

# Effects of rhythm on memory for spoken sequences: a model and tests of its stimulus-driven mechanism

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## Supplementary Information

This document contains supplementary figures and tables from our simulations which could not be included in the main body of the article due to space considerations.

Table S1 presents a summary of the proportion of correct responses in Ryan (1969a), Experiment 2 and our simulations together with the Product of Group Sizes for each grouping pattern.

Table S2 presents correlations of the measures in Table 1.

Figures S1-S28. For each of the 28 grouping patterns considered by Ryan (1969a) and used in Experiment 2 we present the following (from top to bottom):

### a) Encoding/retrieval: Context Signal

The upper trace shows the timing of amplitude pulses (triangular pulses) associated with each item in the simulated input sequence. The lower phase magnitude diagram showing the evolution of the context signal over the same period during encoding. The same states are reproduced at retrieval, and items associated with similar states of the context signal are likely to transpose with one another in errors. Hue is used to indicate the phase of the oscillators, while brightness indicates the relative magnitude of each oscillator's response.

### b) Retrieval: Serial Position Curves

Simulated serial position curves (left) with data from Experiment 2 (right) for comparison. The serial position curves are based on the proportion of correct responses (blue) at each serial position in 10000 simulations of each grouping pattern.

Transpositions of  $\pm 1$  (green),  $\pm 2$  (red),  $\pm 3$  (cyan) are also plotted. **Error bars for simulation data.** Errors in the simulation result from selection under noise as explained in the body of the article. Noise produces different responses on each retrieval attempt. As a result, the model predicts that the proportion of correct responses/errors observed in a particular condition will be somewhat variable in limited samples comparable to those used in experiments. The error bars give an indication of this variability. A "bootstrapping" approach is used to repeatedly resample (with replacement) the simulation responses. The error bars show the 95<sup>th</sup> and 5<sup>th</sup> percentile of the proportions seen in the bootstrapped samples providing a 90% confidence interval around the obtained means.

Table S1: Product of group size and proportions of correct responses for each of the 28 grouping conditions considered by Ryan (1969a) and in Experiment 2 and our simulations.

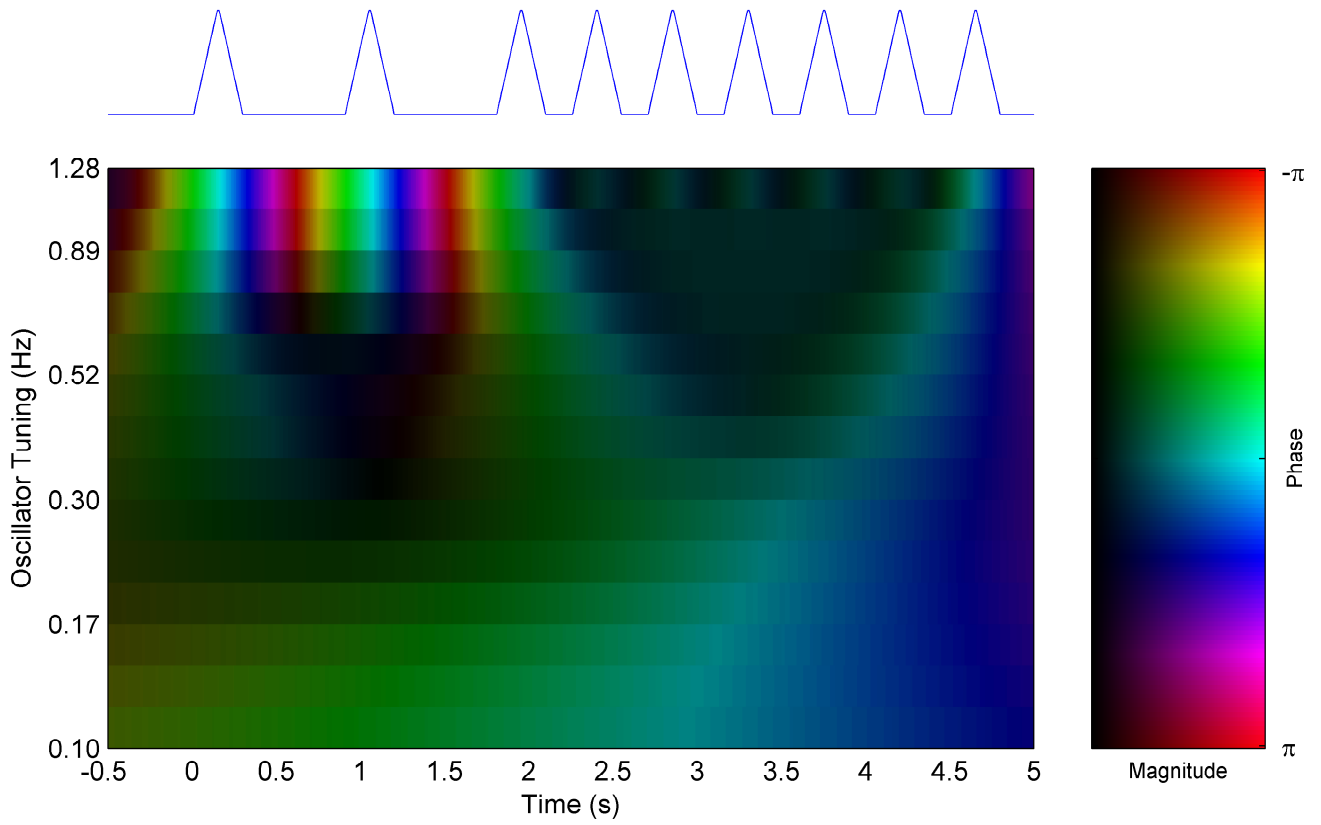
Grouping Pattern	Product of Group Size	Ryan (1969a) proportion correct (%)	Experiment 2 proportion correct (% responses predictable trials)	Experiment 2 proportion correct (% responses unpredictable trials)	Experiment 2 proportion correct (% all responses)	Simulation proportion correct (% all simulated responses)
1-1-7	7	0.758	0.608	0.611	0.610	0.670
1-2-6	12	0.736	0.646	0.649	0.648	0.766
1-3-5	15	0.808	0.624	0.681	0.652	0.835
1-4-4	16	0.869	0.722	0.678	0.700	0.854
1-5-3	15	0.858	0.640	0.641	0.640	0.821
1-6-2	12	0.761	0.581	0.562	0.571	0.743
1-7-1	7	0.678	0.532	0.514	0.523	0.660
2-1-6	12	0.711	0.608	0.630	0.619	0.786
2-2-5	20	0.811	0.724	0.644	0.684	0.796
2-3-4	24	0.822	0.746	0.671	0.709	0.841
2-4-3	24	0.881	0.697	0.675	0.686	0.855
2-5-2	20	0.856	0.665	0.657	0.661	0.815
2-6-1	12	0.728	0.552	0.579	0.566	0.738
3-1-5	15	0.836	0.632	0.675	0.653	0.842
3-2-4	24	0.803	0.722	0.683	0.702	0.870
3-3-3	27	0.944	0.802	0.790	0.796	0.828
3-4-2	24	0.850	0.746	0.717	0.732	0.852
3-5-1	15	0.844	0.617	0.648	0.633	0.816
4-1-4	16	0.817	0.732	0.659	0.695	0.851
4-2-3	24	0.828	0.635	0.732	0.683	0.870
4-3-2	24	0.828	0.710	0.719	0.714	0.842
4-4-1	16	0.875	0.706	0.683	0.694	0.849
5-1-3	15	0.858	0.665	0.632	0.648	0.841
5-2-2	20	0.869	0.757	0.659	0.708	0.798
5-3-1	15	0.833	0.697	0.686	0.691	0.832
6-1-2	12	0.783	0.644	0.665	0.655	0.775
6-2-1	12	0.753	0.643	0.710	0.676	0.754
7-1-1	7	0.700	0.621	0.559	0.590	0.655

Table S2: Correlations between product of group size, proportion of correct responses observed in Ryan (1969), Experiment 2 (predictable, unpredictable and all responses) and simulations.

	Product of Group Lengths	Ryan (1969a) Prop. Correct	Exp 2 Prop. Correct (pred)	Exp 2 Prop. Correct (upred)	Exp 2 Prop. Correct (all)	Simulation Prop. Correct
Product of Group Lengths	1.000	0.731	0.763	0.751	0.816	0.779
Ryan (1969a) Prop. Correct	0.731	1.000	0.738	0.716	0.784	0.768
Exp 2 Prop. Correct (predictable)	0.763	0.738	1.000	0.722	0.938	0.636
Exp 2 Prop. Correct (unpredictable)	0.751	0.716	0.722	1.000	0.917	0.739
Exp 2 Prop. Correct (all)	0.816	0.784	0.938	0.917	1.000	0.737
Simulation Prop. Correct	0.779	0.768	0.636	0.739	0.737	1.000

Figure S1: grouping pattern 1-1-7

a)



b)

