.5
0.6
0.65
factor(juice_offered)
task_failure
joystick_not_stationary
no_bid
undefined
unfinished_bidding
NA

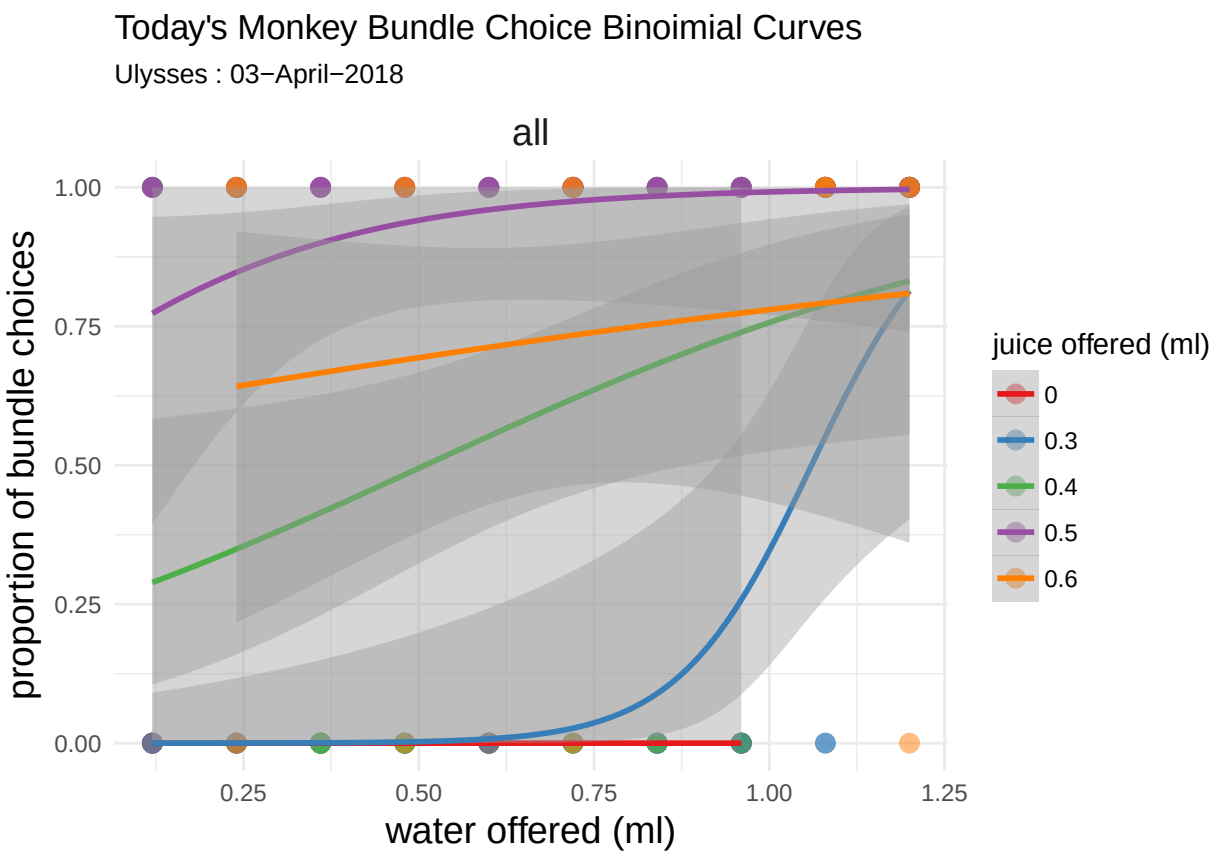
```
p4
```


Monkey Bundle Choice Binoimial Curves
Ulysses : 30−Mar−2018 − 03−April−2018
2018−03−30
1
2018−04−02
2
proportion of bundle choices
water offered (ml)
juice offered (ml)
0
0.2
0.3
0.35
0.4
0.5
0.6
0.65

