

## Supplementary material –

### **Been There, Seen That, Done That: Modification of Visual Exploration across Repeated Exposures**

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#### Summary of experiment 2a, including results of the changing (novel) images:

In the manuscript, we describe the analysis of experiment 2a when excluding the data of the changing (novel) images, because the changing images were not counterbalanced across participants. Thus, the same set of novel images was displayed to all participants, precluding any meaningful conclusion regarding gaze behavior when observing these images. For example, consider the case that the specific (not counterbalanced) set of changing (novel) images in block 2 elicits shorter fixations (in comparison to other sets of images) already in the first observation of these images. Now, if we find that the duration of fixations directed to the changing images in block 2 is similar to the duration of fixations directed towards the changing images of block 1, we cannot isolate the cause for this pattern of results. On the one hand, it is possible that there is no effect of fatigue, thus, the duration of fixations in the two blocks is similar. On the other hand, it is possible that there is an effect of fatigue, but because initially the fixations of the changing images in block 2 are shorter (for any reason that relates to the specific images, e.g. less semantic information in the images), the fatigue led to longer fixations resulting in seemingly no difference between the first and second blocks. Accordingly, even if we get the expected result of no difference in gaze behavior across blocks for the changing images, we cannot rule out the effect of fatigue. A demonstration of the possible impact of improper counterbalancing on measured gaze behavior can be evident from the data of the first block (see figure S1), in which we found a difference between the repeating and changing images, for all ocular measures already in the first block: fixation duration ( $t(31) = 4.726$ ,  $p < .001$ ,  $d = 0.84$ ), saccade amplitude ( $t(31) = 6.915$ ,  $p < .001$ ,  $d = 1.22$ ) and percentage of looking time on semantically meaningful regions ( $t(31) = -5.28$ ,  $p < .001$ ,  $d = -0.93$ ). Importantly, in the first block, both the repeating and changing images are novel. Therefore, no difference in gaze behavior is expected, unless there is a consistent difference between the specific images selected for the two sets. In order to deal with these problems regarding the changing images, in experiment 2b the sets composing the repeating and changing images were counterbalanced between participants. Thus, any difference between the repeating and changing images that is consistent across participants can be attributed to familiarity effects, rather to any specific properties of the images in each set.

In light of these heavy concerns regarding the validity of the results of the changing images in experiment 2a, we decided to discard the data of these images and report only the results regarding the repeating images. It is important to note that the data of the repeating images is still valid – as this set of images is fixed across all blocks, the properties of the images in all blocks are identical and are not expected to elicit any differences between blocks. For completeness, here, we report the results of the complete analysis, including also the changing images (see figure S1) but due to the serious methodological concerns, these results should be taken with caution. Accordingly, we conducted a two-way ANOVA with a within-subject factor of block (1/2/3) and image type (repeating/changing). This analysis was carried out for each one of the ocular measures: fixation duration, fixation rate, length of saccades and percentage of fixation time on meaningful regions, and is identical to the analysis we conducted in experiment 2b. The fixation duration analysis yielded a main effect of image type ( $F(2,62)=29.67$ ,  $p<.001$ ,  $\eta^2 = 0.48$ ) and significant interaction between block and image type ( $F(3,93)=3.436$ ,  $p=.038$ ,  $\eta^2 = 0.1$ ). However, the effect of block was not significant ( $F(2,62)=2.126$ ,  $p=.128$ ,  $\eta^2 = 0.06$ ). For fixation rate, we found a significant effect for block ( $F(2,62)=4.57$ ,  $p=0.014$ ,  $\eta^2 = 0.12$ ) and image type ( $F(2,62)=66.1$ ,  $p<.001$ ,  $\eta^2 = 0.68$ ) but no significant interaction effect ( $F(2,62)=1.488$ ,  $p=.234$ ,  $\eta^2 = 0.04$ ). The analysis of the saccade amplitude elicited significant effects of image type ( $F(2,62)=43.27$ ,  $p<.001$ ,  $\eta^2 = 0.58$ ) and interaction ( $F(3,93)=11.78$ ,  $p<.001$ ,  $\eta^2 = 0.27$ ), but only an insignificant trend of block ( $F(2,62)=2.735$ ,  $p=.072$ ,  $\eta^2 = 0.08$ ). For the percentage of fixation time on meaningful regions we found a significant effect of block ( $F(2,62)=12.73$ ,  $p<.001$ ,  $\eta^2 = 0.29$ ) and a significant effect of image type ( $F(3,93)=25.89$ ,  $p<.001$ ,  $\eta^2 = 0.46$ ). However, on an insignificant trend of the interaction between image type and block ( $F(2,62)=2.643$ ,  $p=.079$ ,  $\eta^2 = 0.07$ ). Finally, the analysis regarding fixation time on the low-level features of the image yielded a significant effect of image type ( $F(2,62)=16.04$ ,  $p<.001$ ,  $\eta^2 = 0.34$ ) and a significant interaction effect ( $F(2,62)=3.83$ ,  $p=.027$ ,  $\eta^2 = 0.11$ ), but insignificant effect for block ( $F(2,62)=0.197$ ,  $p=.822$ ,  $\eta^2 = 0.006$ ).