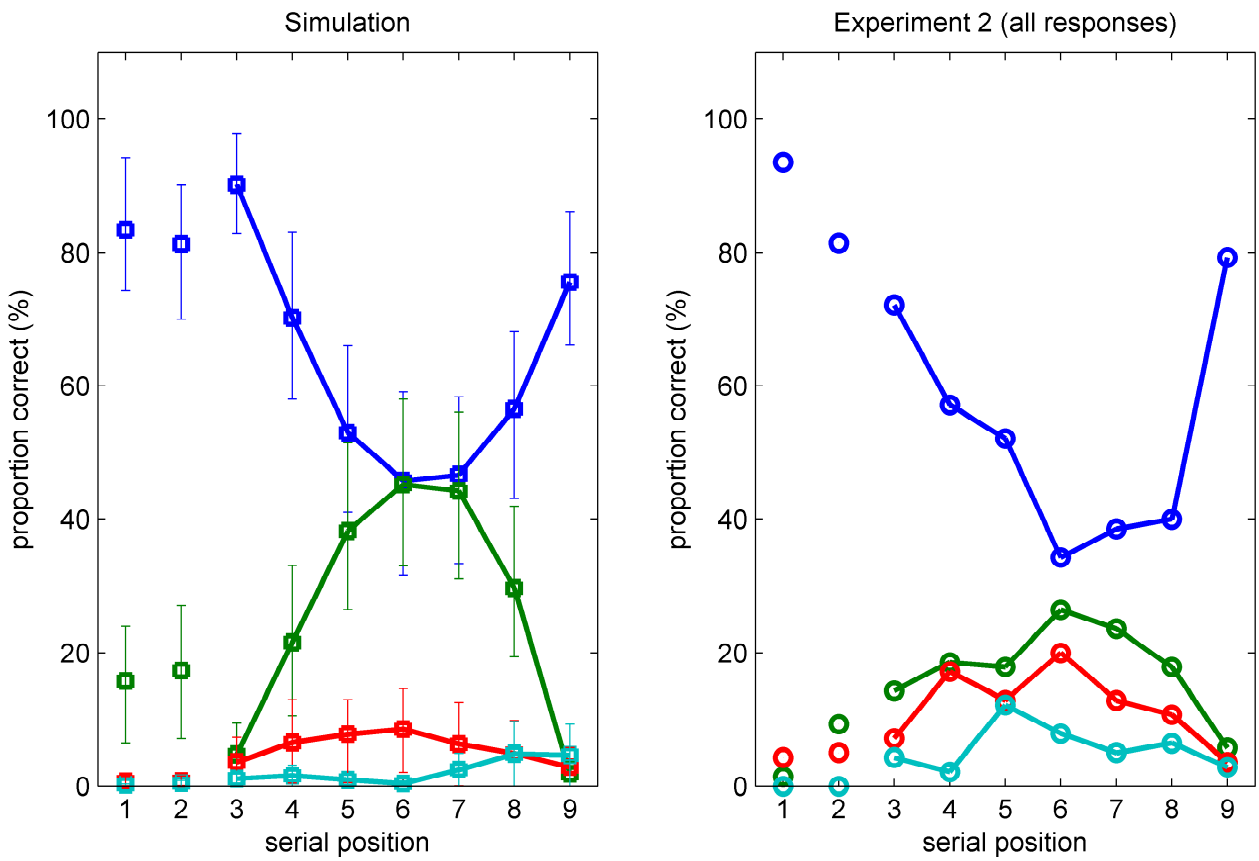
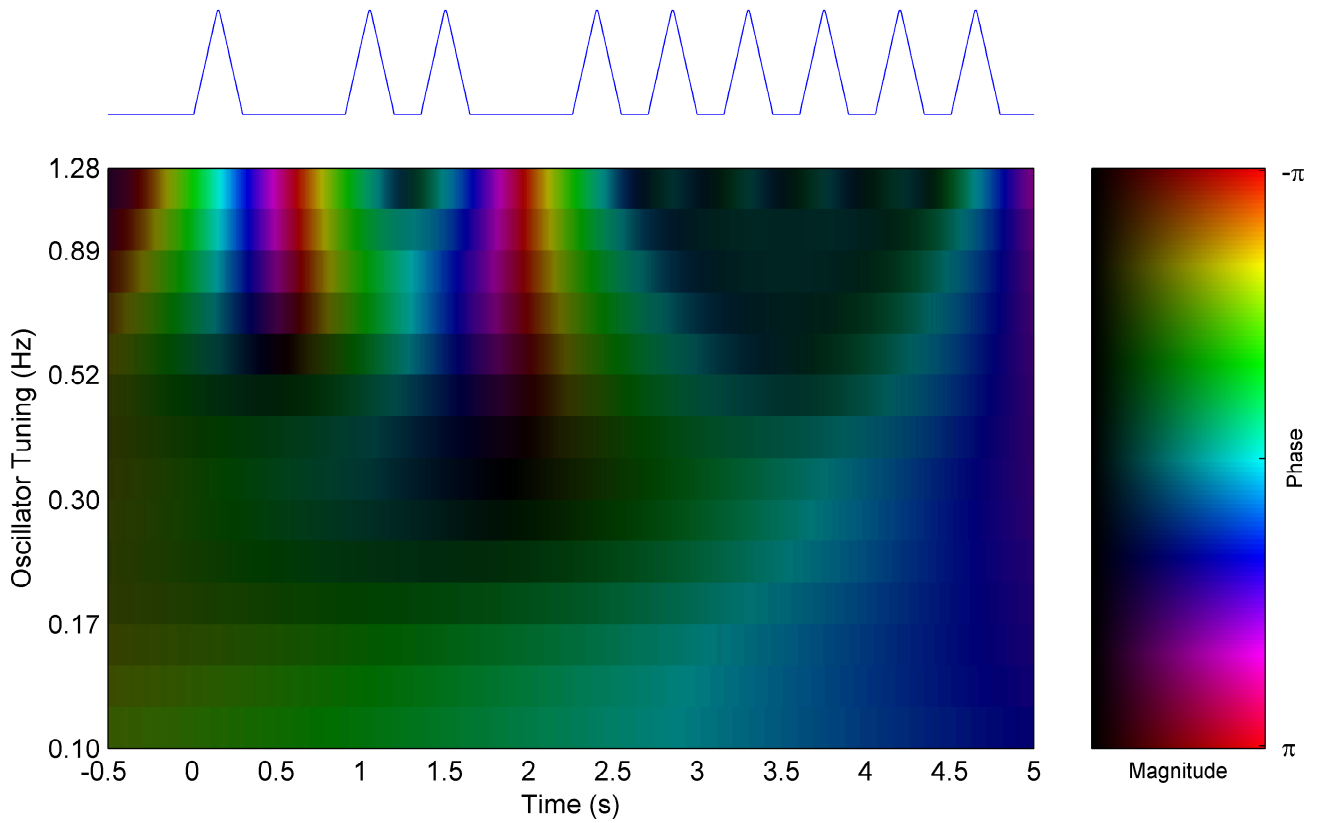


Figure S2: grouping pattern 1-2-6

a)



b)

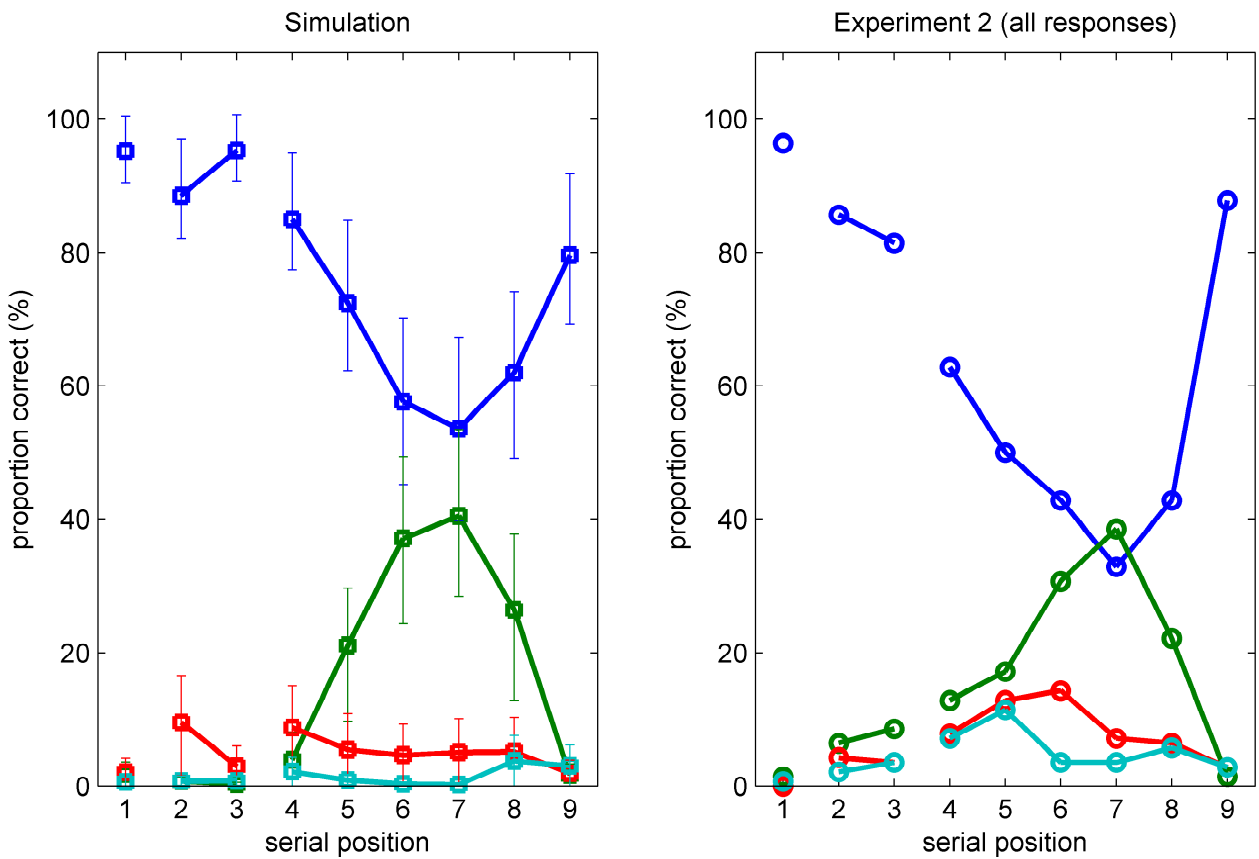
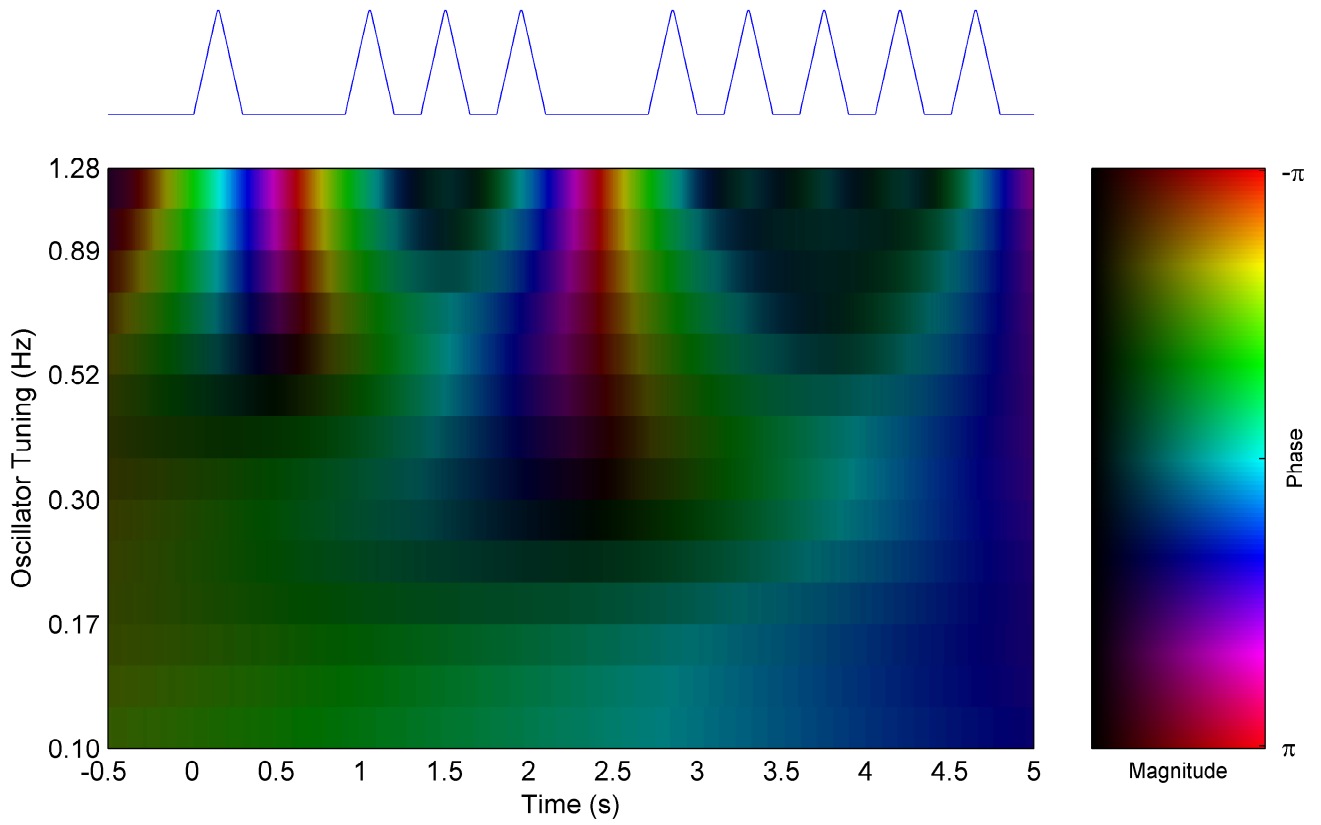


