# Search slopes in dynamic and static search

Here we conducted three experiments with dynamic and static search, and examined the search slope ratios between the target-absent to target-present for the dynamic and static search displays. We then developed a search termination model to account the findings of 'flat' search slope ration in the dynamic search. This notebook generates the figures and statistics for the formal manuscript.

Schematic illusration of signal detection approach

When the target is present in the dynamic search, the probability of target hasn't been sampled decreases over the time. This is due to the resample design itself. The following figure illustrate the miss rate and false alarm as well as the miss rate decreases over the time.

Experiment 1

1.1 Mean RTs and error rates
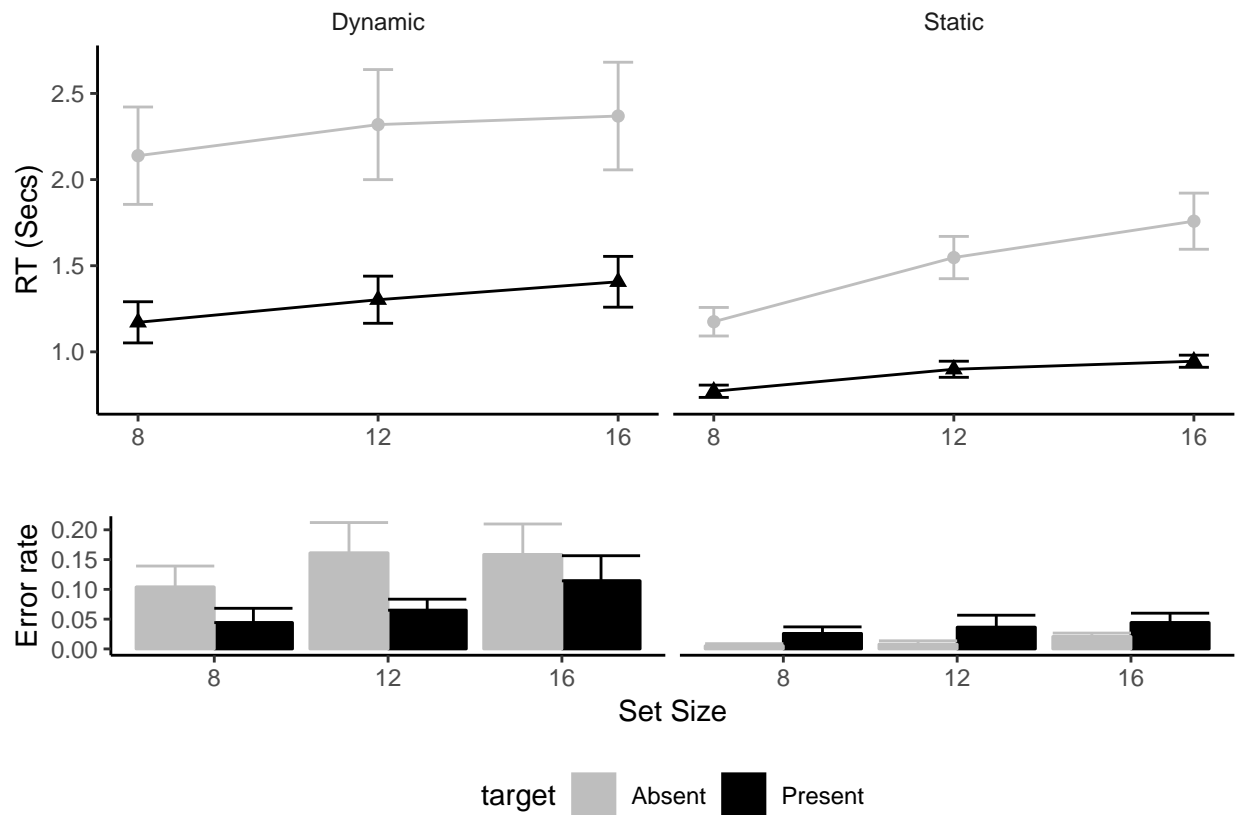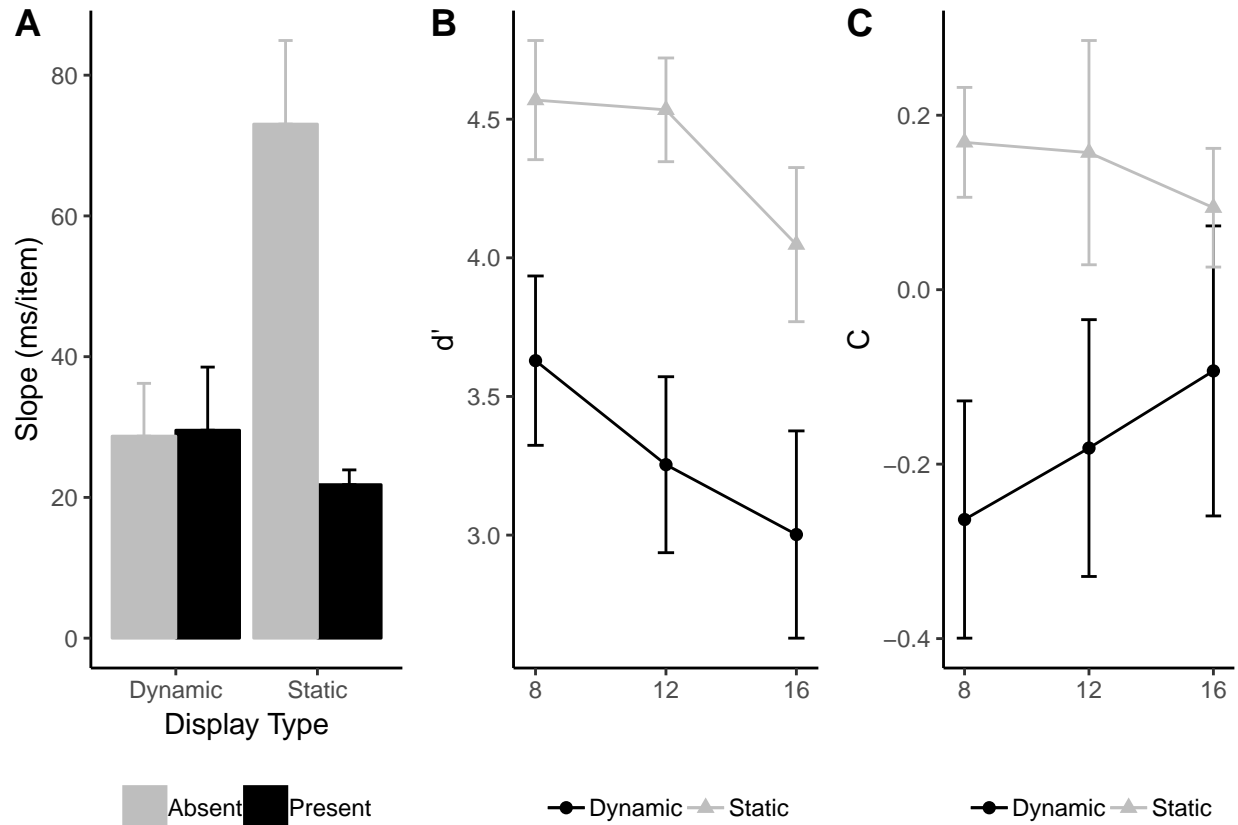

1.2. ANOVA test on RTs

```
##              Effect DFn DFd     F        p p<.05     ges
## 2          setsize   2  20 44.69 4.18e-08     * 0.05215
## 3           target   1  10 38.15 1.05e-04     * 0.35384
```

```
## 4                dyn  1  10 15.26 2.93e-03    * 0.23576
## 5    setsize:target  2  20 13.61 1.86e-04    * 0.00616
## 6       setsize:dyn  2  20  4.14 3.14e-02    * 0.00311
## 7        target:dyn  1  10  6.71 2.69e-02    * 0.02690
## 8 setsize:target:dyn  2  20 10.87 6.39e-04    * 0.00606
```

1.3. Slopes,d' and biases:

A

B

C

| | Absent | Present | | Dynamic | Static | | Dynamic | Static |

1.4. ANOVA for the slopes

```
##      Effect DFn DFd     F       p p<.05   ges
## 2    target  1  10 14.66 0.00333     * 0.198
## 3       dyn  1  10  6.36 0.03025     * 0.115
## 4 target:dyn  1  10 16.27 0.00239     * 0.209
```

The interaction in the slopes was mainly caused by the large slope in the static target-absent condition. We further tested if the slopes in the dynamic conditions were the same or not.

