Report of CCVR04

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This file takes the form of a brief "lab report", but is also the main data processing of CCVR04, which feeds into the CCVR_ms_1 (manuscript) folder

Summary of the DESIGN of the experiment

The main control of the pattern generation is found in "CreatePats.m" in the experiment code folder

Set 1 - Near target repeated configurations (half pattern repeated, half random)
Set 2 - Far target repeated configurations (half pattern repeated, half random)
Set 3 - Near target random configurations
Set 4 - Far target random configurations

odd participants: proximal distractors were repeated, distal Ds randomised
even participants: distal distractors were repeated, proximal Ds randomised

Blocks 1:16, 21:36, 41:56, 61:62 - Repeated configurations (sets 1 and 2)
Blocks 17:20, 37:40, 57:60 - Random configurations (sets 3 and 4)

NB: the block numbers in the raw data files were mislabeled - blocks 21:36 were written out as 20:35. This had no consequence on the presentation of stimuli, but the block numbers are adjusted in 1_read_tidy_CCVR04.R

Analysis report

There were 68 participants in the sample, of which 48 identified as female, and 20 as male. 34 were assigned to the "proximal repeated" condition, while 34 were assigned to the "distal repeated" condition.

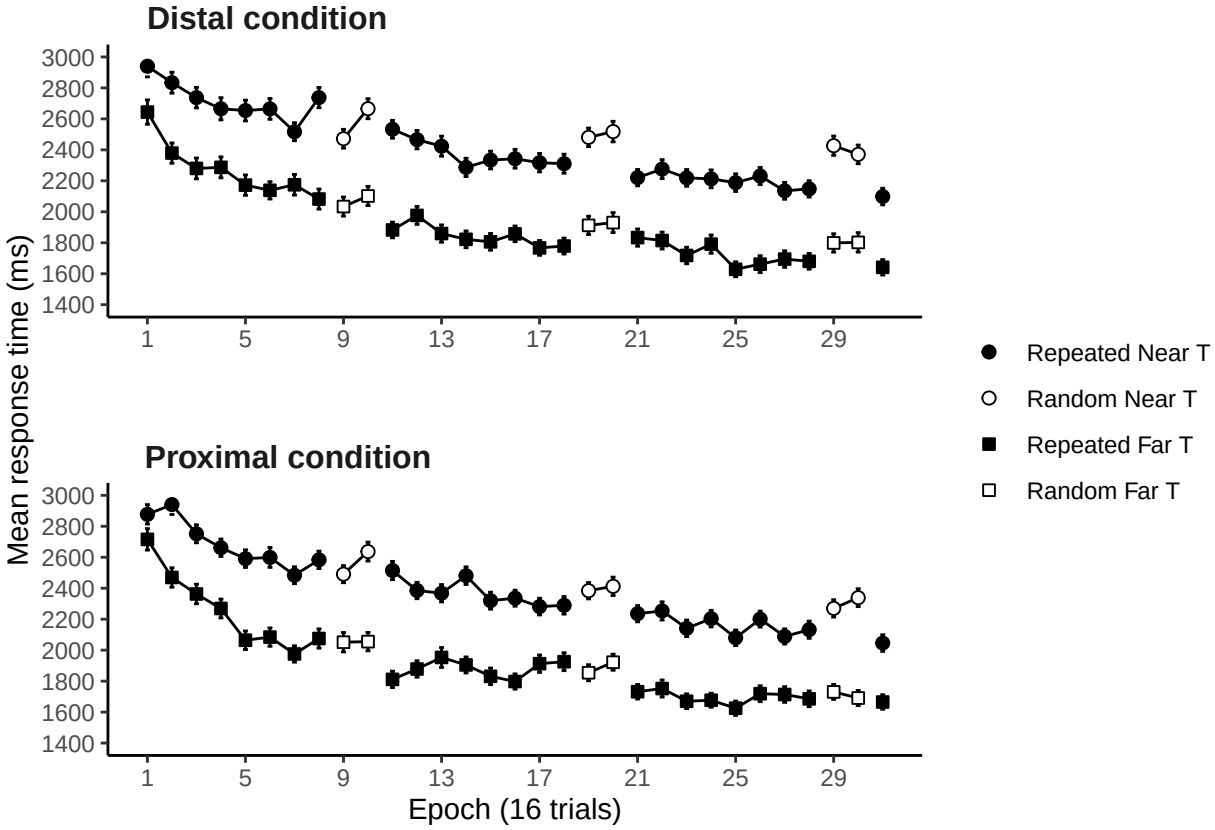
Summary statistics for RTs and number of responses made:

mean_RT_mean	0.98
perc_Timeouts_mean	0.02
mean_Extra_Resp_mean	0.34
perc_Rs_Over1_mean	0.21
perc_Rs_Over2_mean	0.06
mean_RT_sd	0.02
perc_Timeouts_sd	0.02
mean_Extra_Resp_sd	0.23
perc_Rs_Over1_sd	0.09
perc_Rs_Over2_sd	0.05

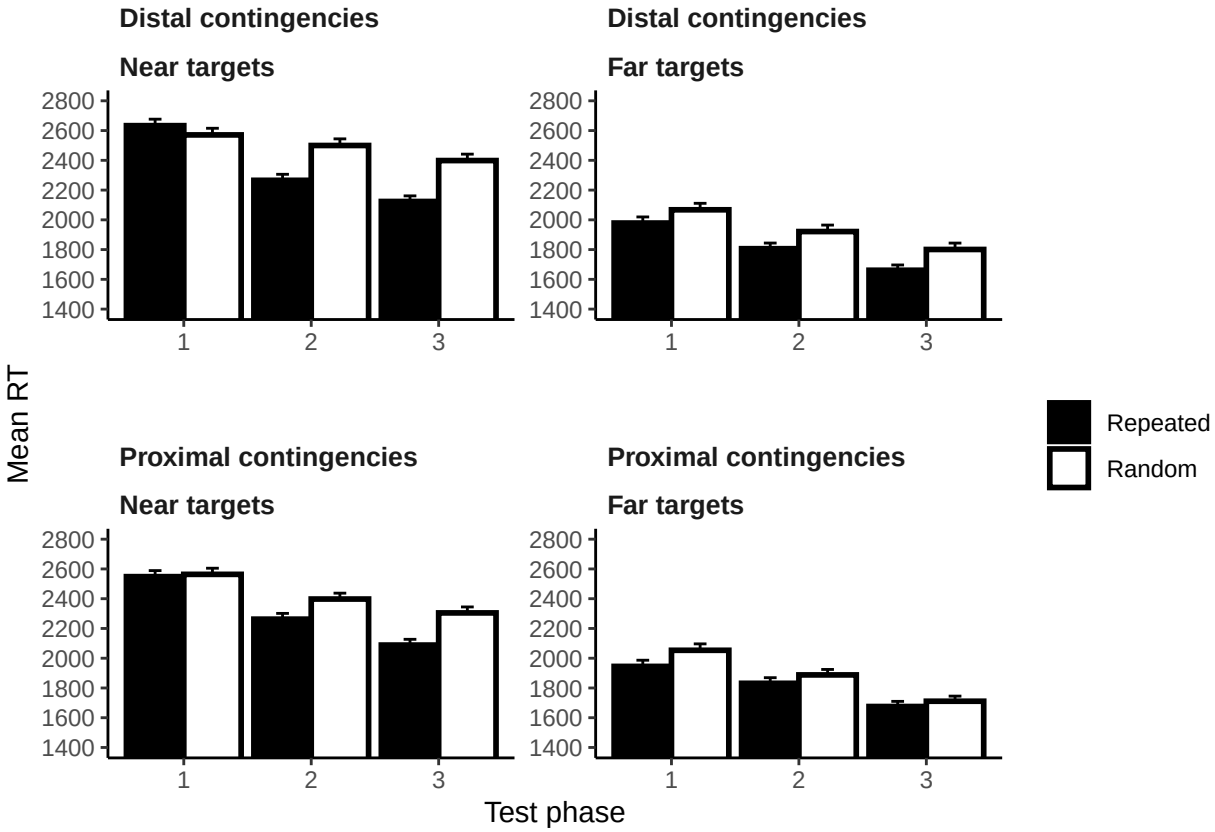
Data processing: trials which led to timeouts, and trials that had more than one additional responses (i.e., up to 2 responses allowed) were removed. Following this, RTs greater or less than 2.5 SDs from the participant mean RT were removed. On average this resulted in the loss of 9.6% of trials. Normalised RT was computed in order to create within-subject error bars in all plots.