Figure S3: grouping pattern 1-3-5

a)



b)

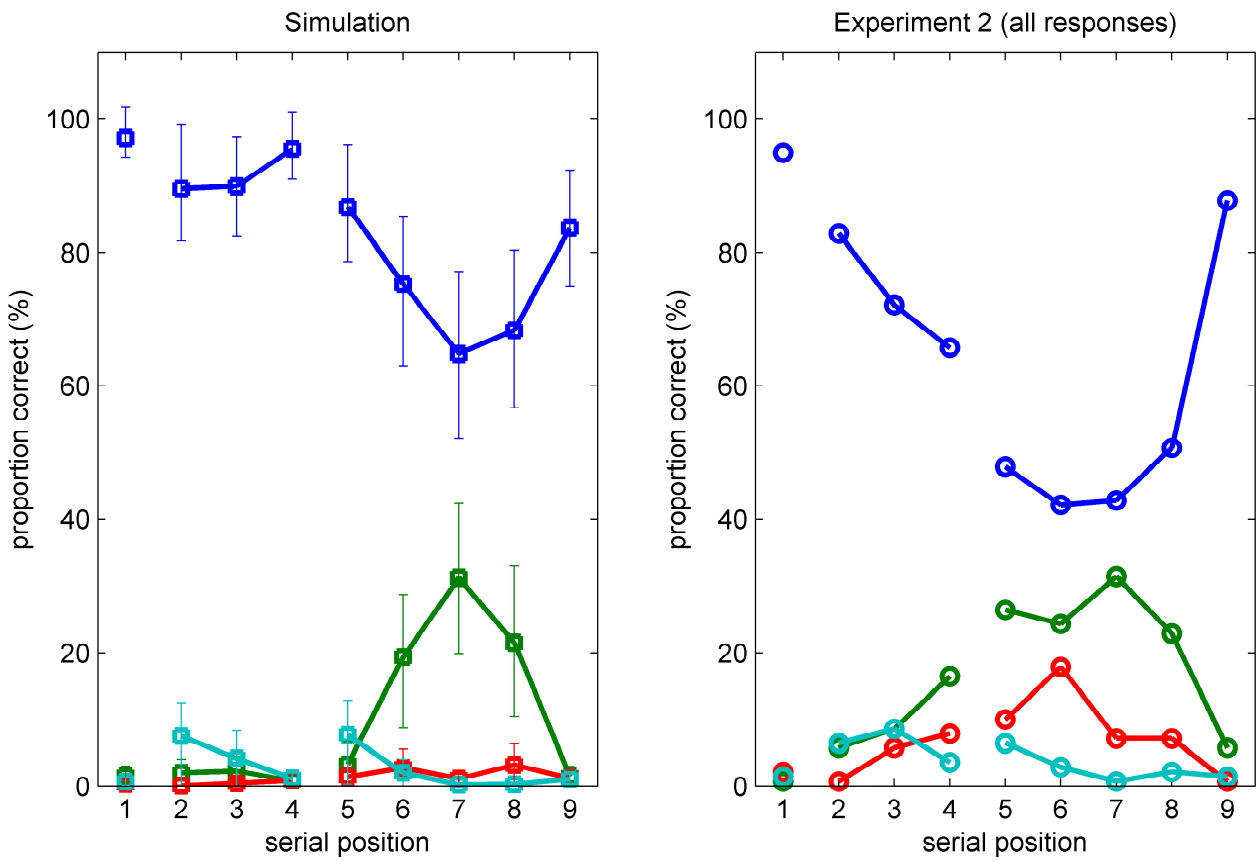
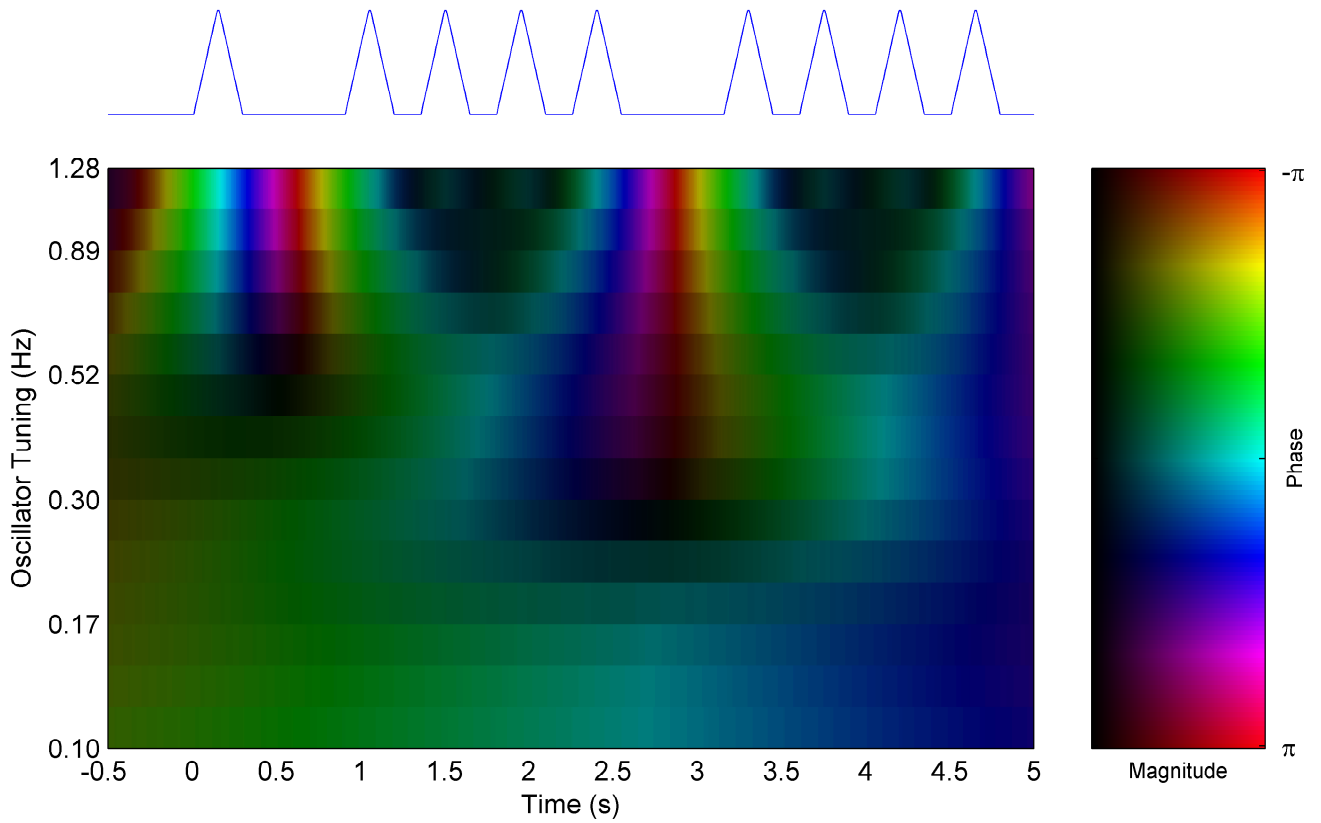


