Hello Everyone,

I asked for this jclub opportunity to informally present some new data that i have been working on. As usual i am struggling a bit in finding a concise way to organize a report, so I was hoping that by presenting it to the journal club i might make some progress along that line.

please view the attached overview and figures as a preliminary outline, and please raise questions and suggest changes in figures or additional data or figures or less figures, etc. during and after my presentation.

thanks
Brad
Retinotopic Forward Masking Has a Major Impact on Search Behavior and the Activity of Area V4 Neurons During Visual Search

A. The search array components and the fixation by fixation analysis of retinotopic forward masking outcomes during search. The initial outcome hypothesis based on prior stimulus history.

B. Measuring observed and expected (possible) outcomes of retinotopic masking. Test the prior stimulus hypothesis. Revision of hypothesis?

C. Describe the analysis of stimulus history for single neurons. The initial neural outcome hypothesis.

D. Examples of the raw database: rasters and rate box plots.

E. Define forward suppression and show the results of fixation sequence analysis for each stimulus type.

F. Analysis of neural responses as function of feature selection (matching condition), fixation sequence, and the prior stimulus effect. Clear suppression of prior same compared to prior different condition, whereas very similar levels for different and blank conditions. If different and blank conditions are similar, then why the difference in the behavioral outcomes?

G. One possibility is that other correlations are obscuring the differences. Consider that the behavioral effects are based on saccades to items and involve focal attentive processes that are specifically excluded in previous analyses. Therefore consider:
   a. saccades into RF (focal attention) and
   b. controlling for saccadic momentum effects

Comparing behavioral and neural data using 3D bar plots. If the comparisons are not convincing enough what else is there?

H. Examine the activity in the timeline histograms. Differences are apparent in regard to the activity occurring before the current fixation.

I. Box plots of Weber fraction ((response-baseline) / baseline) for the different stimulus types, prior conditions, and matching condition. The response with respect to the previous baseline, differentiates the prior conditions.
Behavioral data were collected across the same trials used for neural data collection using a conjunction style search paradigm. Figure A illustrates the basic search display. RF depicted by circle to the lower right of the initial central fixation spot. Grid spacing, grid orientation, and number of elements of the array are based on the RF eccentricity, angle, and the limits of the 35x25 deg screen size.

Four stimuli were chosen for each neuron based on tuning preference. The preferred stimulus (PR), a two stimuli that shared either the preferred color (CL) or (SH), and a stimulus that combined the non-preferred (NP) stimulus features. For each trial one of the four was randomly chosen as the target and the two stimuli sharing one of the target's features were used as distracters.

Once fixation is established (within 0.5 deg for 300 ms) the spot is replaced a replica of the target stimulus for the trial. After 300 msec the replica is removed and the array is simultaneously presented without a stimulus at the center location. Subjects searched through the array until the target was found. Fixation of the target for 600 msec terminated the trial.

Figure B sets up the analytic proposition. The current fixation is at d, with the next saccade going to the stimulus at e. The question is whether the saccade to e is influenced by what was in that retinotopic position on the previous fixation. Three alternatives are recognized, either the SAME stimulus was present on the prior fixation as at a, or a different stimulus was present as at b, or there was no stimulus (blank) present as at c.

Data were collected by counting the occurrences for each mid-trial fixation. This distribution of observed SAME, DIFFERENT, and BLANK prior states was compared to the expected distribution. The expected distribution was obtained by counting all the possible prior state outcomes from a consideration of all the possible fixation locations in the array. The expected distribution represents no effect of prior state beyond that of a random draw.

So, given that maskers that resemble the target are often more effective at masking, what is the initial hypothesis? Note that unlike a more typical masking paradigm, we are not asking the identity of the masked item, rather we are asking about the targeting of that item.
1. Describe counting methodology. Because the stimuli are randomly placed within the array the number of items in the array does change the expected distribution. Any imbalance in distractor types is taken into account by counting method.