first, confirmation of the original study, 'present' slopes had no difference.

```
##  Effect DFn DFd     F     p p<.05    ges
## 2   dyn  1  10 0.902 0.365       0.0373
```

Bayes Factor:

```
## Bayes factor analysis
## --------------
```

```
## [1] dyn + sub : 0.612 ±7.01%
##
## Against denominator:
##   slope ~ sub
## ---
## Bayes factor type: BFlinearModel, JZS

##   Effect DFn DFd     F     p p<.05      ges
## 2 target   1  10 0.013 0.911       0.000284

## Bayes factor analysis
## --------------
## [1] target + sub : 0.398 ±1.08%
##
## Against denominator:
##   slope ~ sub
## ---
## Bayes factor type: BFlinearModel, JZS
```

1.5. ANOVA for d' and bias C

Search discrimination sensitivity d':

```
##        Effect DFn DFd      F       p p<.05     ges
## 2         dyn   1  10 15.840 0.00260     * 0.28431
## 3     setsize   2  20  6.320 0.00746     * 0.07037
## 4 dyn:setsize   2  20  0.675 0.52038       0.00672
```
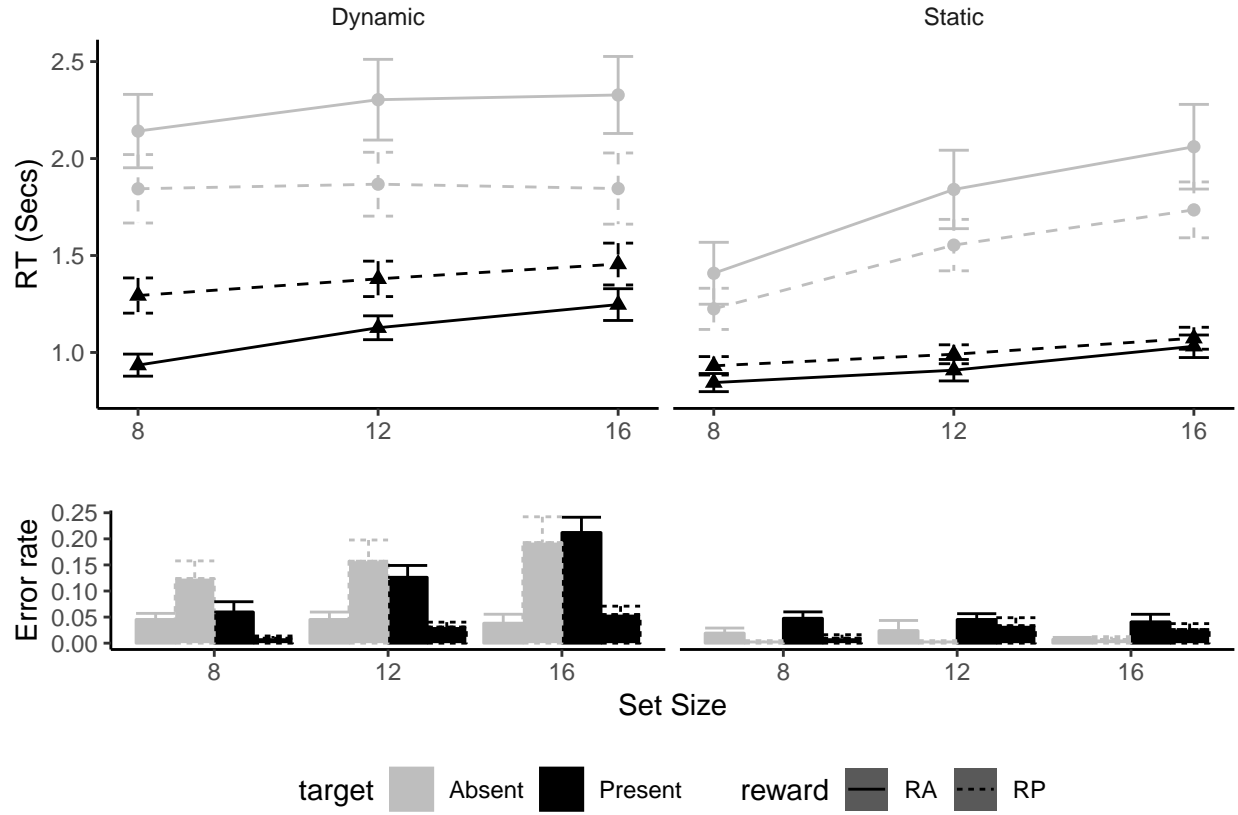
Search response bias C:

```
##        Effect DFn DFd      F       p p<.05     ges
## 2         dyn   1  10 12.812 0.00502     * 0.15335
## 3     setsize   2  20  0.148 0.86341       0.00289
## 4 dyn:setsize   2  20  0.808 0.45986       0.01781
```