Figure S4: grouping pattern 1-4-4

a)



b)

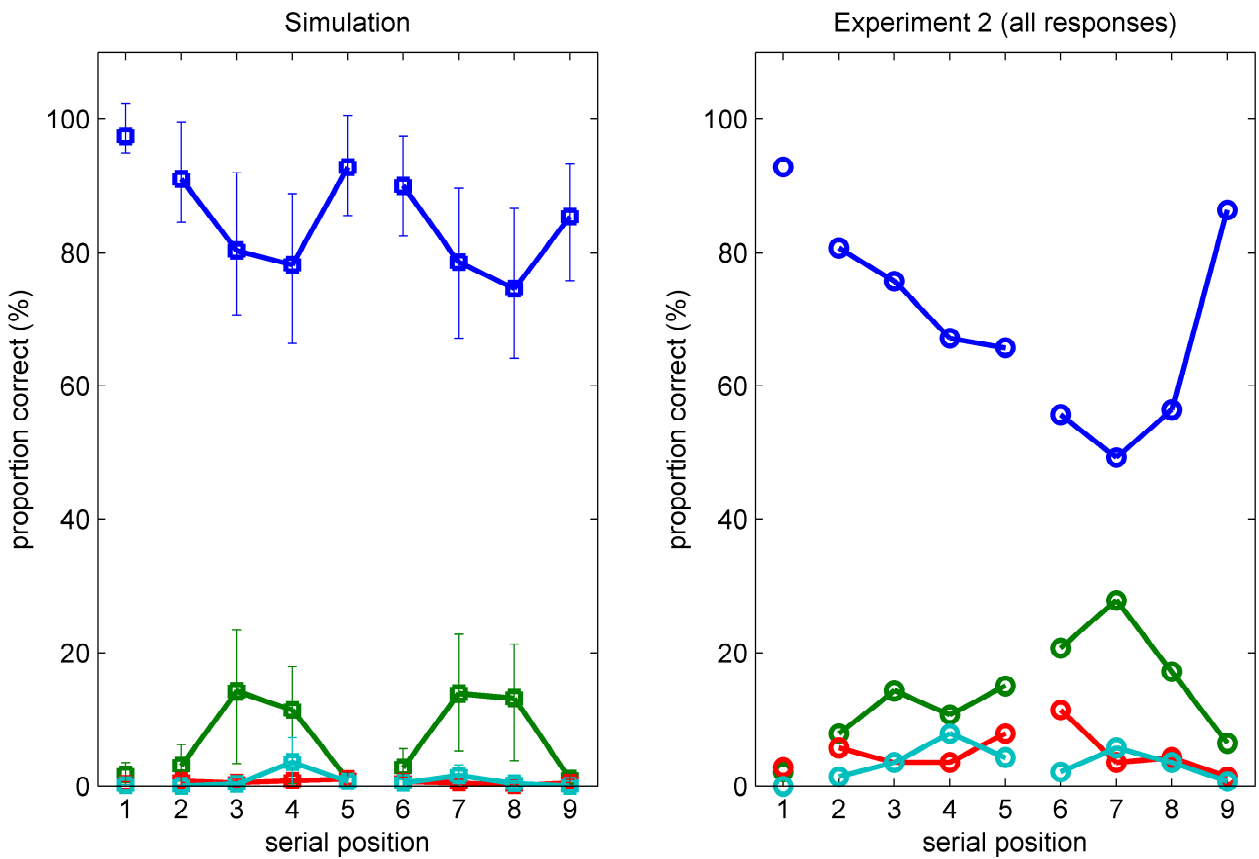
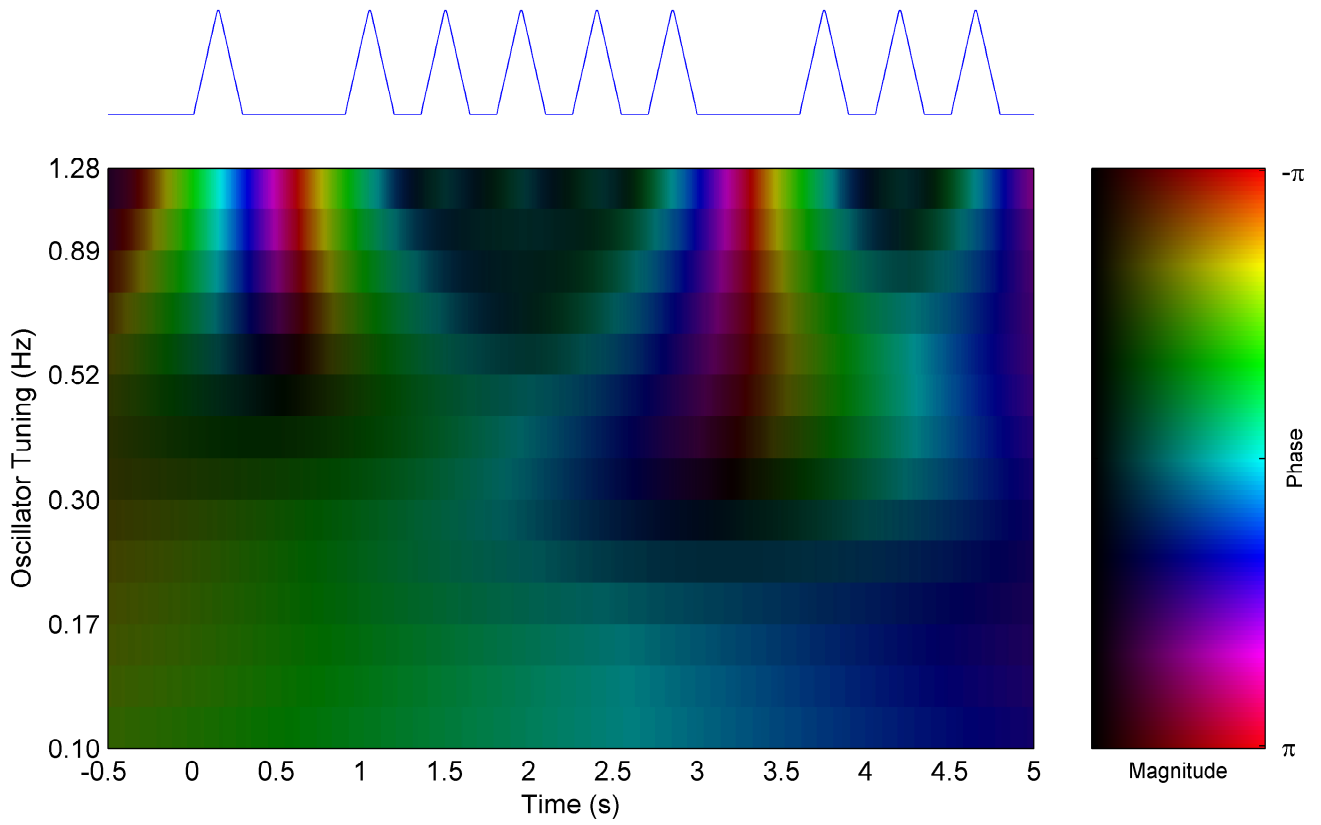


Figure S5: grouping pattern 1-5-3

a)



b)