### Summary of Bayesian analysis:

**Bayesian parameter estimation.** For all ocular measures (i.e., fixation duration, fixation rate, saccade amplitude and percentage of fixation time on image's features), we built a model for the difference between the last block and the first one and for the difference between the last block and the third one. This procedure yielded ten models overall – two models for each ocular measures. For all models, we assumed that the prior distribution of the difference between blocks is a t distribution. In order to be conservative, we used a non-informative prior distribution centered on zero (the expected difference under the null hypothesis). Importantly, we chose this option over the less conservative approach of building the distribution around the expected difference according to experiment 1. The degrees of freedom and the variance distributions in each model are based on the data from the experiments. The degree of freedom distribution is an exponential distribution with a parameter of 66 (number of participants in experiment 2a + number of participants in experiment 2b – 1). For the standard deviation distribution, we took a non-informative uniform distribution, with the upper limit determined by the sample standard deviation. Specifically, we took the upper limit to be larger than the estimated standard deviation from the sample, in order to make sure that the range is wide enough (see below). For the sake of consistency, we determined this upper limit around 5 times of the estimated standard deviation. However, the results were robust for other values of the standard deviation as well. Here, we present the general script of the model. Specifically, the only difference between the ten models is in the value of the upper limit of the uniform distribution of the standard deviation (attributed as *u\_sigma* in the script). The values inserted for these variables are described in the table below. The general model is as follows:

```
Jmodel = "model {  
  
for ( i in 1:N ) { diff[i] ~ dt( mu , tau , nu ) }  
  
mu ~ dnorm(0,0.001)  
  
tau ← 1/sigma^2  
  
sigma ~ dunif(0, u_sigma)  
  
nuMinusOne ~ dexp(1/66)  
  
nu ← nuMinusOne +1  
  
}"
```

	Standard deviation		
	Sample		In model ( <i>u_sigma</i> )
	First & last blocks	Third & last blocks	
<b>Fixation rate</b>	0.22	0.22	1
<b>Fixation duration</b>	27.03	30.48	150
<b>Saccade amplitude</b>	0.98	0.75	5
<b>Percentage fixating time on semantic regions</b>	5.81	6.69	30
<b>Percentage fixating time on low-level regions</b>	4.48	3.98	20

**Bayesian model comparison.** For all ocular measures (i.e., fixation duration, fixation rate, saccade amplitude, percentage of fixation time on low-level features and percentage of fixation time on semantic features), we built a model for the effect size of the difference between the fourth block and the first one and for the difference between the fourth block and the third one. This procedure yielded ten models overall – two models for each ocular measures. For all models, we assumed that the prior distribution of the difference between blocks is a t distribution, similar to the one described for the Bayesian parameter estimation (see above). In this model, we also used a normal distribution centered around zero as the non-informative prior for the effect size. This prior stands in line with the null model, in which the effect size is expected to be zero. This model enables us to estimate the posterior of the effect size, and thus calculate the Bayes Factor by dividing the height of the posterior distribution of the effect size by the height of the prior distribution of the effect size.

Here, we present the general script of the model. Specifically, the only difference between the ten models is in the value for the upper limit of the uniform distribution of the standard deviation (attributed as *u\_sigma* in the script). The values inserted for these variables are described in the table above. The general model is as follows:

```

model{
  for (i in 1:N){
    x[i] ~ dt( mu , tau , nu )
  }
  sigma~dunif(0,u_sigma)
  mu <- delta*sigma
  tau<-1/sigma^2

```

`nuMinusOne ~ dexp(1/66)`

`nu <- nuMinusOne + 1`

`lambdadelta ~ dchisqr(1)`

`delta ~ dnorm(0,lambdadelta)`