Experiment 2

2.1. Correct RTs from Experiment 2


2.2. RT statistics

```
##                      Effect DFn DFd      F         p p<.05      ges
## 2                   setsize   2  22 95.340 1.45e-11     * 6.36e-02
## 3                    target   1  11 53.912 1.46e-05     * 4.33e-01
## 4                       dyn   1  11 15.526 2.31e-03     * 1.42e-01
## 5                    reward   1  11  2.557 1.38e-01       9.12e-03
## 6            setsize:target   2  22 12.185 2.74e-04     * 5.65e-03
## 7               setsize:dyn   2  22 17.909 2.42e-05     * 9.79e-03
## 8                target:dyn   1  11  2.210 1.65e-01       6.83e-03
## 9            setsize:reward   2  22  7.339 3.62e-03     * 4.05e-03
## 10            target:reward   1  11 27.944 2.58e-04     * 8.12e-02
## 11               dyn:reward   1  11  0.333 5.75e-01       3.46e-04
## 12        setsize:target:dyn   2  22 36.603 1.00e-07     * 1.82e-02
## 13     setsize:target:reward   2  22  1.551 2.34e-01       3.31e-04
## 14        setsize:dyn:reward   2  22  1.100 3.50e-01       3.88e-04
## 15         target:dyn:reward   1  11 16.504 1.88e-03     * 1.00e-02
## 16 setsize:target:dyn:reward   2  22  0.254 7.78e-01       8.08e-05
```

2.3. Slopes,d' and biases:
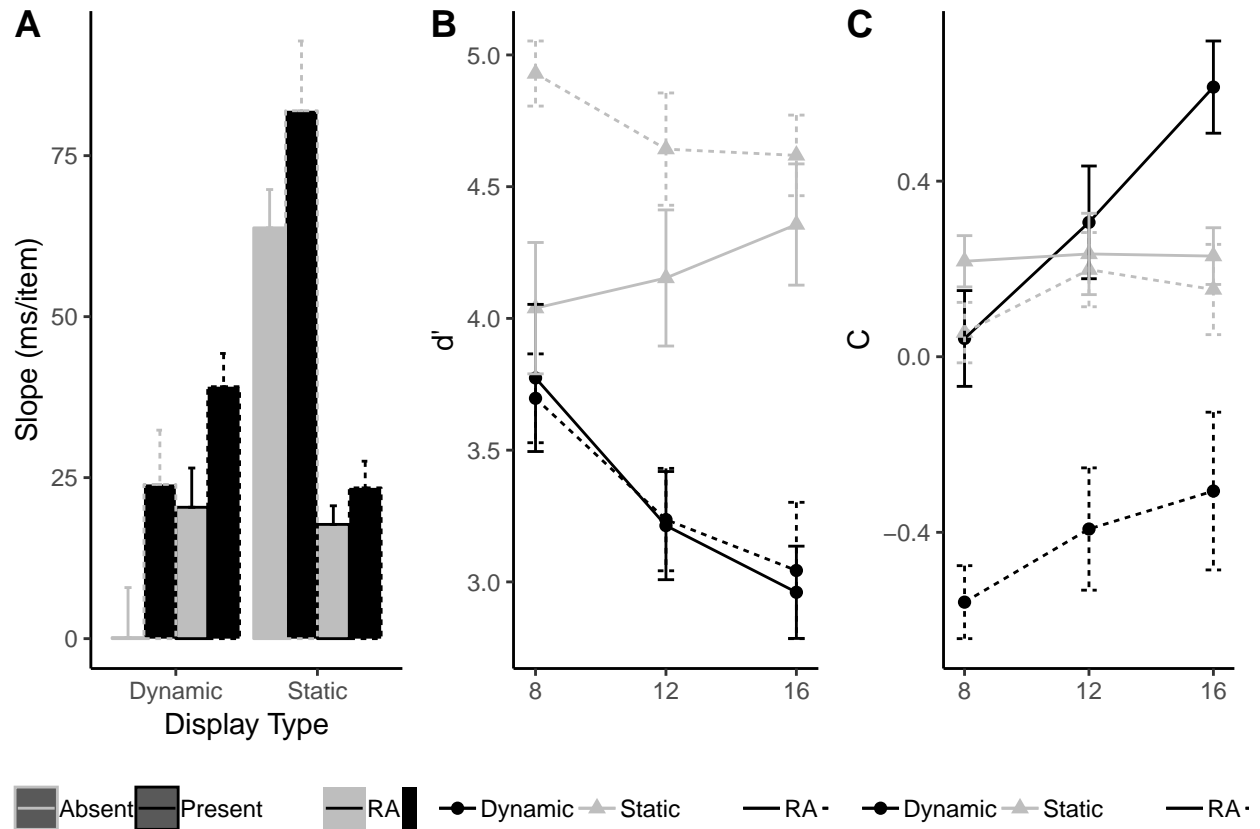
2.4. ANOVA for the slopes

```
##              Effect DFn DFd      F        p p<.05     ges
## 2           target   1  11 10.445 7.99e-03     * 0.13738
## 3              dyn   1  11 24.352 4.46e-04     * 0.26172
## 4           reward   1  11  9.229 1.13e-02     * 0.12767
## 5       target:dyn   1  11 47.530 2.61e-05     * 0.39454
## 6    target:reward   1  11  4.415 5.95e-02       0.01015
## 7       dyn:reward   1  11  1.946 1.91e-01       0.01142
## 8 target:dyn:reward   1  11  0.624 4.46e-01       0.00185
```