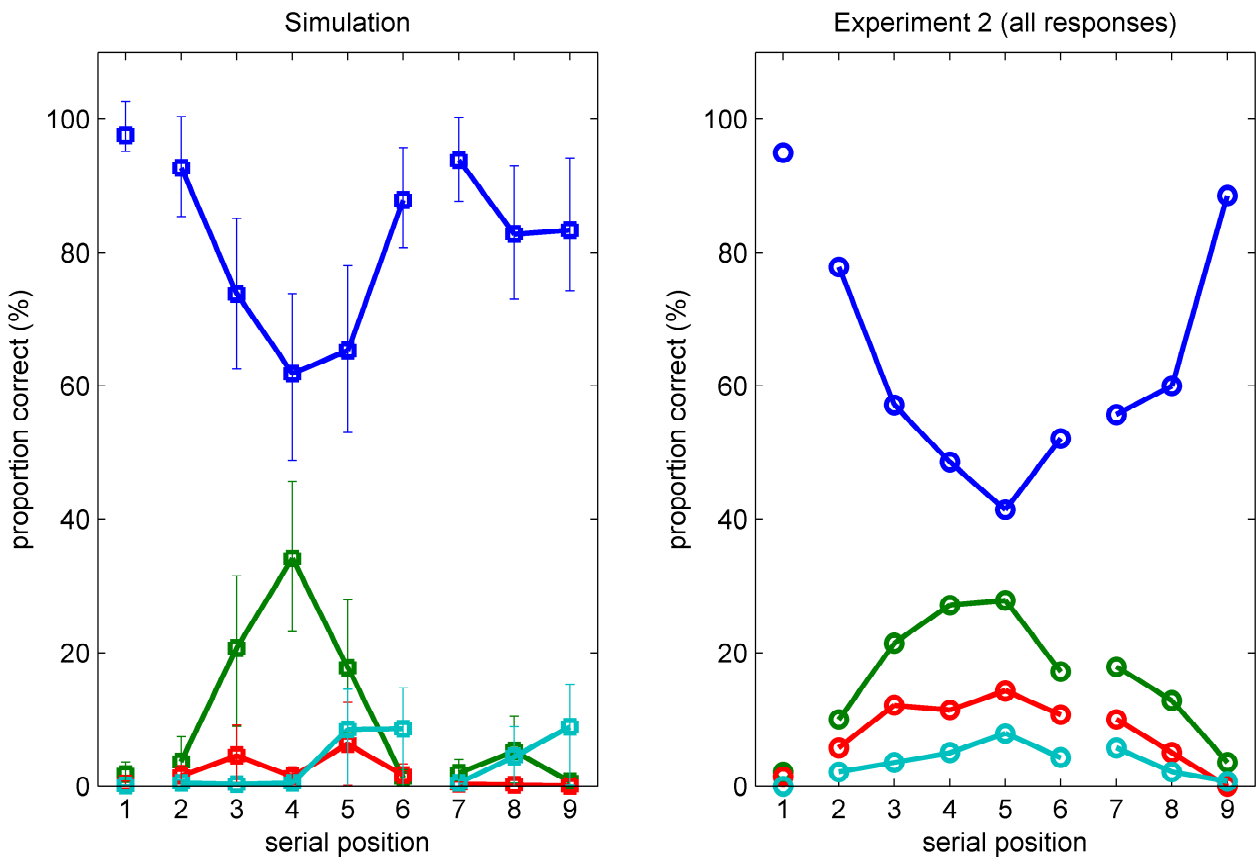
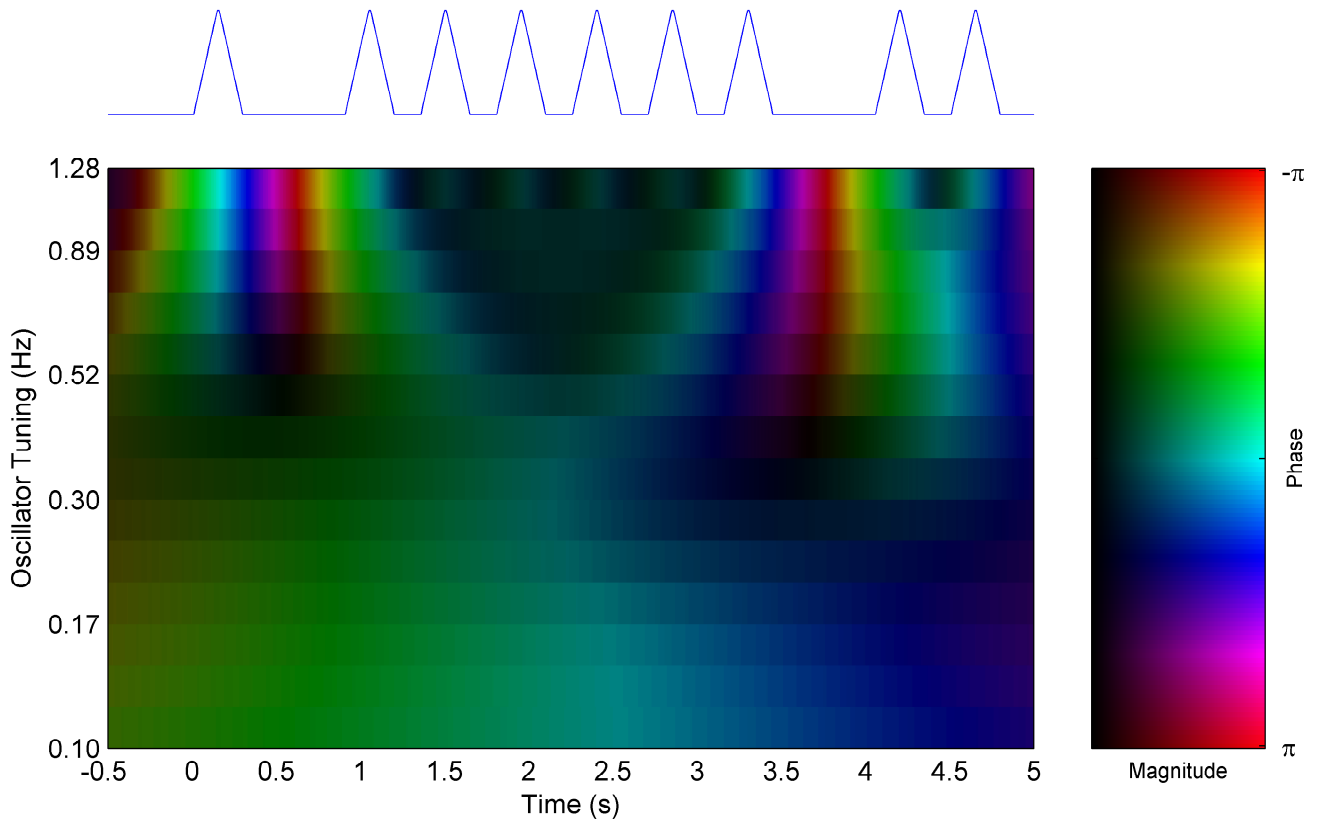




Figure S6: grouping pattern 1-6-2

a)



b)

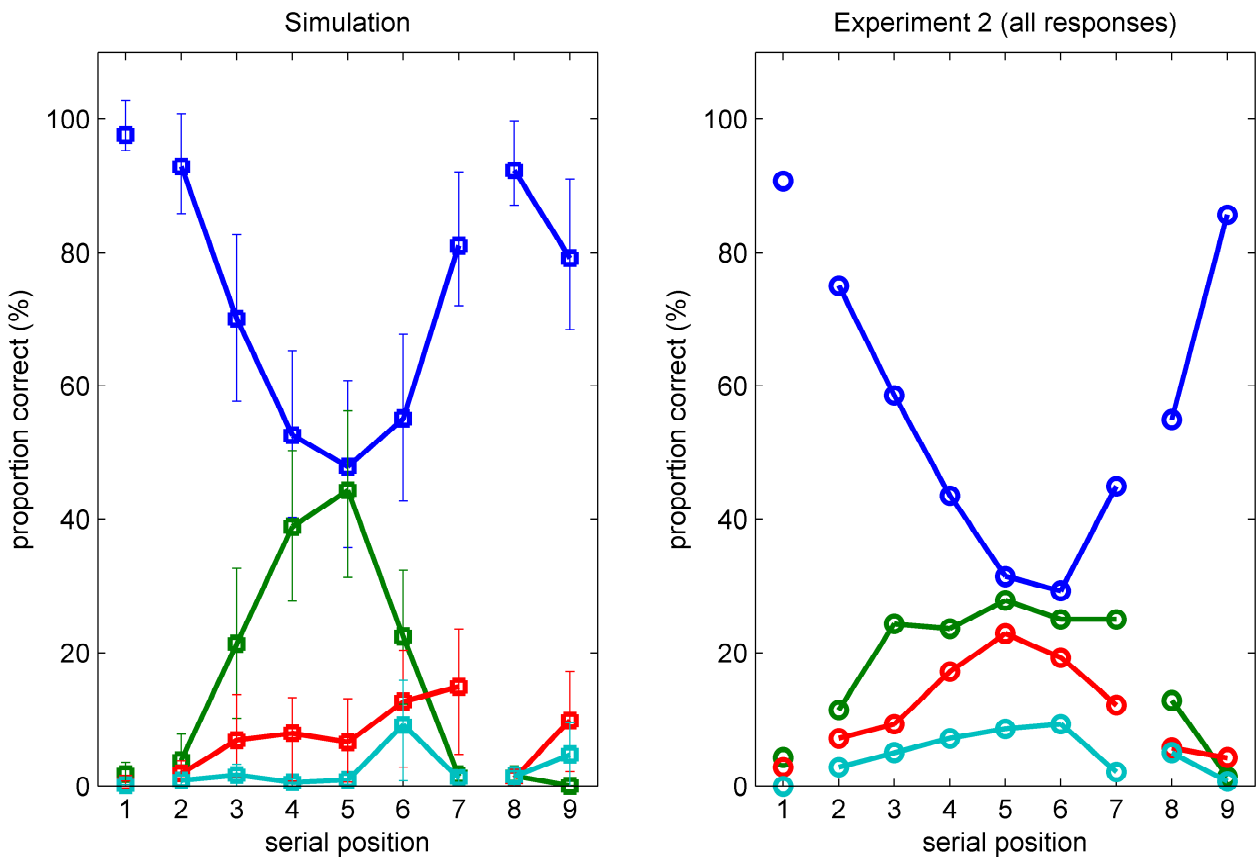
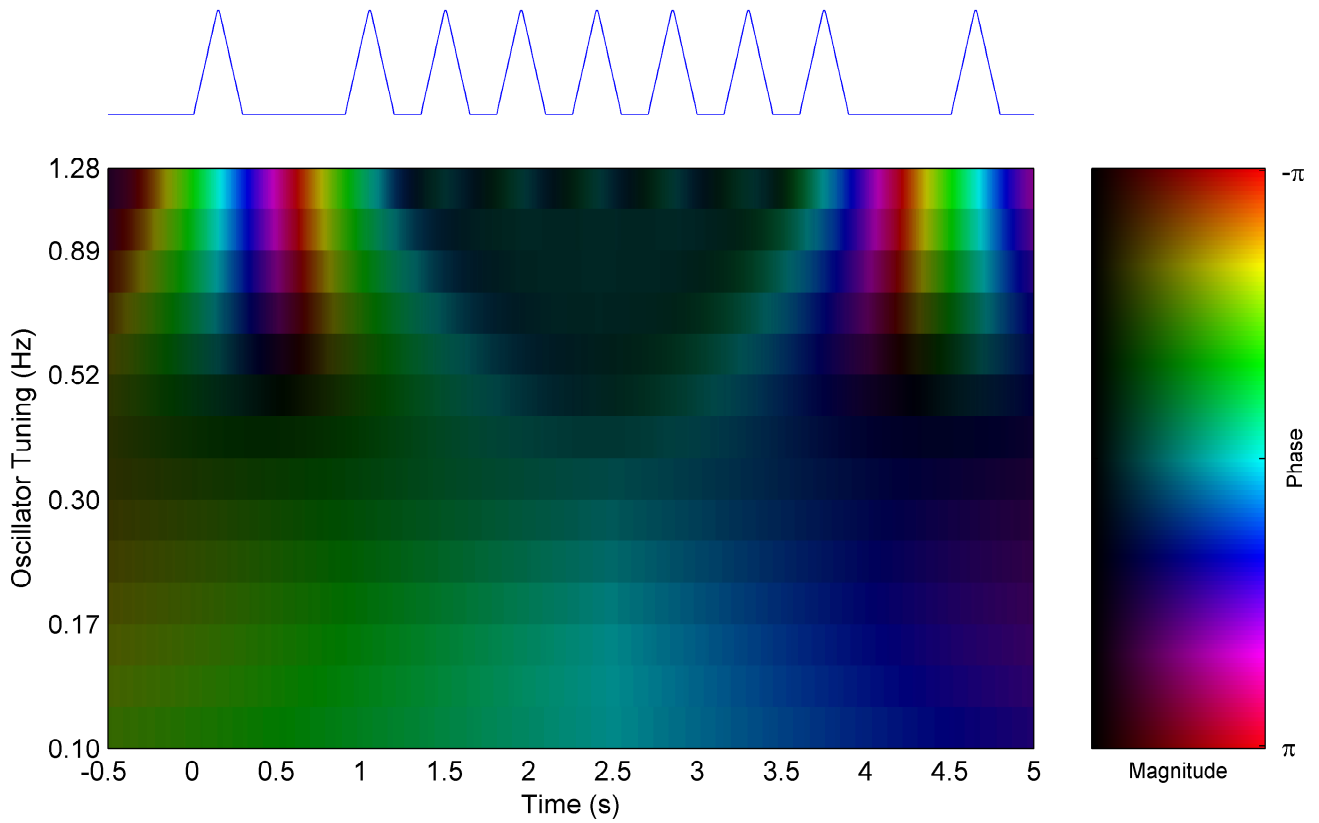