Mean RTs for each participant were computed and the mean across the sample was 2190 ms (SD = 345). 2 participants [27, 44] produced means that were more than 2.5 SDs above the mean of the sample, and were removed from further analysis.

RTs were analysed by averaging the data across two consecutive blocks, producing 31 epochs of XX trials. As can be seen from the figure, RTs were slower for near targets compared to far targets. At three points in the experiment, random trials were introduced (epochs 9 and 10, 19 and 20, 29 and 30). These seemed to cause the expected increase in RT, which is evident particularly later on in the experiment.



The difference in RT between repeated and random patterns during "test phases" (Test 1 = epochs 8:11; Test 2 is epochs 18:21; Test 3 is epoch 28:31)



The data from the Test phases were submitted to ANOVA:

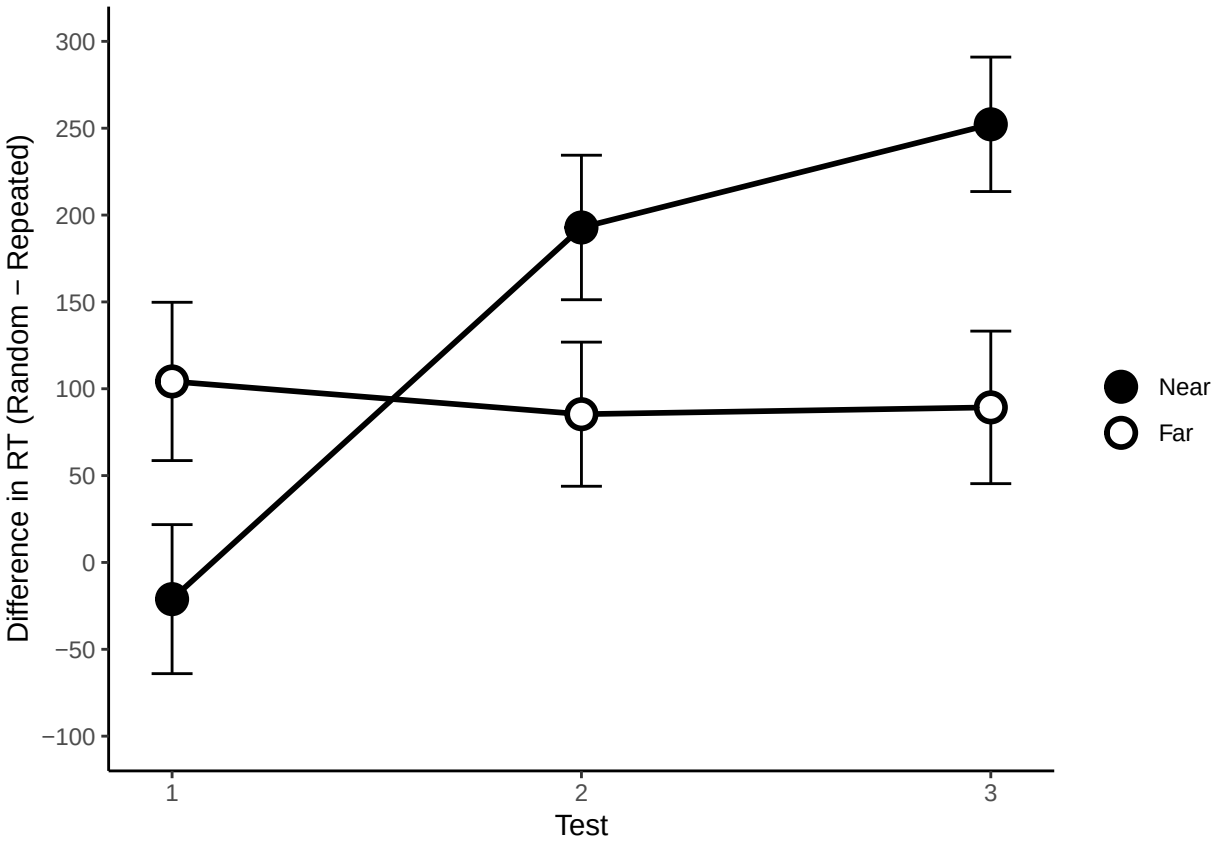
```
## Anova Table (Type 3 tests)
##
## Response: meanRT
##                              Effect           df        MSE          F   ges
## 1                         condition        1, 61 1059963.63       0.45  .004
## 2                              test 1.99, 121.58  106307.58  64.49 ***  .102
## 3                    condition:test 1.99, 121.58  106307.58       0.04 <.001
## 4                                TT        1, 61   80749.61  32.51 ***  .021
## 5                     condition:TT        1, 61   80749.61       0.74 <.001
## 6                       targ_depth        1, 61  267903.62 194.42 ***  .302
## 7             condition:targ_depth        1, 61  267903.62       0.18 <.001
## 8                           test:TT 1.86, 113.48   53705.06    6.01 **  .005
## 9                condition:test:TT 1.86, 113.48   53705.06       1.90  .002
## 10                test:targ_depth 1.98, 120.98   47782.68       1.61  .001
## 11     condition:test:targ_depth 1.98, 120.98   47782.68       0.04 <.001
## 12                  TT:targ_depth        1, 61   77246.70       1.41 <.001
## 13       condition:TT:targ_depth        1, 61   77246.70       0.02 <.001
## 14             test:TT:targ_depth 1.91, 116.69   43559.90   8.88 ***  .006
## 15 condition:test:TT:targ_depth 1.91, 116.69   43559.90       0.15 <.001
##    p.value
## 1     .503
## 2    <.001
## 3     .963
## 4    <.001
```

```
## 5     .392
## 6    <.001
## 7     .669
## 8     .004
## 9     .158
## 10    .205
## 11    .963
## 12    .239
## 13    .885
## 14   <.001
## 15    .851
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '+' 0.1 ' ' 1
##
## Sphericity correction method: GG
```