Examine if the slopes in the dynamic search differ between the target absent/present, reward present/absent.

```
##         Effect DFn DFd    F      p p<.05     ges
## 2       target   1  11 3.95 0.0724       0.13756
## 3       reward   1  11 8.68 0.0133     * 0.18693
## 4 target:reward   1  11 0.52 0.4860       0.00324
```

2.5 ANOVA for d' and bias C

Search discrimination sensitivity d':

```
##              Effect DFn DFd      F        p p<.05     ges
## 2              dyn   1  11 66.466 5.45e-06     * 0.41113
```

```
## 3          setsize   2  22 11.863 3.20e-04    * 0.05171
## 4           reward   1  11  4.202 6.50e-02      0.04025
## 5       dyn:setsize   2  22  6.448 6.26e-03    * 0.04702
## 6        dyn:reward   1  11  5.559 3.80e-02    * 0.03767
## 7    setsize:reward   2  22  0.798 4.63e-01      0.00505
## 8 dyn:setsize:reward 2  22  2.177 1.37e-01      0.01415
```
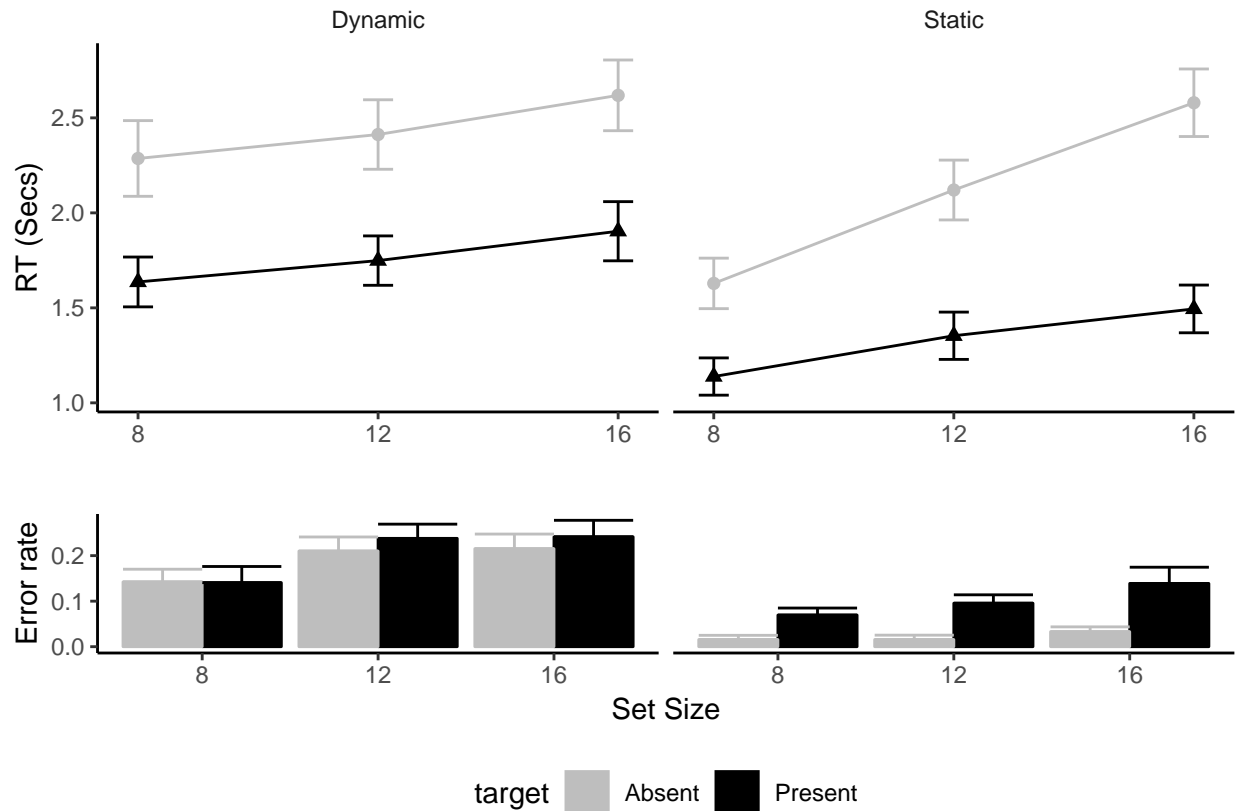
Search response bias C:

```
##               Effect DFn DFd      F        p p<.05      ges
## 2                dyn   1  11 14.193 0.003114    * 0.10369
## 3            setsize   2  22  8.477 0.001864    * 0.07517
## 4             reward   1  11 22.067 0.000653    * 0.27335
## 5        dyn:setsize   2  22  6.987 0.004474    * 0.04526
## 6         dyn:reward   1  11 15.452 0.002349    * 0.18623
## 7     setsize:reward   2  22  0.706 0.504450      0.00744
## 8 dyn:setsize:reward   2  22  2.236 0.130589      0.01479
```