Figure S7: grouping pattern 1-7-1

a)



b)

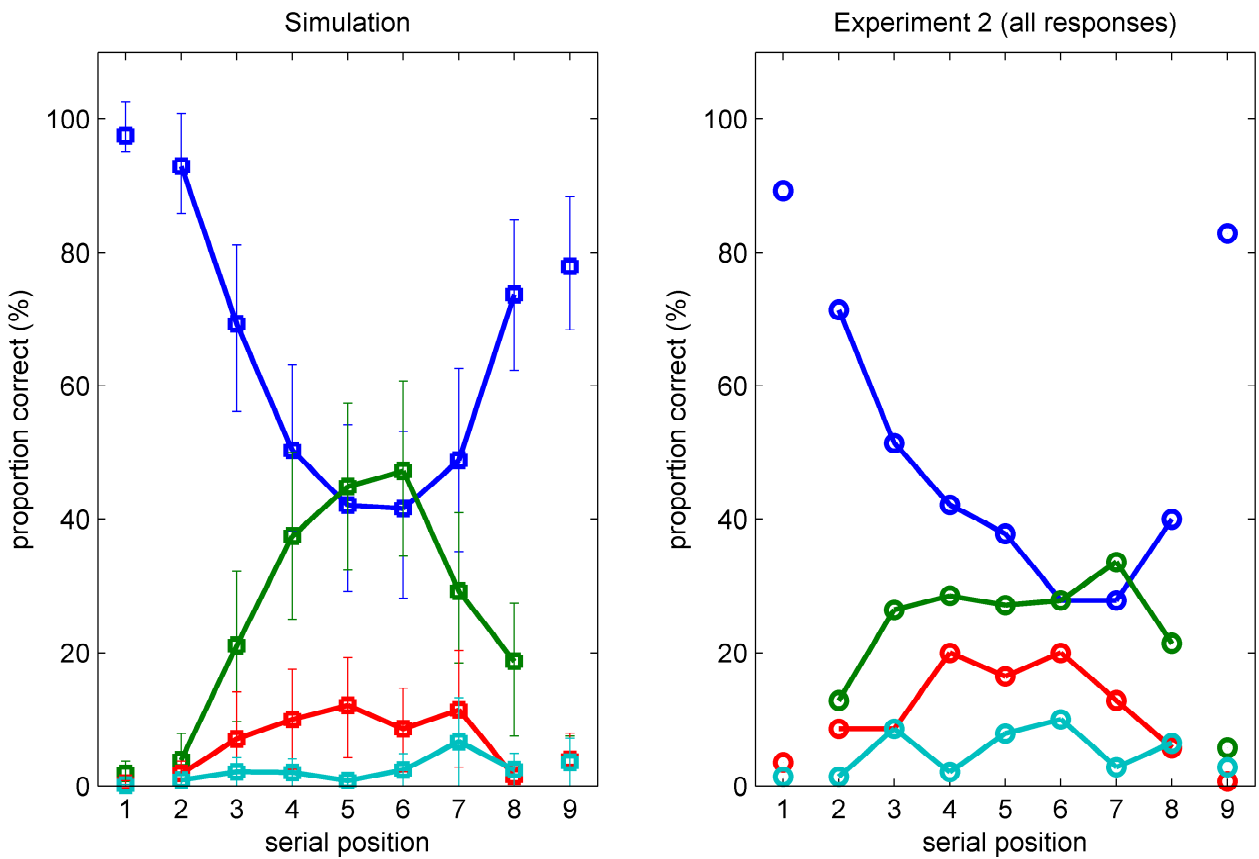
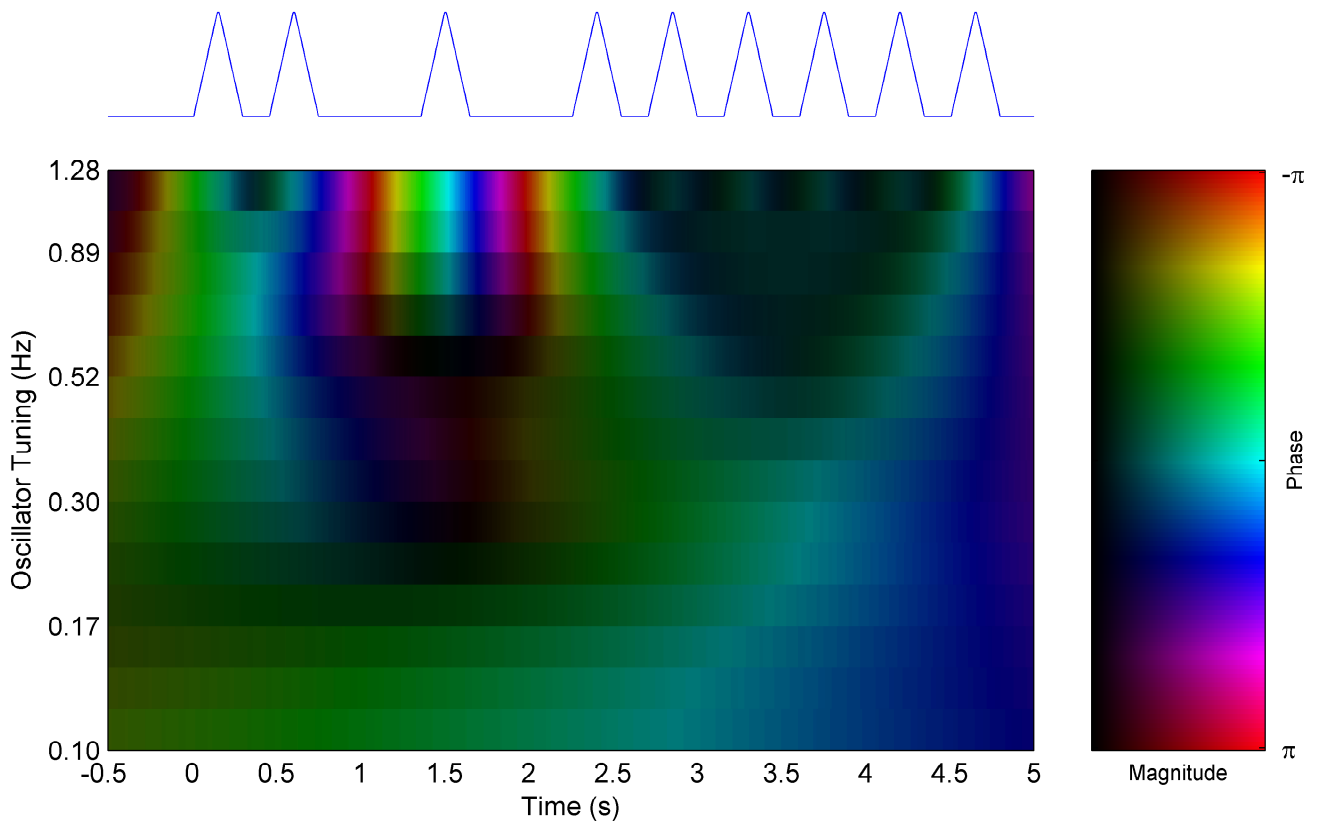


Figure S8: grouping pattern 2-1-6

a)



b)