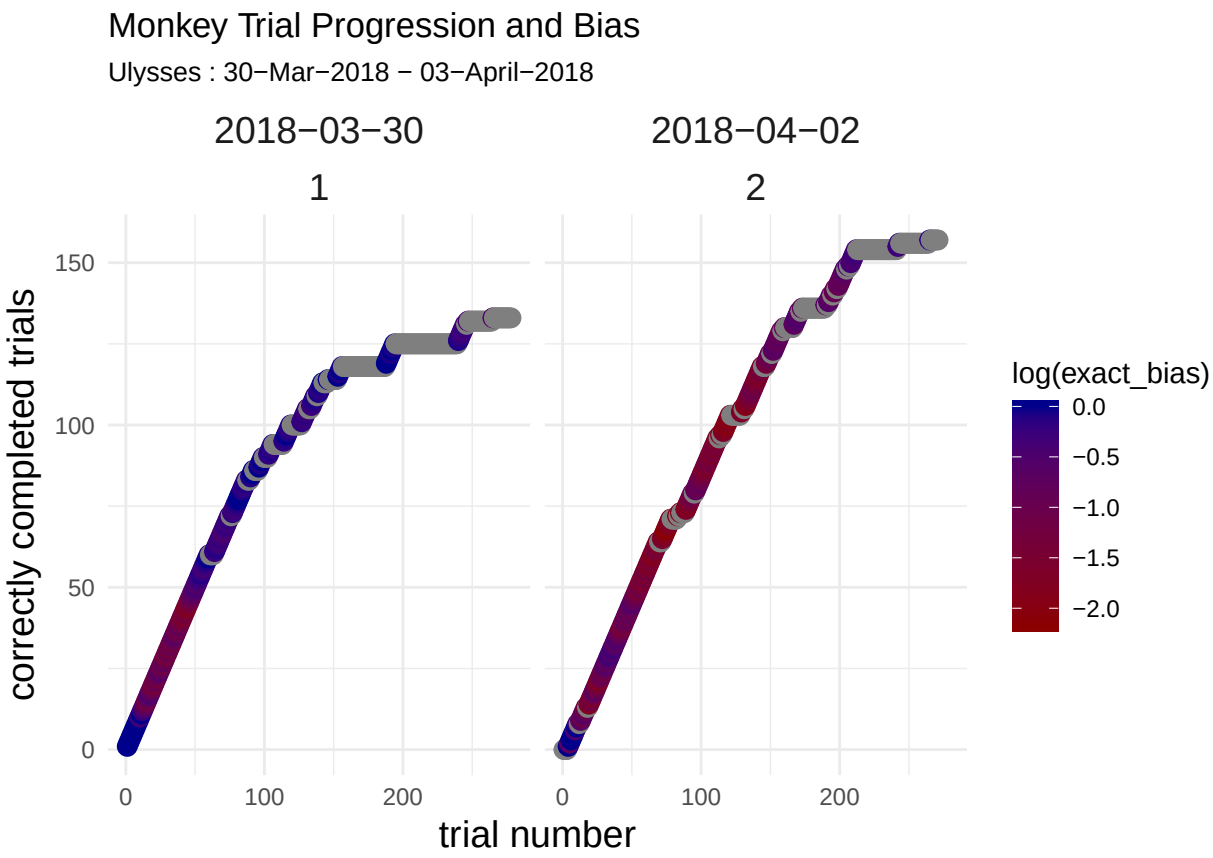
p5


Monkey Bundle Choice Binoimial Curves
Ulysses : 30−Mar−2018 − 03−April−2018
0
0.2
0.3
0.35
0.4
0.5
0.6
0.65
proportion of bundle choices
water offered (ml)
block
1
2