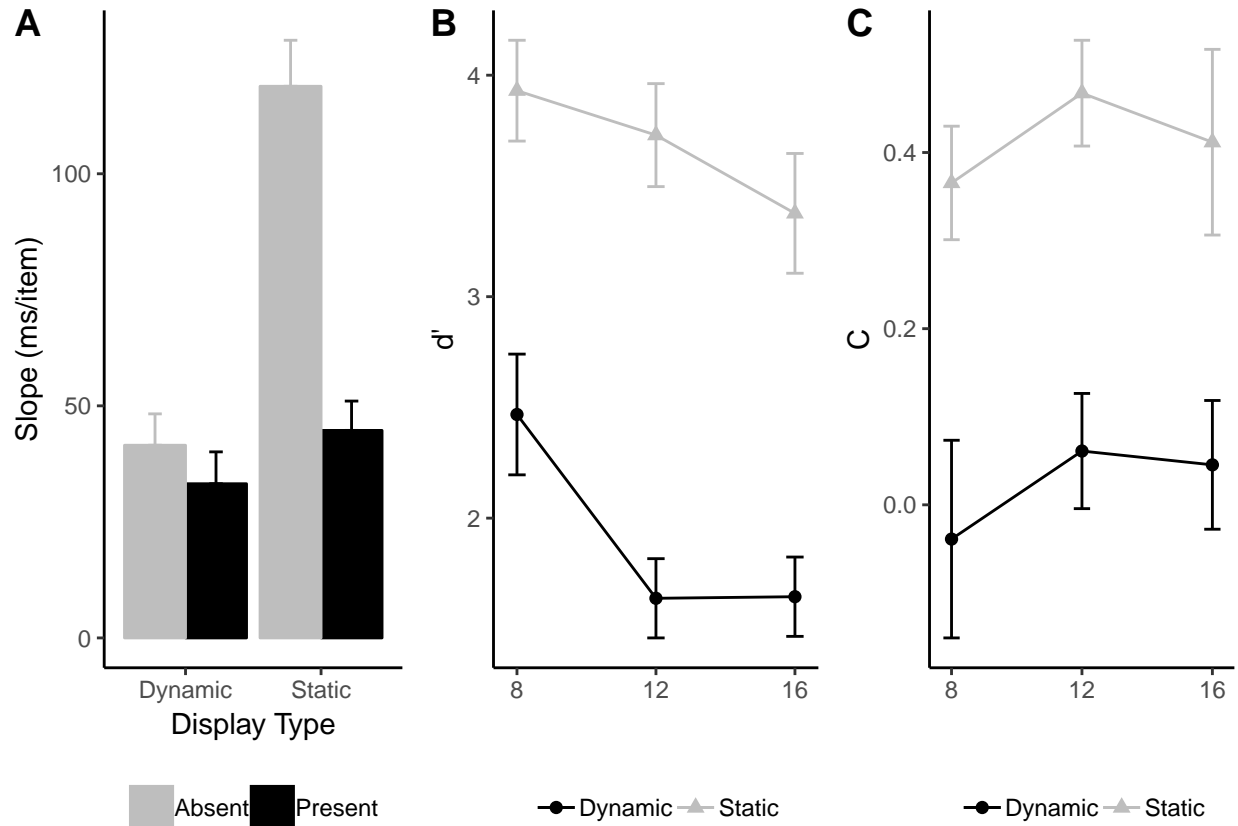# Experiment 3

3.1. Correct RTs from Experiment 3

3.2. RT statistics

```
##                 Effect DFn DFd      F        p p<.05       ges
```

```
## 2           setsize  2  22 118.21 1.70e-12    * 0.13807
## 3            target  1  11 102.81 6.43e-07    * 0.35971
## 4               dyn  1  11  26.06 3.42e-04    * 0.13368
## 5     setsize:target  2  22  18.77 1.75e-05    * 0.01895
## 6        setsize:dyn  2  22  34.96 1.48e-07    * 0.02234
## 7         target:dyn  1  11   2.21 1.65e-01      0.00289
## 8 setsize:target:dyn  2  22  12.45 2.41e-04    * 0.01222
```

3.3. Slopes,d' and biases:

3.4. ANOVA for the slopes

```
##        Effect DFn DFd   F        p p<.05   ges
## 2     target   1  11 77.2 2.64e-06     * 0.422
## 3        dyn   1  11 52.2 1.70e-05     * 0.458
## 4 target:dyn   1  11 21.0 7.91e-04     * 0.317
```

We further test if the slope in the dynamic condition was different.

```
##   Effect DFn DFd     F     p p<.05    ges
## 2 target   1  11 0.653 0.436       0.0355
```

Bayes Factor:

```
## Bayes factor analysis
## --------------
```

```
## [1] target + sub : 0.516 ±0.99%
##
## Against denominator:
##   slope ~ sub
## ---
## Bayes factor type: BFlinearModel, JZS
```