The main effect of condition (proximal or distal distractors repeating) was not significant, and did not interact with any other factor.

The trial type by target depth interaction was not significant. This suggests that the learning was equivalent across depths. However, the ANOVA reveals an interesting test by trial type by target depth interaction effect, which is significant. This suggests that the pattern of learning effects observed across three tests was quite different in the two depths. Eye-balling the above figure suggests this is because there is a gradual emergence of a CC effect for near targets, but that the effect is present in Test 1 for far targets. Further, the CC effect seems larger in Test 3 for near targets than far targets.

To explore this interaction further we can remove the TT factor by subtracting RTs for repeated patterns from those for random patterns:



We can look at t-tests on the three tests to see whether these differences were real.

```
##
##  Welch Two Sample t-test
##
## data:  .$CC_RT by .$targ_depth
## t = -2.0027, df = 123.55, p-value = 0.0474
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -249.193762   -1.462952
## sample estimates:
## mean in group Near  mean in group Far
##          -21.11441          104.21395
```

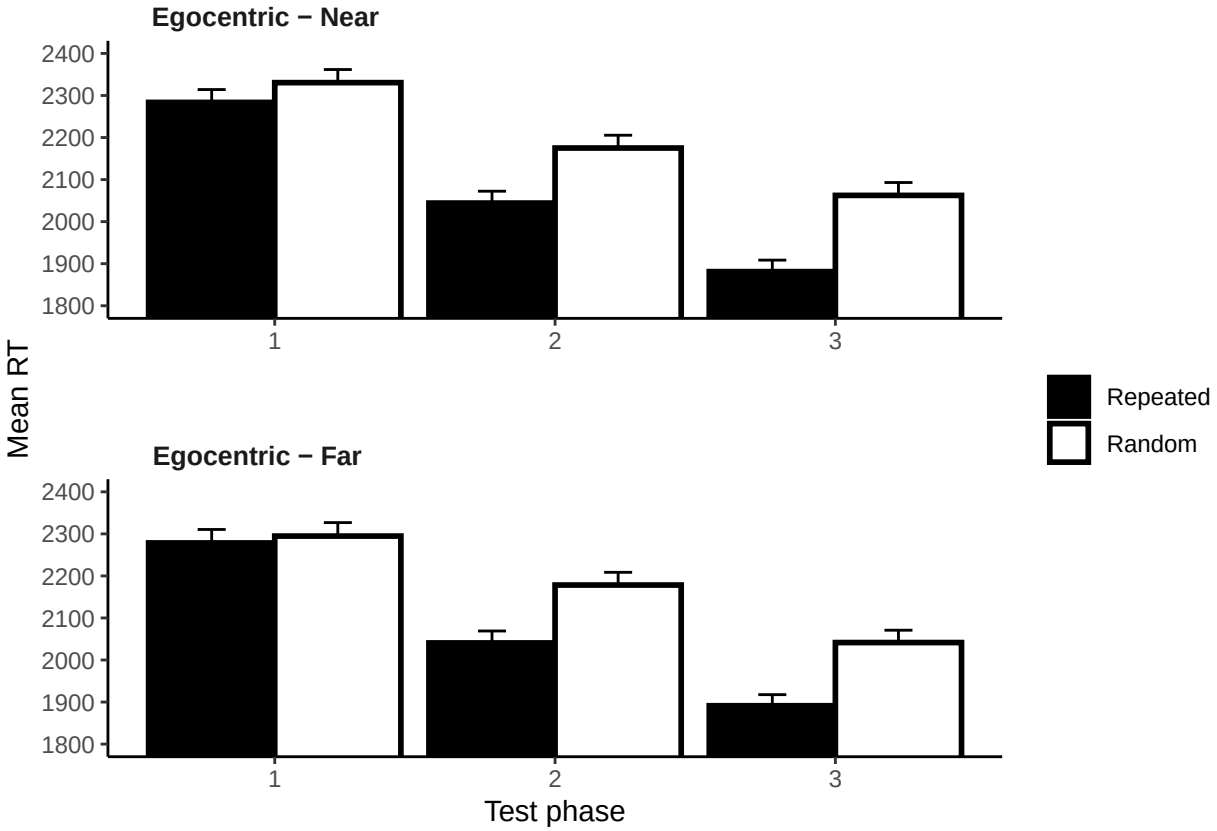
```
##
##  Welch Two Sample t-test
##
## data:  .$CC_RT by .$targ_depth
## t = 1.8297, df = 124, p-value = 0.0697
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##   -8.788057 223.777614
## sample estimates:
## mean in group Near  mean in group Far
##          192.84555           85.35078
```

