In your group assignment, you focused on object-based representational similarity analyses. In that case, the response pattern to every object is correlated with the response pattern to every other object to compute a representational dissimilarity matrix, with each row or column showing a different object.
However, in class we also saw that neuroimaging methods with high temporal resolution (like MEG or EEG) allow time-based representational similarity analyses. Here, the response pattern at a particular moment in time can the correlated with the response pattern at every other moment in time. This produces a representational (dis)similarity matrix, with each row or column showing a different TIME, as we see below for the early visual cortex (EVC) and inferior temporal cortex (IT).

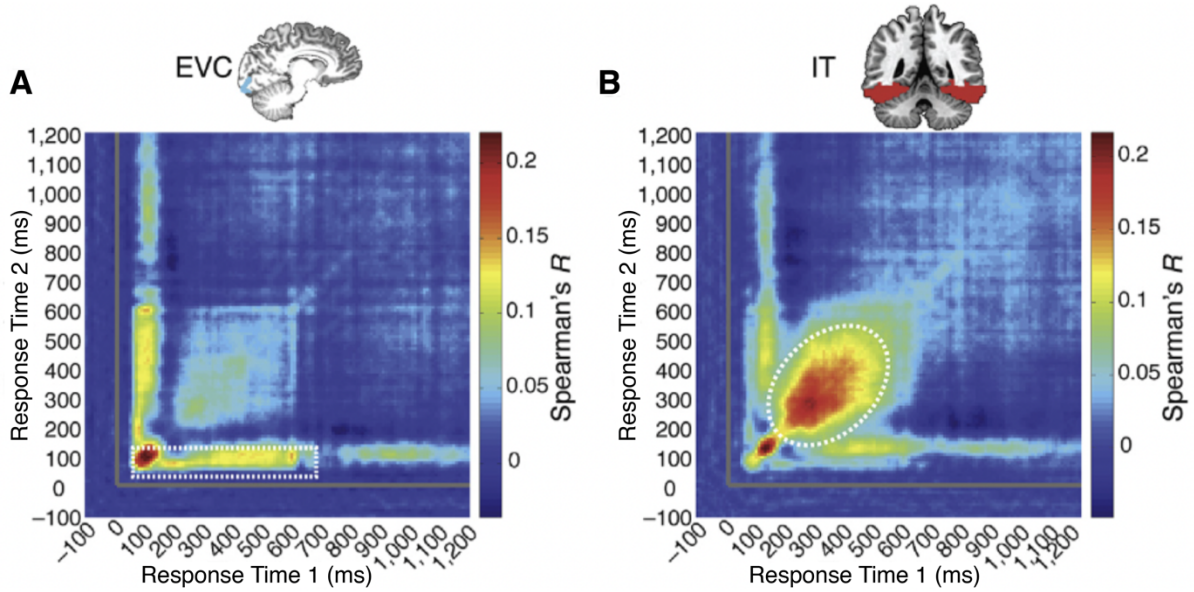

Figure 1. Time-based representational SIMILARITY matrices for the responses of early visual cortex (A) and inferior temporal cortex (B). This show similarity, not dissimilarity: here higher values and red colours show more similar responses.

(Question 1a) In the early visual cortex we see the strongest correlations along a horizontal or vertical line, surrounded by a white dashed rectangle. How do you interpret this component of the response?

(Question 1b) In the inferior temporal cortex we see the strongest correlations around a diagonal line, surrounded by a white dashed oval. How do you interpret this component of the response?