2. A chi-sq analysis of observed vs expected is highly significant, even with proportionate reduction of the total counts. The o/e ratio index depicts the departure from random assignment.

3. The results shown in D show that although saccades went to stimuli with SAME priors at chance levels, but they were much more likely to go to stimuli with DIFFERENT priors, and less likely to go to stimuli with BLANK priors. The opposite directions of the effect for DIFFERENT and BLANK were not anticipated.

Any possible explanations?
The initial hypothesis was based on a salience argument, with the difference from prior adding salience and thus making a saccade to that stimulus more probable. What if the BLANK condition also made the stimulus more easily identified? It could then be correctly rejected.

4. What else makes objects more easily identified?
   Proximity to fixation.
5. Split data into two, based on saccades to nearest neighbors vs beyond.
   What is the new hypothesis?
   Is it supported by the new analysis?
The behavioral analysis demonstrated that the probability of going to a particular stimulus was influenced by what object was in the targeted stimulus's retinotopic position on the previous fixation.

For individual neurons this corresponds to what was in the RF on the prior fixation. In Figure C the inverted lollipops indicate the position of the RF with respect to different fixation positions. Fixations at d were preceded by fixations at a, b, or c, representing the SAME, DIFFERENT and BLANK prior conditions.

We want to generate a picture of how this affects processing throughout the visual scene, to do this we will exclude for the moment cases where a saccade is made into the RF as these also are accompanied by a shift in focal attention to the target and not elsewhere.

Figure C sets up the analytic proposition. The current fixation is at d, with the RF centered on the grid location directly below. The question is whether the response to the 'T' stimulus is influenced by what was in that retinotopic position on the previous fixation. Three alternatives are recognized, either the SAME stimulus was present on the prior fixation as at a, or a different stimulus was present as at b, or there was no stimulus (blank) present as at c.

In addition to stimulus type (PR, CL, SH or NP) the analysis must be sensitive to whether the stimulus in the RF matches the trial's target stimulus in color, because selection for color is known to guide search in these arrays and because feature selective processes are known to affect V4 responsiveness.

And in addition we will need to take into account forward suppression.
ONTORF4 and A-1 excluding 1st midtrial fix
1. Define forward suppression starting with paired pulse paradigm
Sacha Nelson 1991 Temporal Interactions in the Cat Visual System: I. Orientation-
Michael Wehr and Anthony Zador 2005 Synaptic Mechanisms of Forward Suppression
in Rat Auditory Cortex. Neuron, 47: 437-445

2. Previous V4 work using flashed stimulus sequences duration 200 ms ISI 55ms
open circles on left

3. Search data using response to stimuli in RF after each saccade, sacc duration 20-30 ms

4. Each stimulus type shows a multiplicative suppression to about 80% of the onset for the
1st mid trial fixation and thereafter a smaller, perhaps subtractive, suppression with an
apparent saturation. loss of transient?

5. Reasons to treat 1st midtrial fixation separately.
upper vs lower comparison shows the feature attentive effect

left to right shows the fixation sequence effect

within each frame shows the prior effect,
with response to prior SAME consistency less than others

also as tuning decreases, effects are minimized

note prior DIFF and prior BLANK show similar response,
but behavior is quite different.

One possibility is that other correlations are obscuring the differences. Consider that the behavioral effects are based on saccades to items and involve focal attentive processes that are specifically excluded in the previous analyses. Also saccadic momentum.
Note that in Figure B the FW BLANK bin has very few inclusions based on saccades into the RF because the array structure provides few opportunities for this to occur.

After considering saccades into RF (focal attention) and controlling for saccadic momentum effects, does the comparison between behavioral and neural data provide a convincing explanation for difference between DIFFERENT and BLANK prior conditions?

What else is there?
If you consider the activity prior to the start of fixation - how do you judge the responses?

Are there responses to the SAME prior condition?

Are there responses to the SH and NP stimuli?
Weber contrast indexes for consecutive 200 msec intervals spanning the start of fixation.

What role does tuning play?