and the 'present' slopes between the dynamic and static displays

```
##   Effect DFn DFd    F     p p<.05    ges
## 2    dyn   1  11 2.61 0.134       0.0699
```

Bayes Factor:

```
## Bayes factor analysis
## --------------
## [1] dyn + sub : 0.984 ±0.73%
##
## Against denominator:
##   slope ~ sub
## ---
## Bayes factor type: BFlinearModel, JZS
```

3.5 ANOVA for d' and bias C

Search discrimination sensitivity d':

```
##         Effect DFn DFd      F        p p<.05    ges
## 2          dyn   1  11 143.03 1.20e-07     * 0.5926
## 3      setsize   2  22  30.27 4.82e-07     * 0.1381
## 4  dyn:setsize   2  22   4.11 3.04e-02     * 0.0302
```

Search response bias C:

```
##         Effect DFn DFd       F        p p<.05     ges
## 2          dyn   1  11 44.6725 3.45e-05     * 0.35792
## 3      setsize   2  22  1.1901 3.23e-01       0.02469
## 4  dyn:setsize   2  22  0.0762 9.27e-01       0.00123
```

RT distributions

RT distributions for the target absent condition can provide useful information of how observers set their stopping rules.

Here are typical RT distributions from the target absent conditions in Experiments 1 and 2.