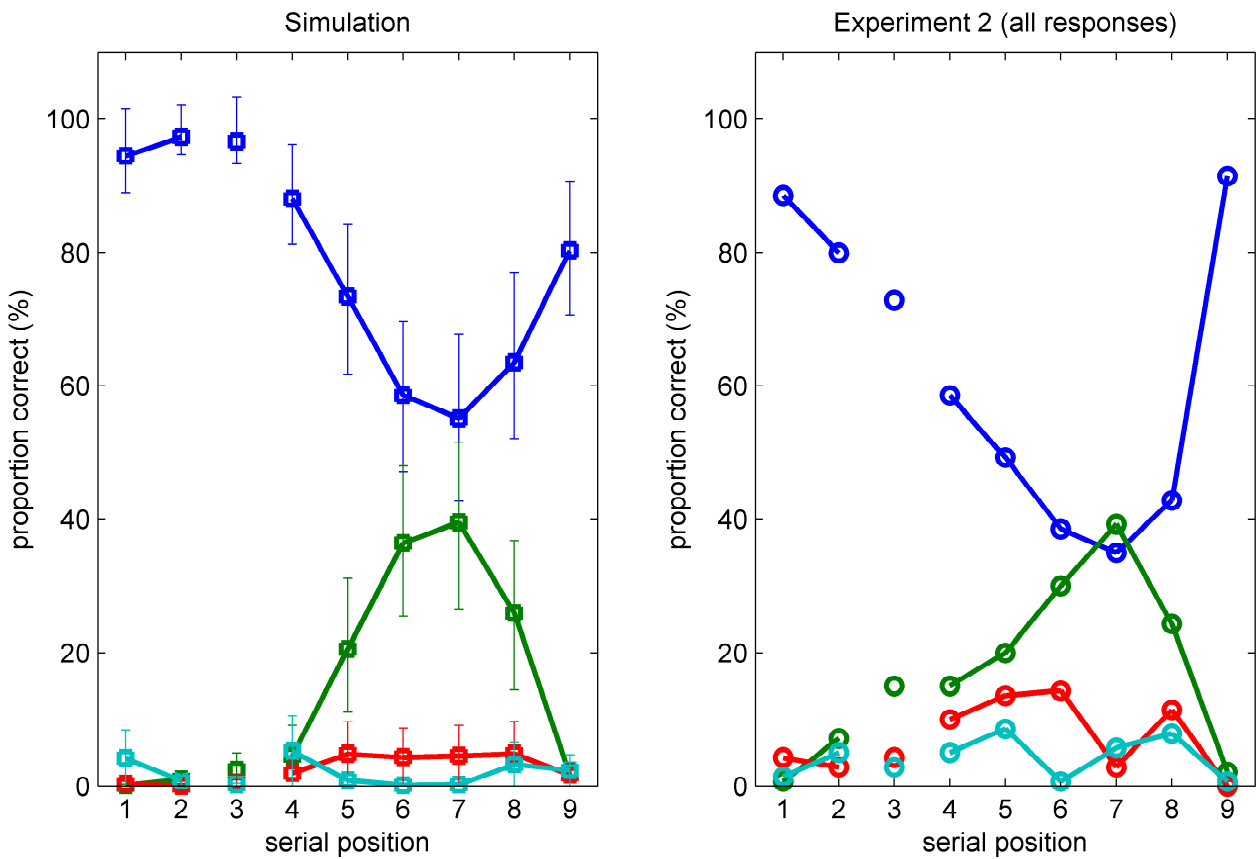
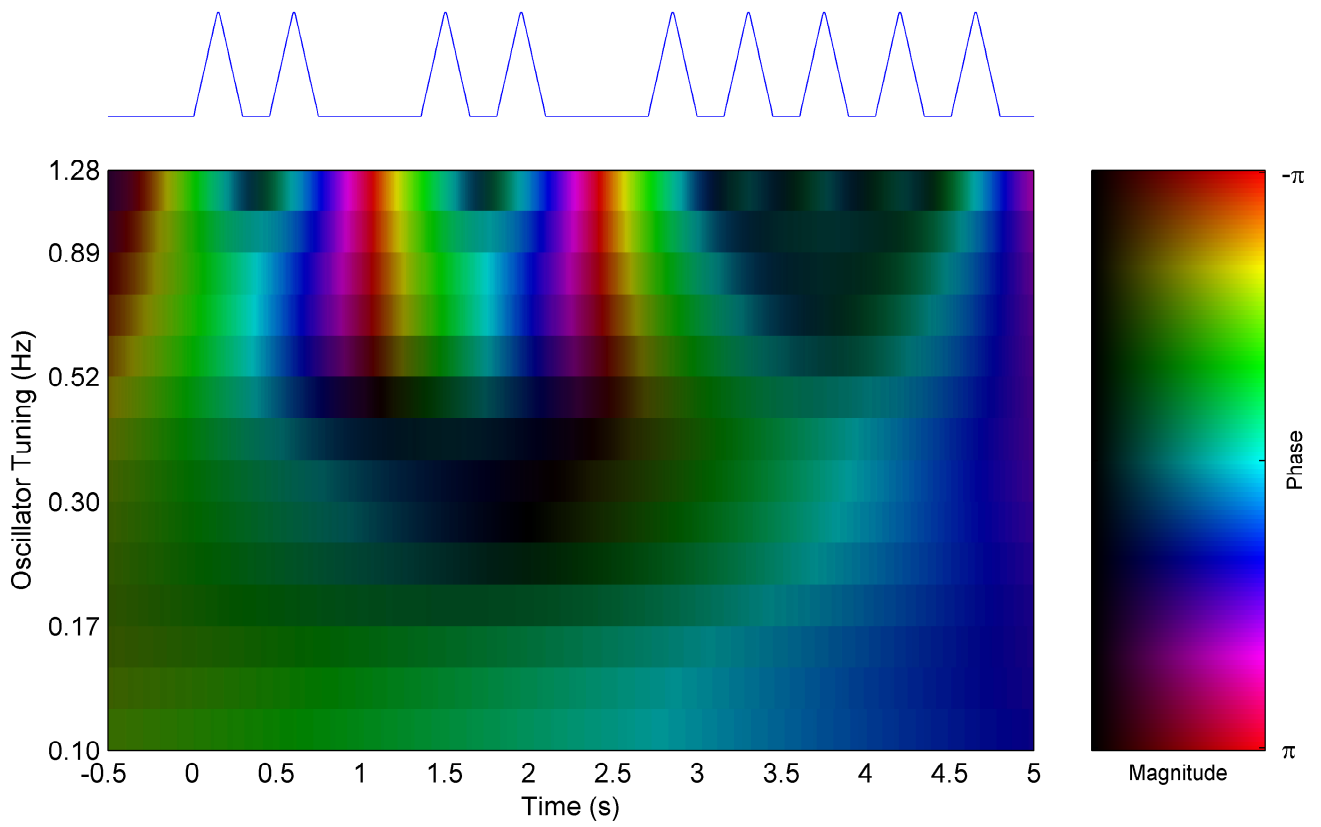


Figure S9: grouping pattern 2-2-5

a)



b)

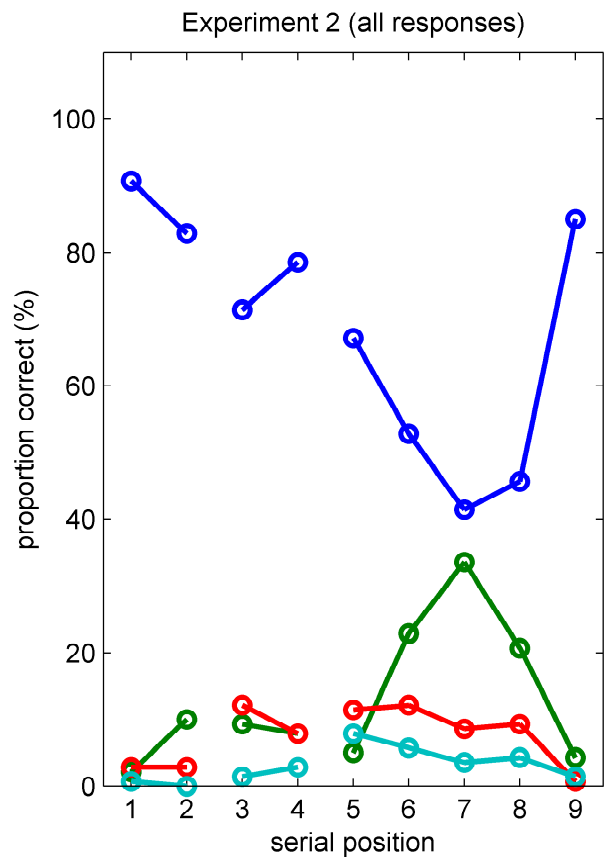
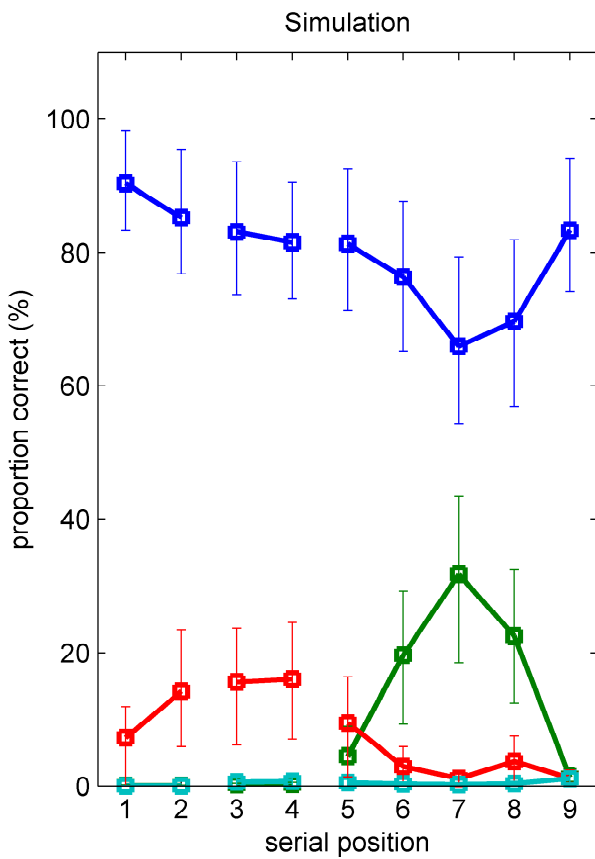
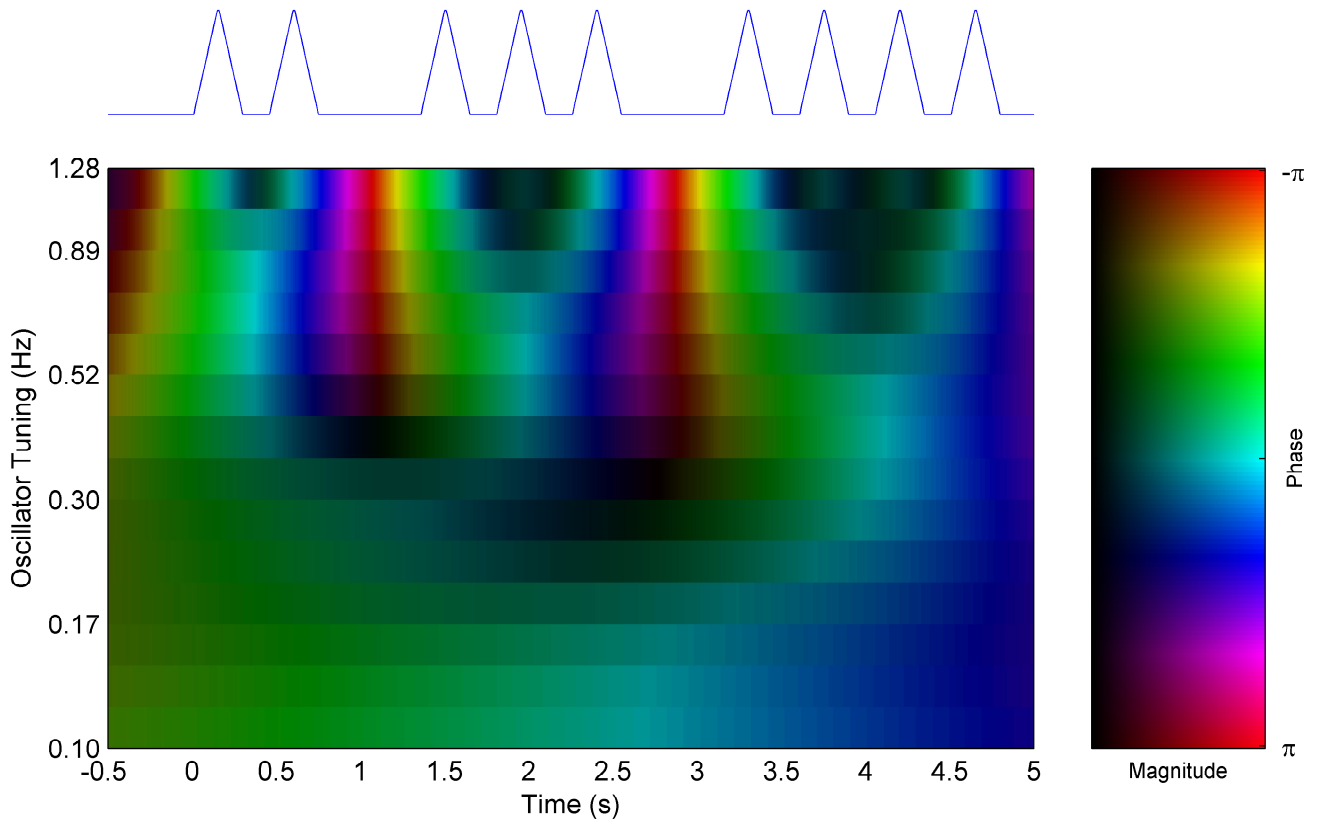