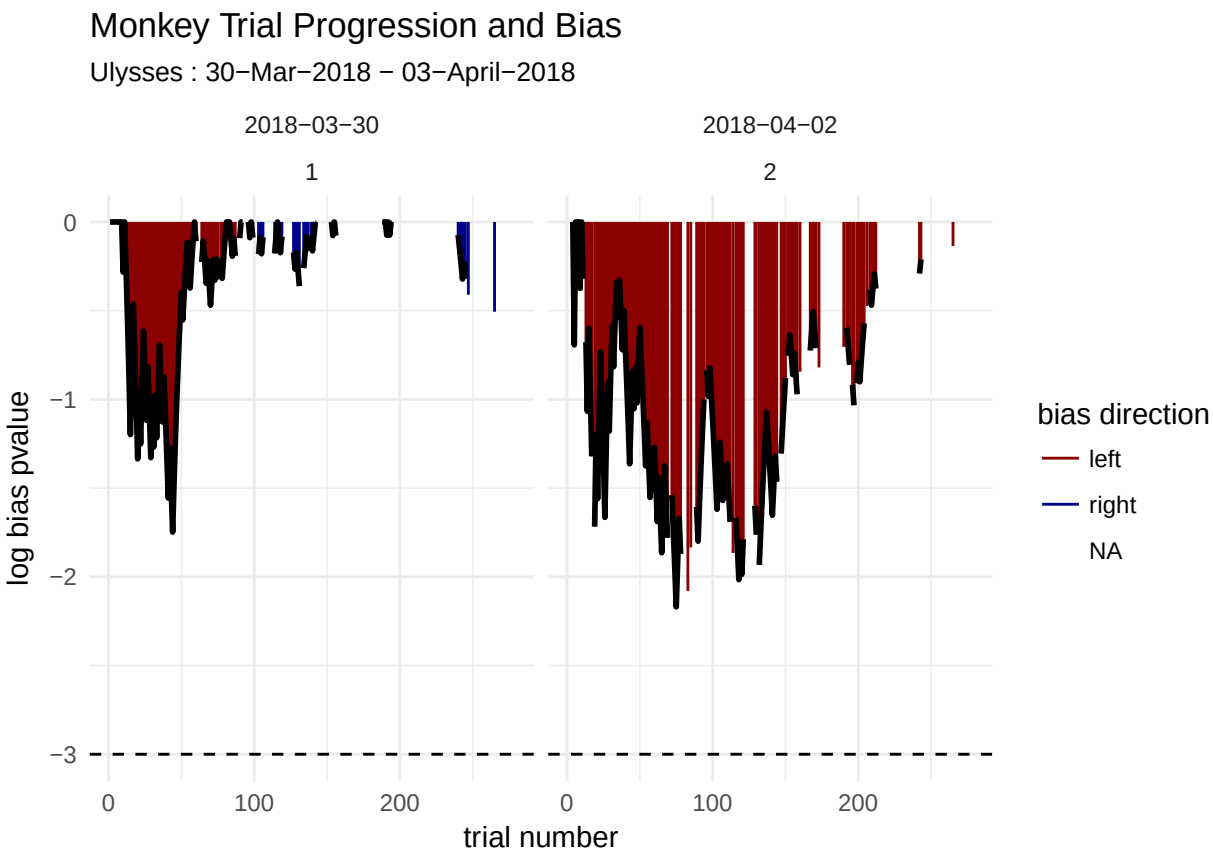
p6


Today's Monkey Bundle Choice Binoimial Curves
Ulysses : 03−April−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
0.3
0.4
0.5
0.6

```
p7
```


Monkey Trial Progression and Bias
Ulysses : 30−Mar−2018 − 03−April−2018
2018−03−30
1
2018−04−02
2
correctly completed trials
150
100
50
0
0
100
200
0
100
200
trial number
log(exact_bias)
0.0
−0.5
−1.0
−1.5
−2.0

```
p8
```


Monkey Trial Progression and Bias
Ulysses : 30−Mar−2018 − 03−April−2018
2018−03−30
2018−04−02
1
2
0
−1
−2
−3
log bias pvalue
0
100
200
trial number
bias direction
left
right
NA