```
##
##  Welch Two Sample t-test
##
## data:  .$CC_RT by .$targ_depth
## t = 2.7844, df = 122.08, p-value = 0.006218
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##   47.10194 278.81972
## sample estimates:
## mean in group Near  mean in group Far
##           252.2319            89.2711
```

It does look like there was a real difference in Test 1 and Test 3.

ego-centric analysis

We have explored the allocentric contingencies in the design, but we can also look at whether the learning varied as a factor of whether the contingencies were close to the observer or not, which we term the egocentric factor.



A repeated-model ANOVA shows that the factor of egocentricity of the configuration (near to observer or far from the observer) has no bearing on response times or the TT effect):

```
## Anova Table (Type 3 tests)
##
## Response: meanRT
```

```
##                Effect           df        MSE         F   ges p.value
## 1         egocentric        1, 62 1103689.37      0.01 <.001    .908
## 2                 TT        1, 62   80417.05 32.25 ***  .015   <.001
## 3               test 1.99, 123.58  104654.14 65.72 ***  .073   <.001
## 4      egocentric:TT        1, 62   77759.76      0.04 <.001    .841
## 5    egocentric:test 1.97, 122.38   48477.90      0.06 <.001    .937
## 6            TT:test 1.85, 114.93   54673.21   5.64 **  .003    .006
## 7 egocentric:TT:test 1.82, 113.02   51520.35      0.10 <.001    .886
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '+' 0.1 ' ' 1
##
## Sphericity correction method: GG
```