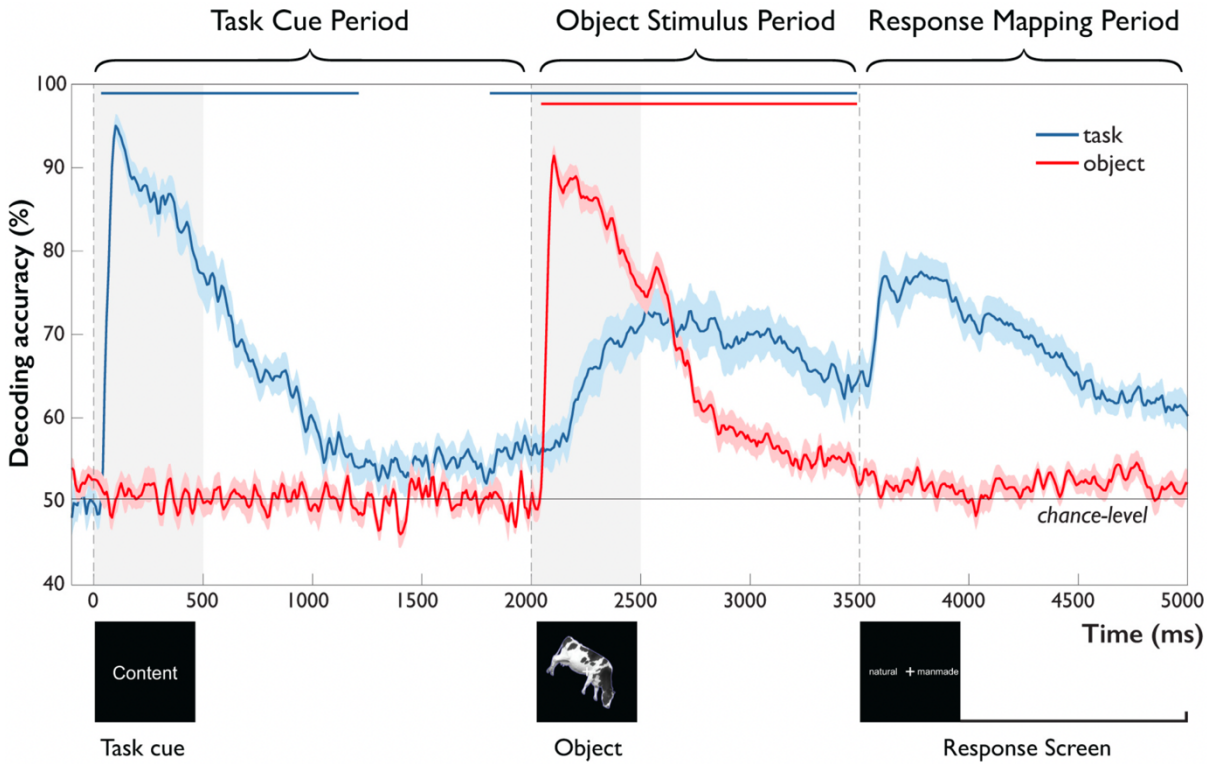

Figure 2 (previous page). SVM decoding accuracy for the object viewed (red) and the task performed (blue) at every time point. The task was shown from 0 to 500 ms in each trial and could cue the participant to judge the image content (natural or man-made) or object size (larger or smaller than a microwave oven). During the Object Stimulus Period, the object image was shown from 2000 to 2500 ms. Throughout the Response Mapping Period, the participant gave a response, but which button corresponding to which answer changed randomly between trials. Decoding was done on the response pattern across all sensors across the whole brain.

(Question 2A) In Figure 2, task can be decoded well both during the Task Cue Period and the Response Mapping Period. However, in Figure 3, we see that the responses in these periods do not generalize with each other: training on responses in the Task Cue Period doesn't allow decoding in the Response Mapping Period. How can both findings be correct? In other words, how do you interpret both results together?

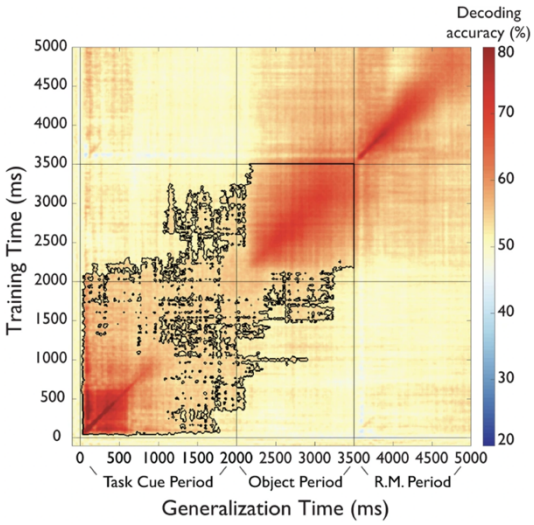

Figure 3. Representational SIMILARITY matrix for the different times in the trial, here showing the performance of an SVM classifier trained with the pattern at the vertical axis time and tested on the pattern at the horizontal axis time. The black outlined area shows where decoding performance was significant, but does not include the Response Mapping Period times and is not important for the question.

(Question 2B) Conversely, training on responses in the Object Stimulus Period allows decoding from the Response Mapping Period. How do you interpret this?

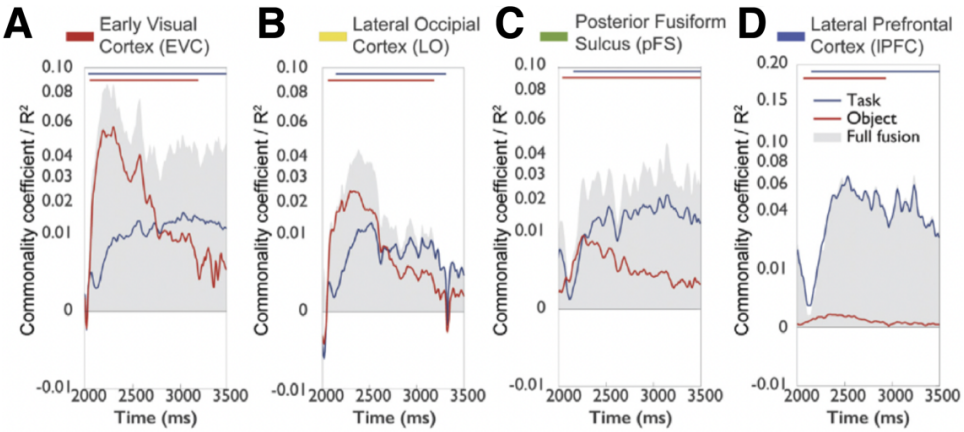

Figure 4. The correlation between the RDM for all object and task combinations with a task-hypothesis RDM (blue), an object-hypothesis RDM (red) or their sum (gray) at every time point during the Object Stimulus Period. This is shown for several brain areas: (A) Early visual cortex; (B) Lateral occipital cortex, a mid-level shape processing area; (C) Posterior Fusiform Sulcus in the inferior temporal cortex; (D) The lateral prefrontal cortex, an area implicated in decision making and response planning.

(Question 3) Figure 4 shows that the amount of the Object Stimulus Period response pattern predicted by the task and the object differs between brain areas and changes in different ways in each area. What differences do you note as we move from brain areas involved in early vision to those involved in object recognition to those involved in action planning:

(a) In the relative amounts of these responses to object and task?
(b) In the timing of the peak responses to the object and task?