Figure S10: grouping pattern 2-3-4

a)



b)

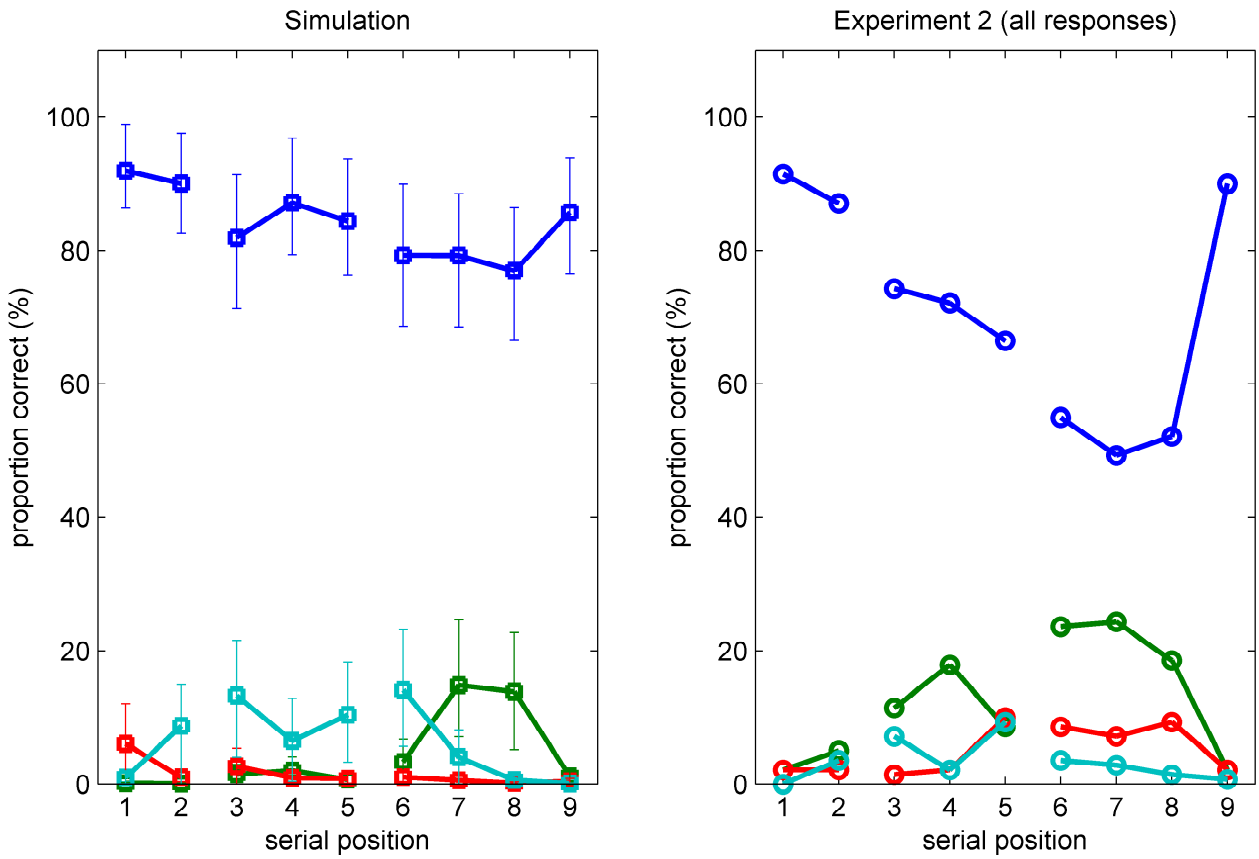
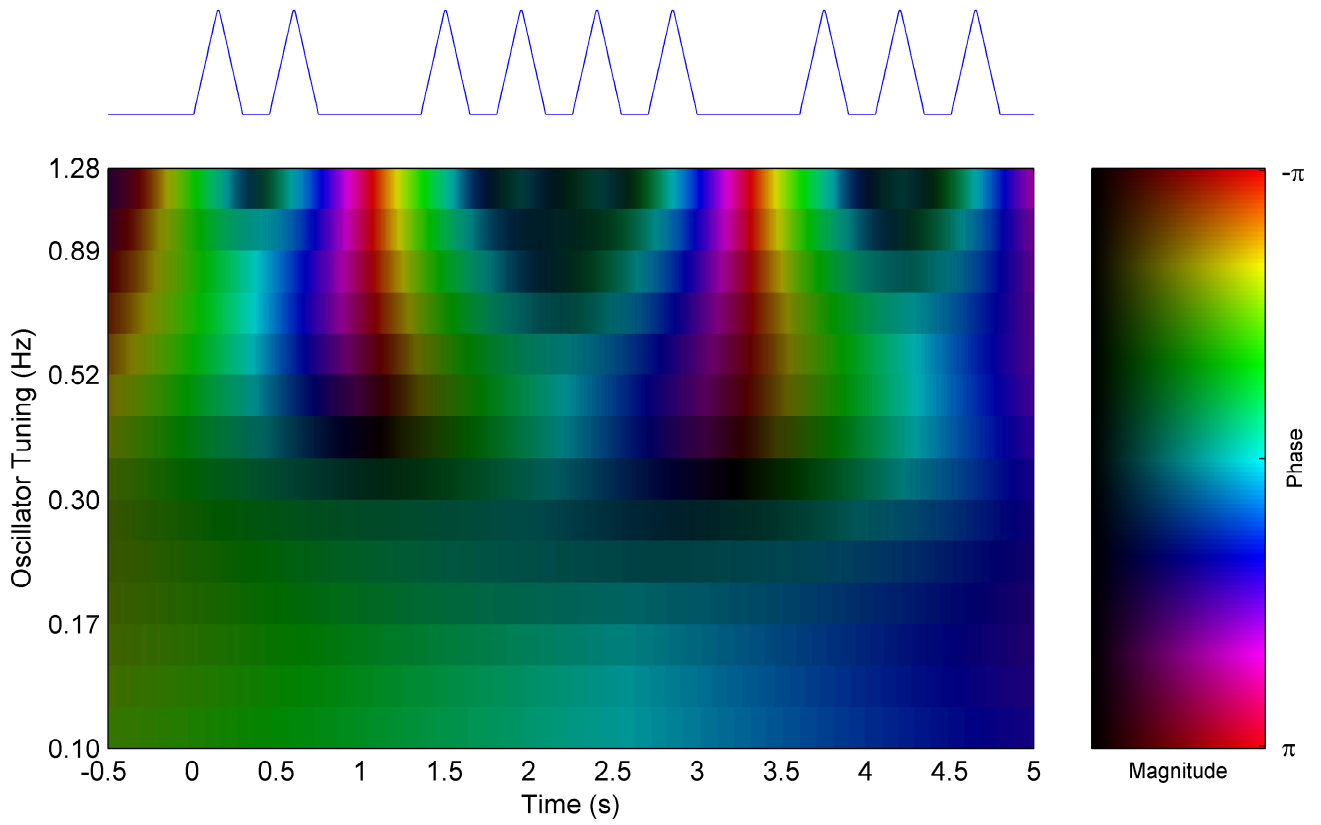


Figure S11: grouping pattern 2-4-3

a)



b)

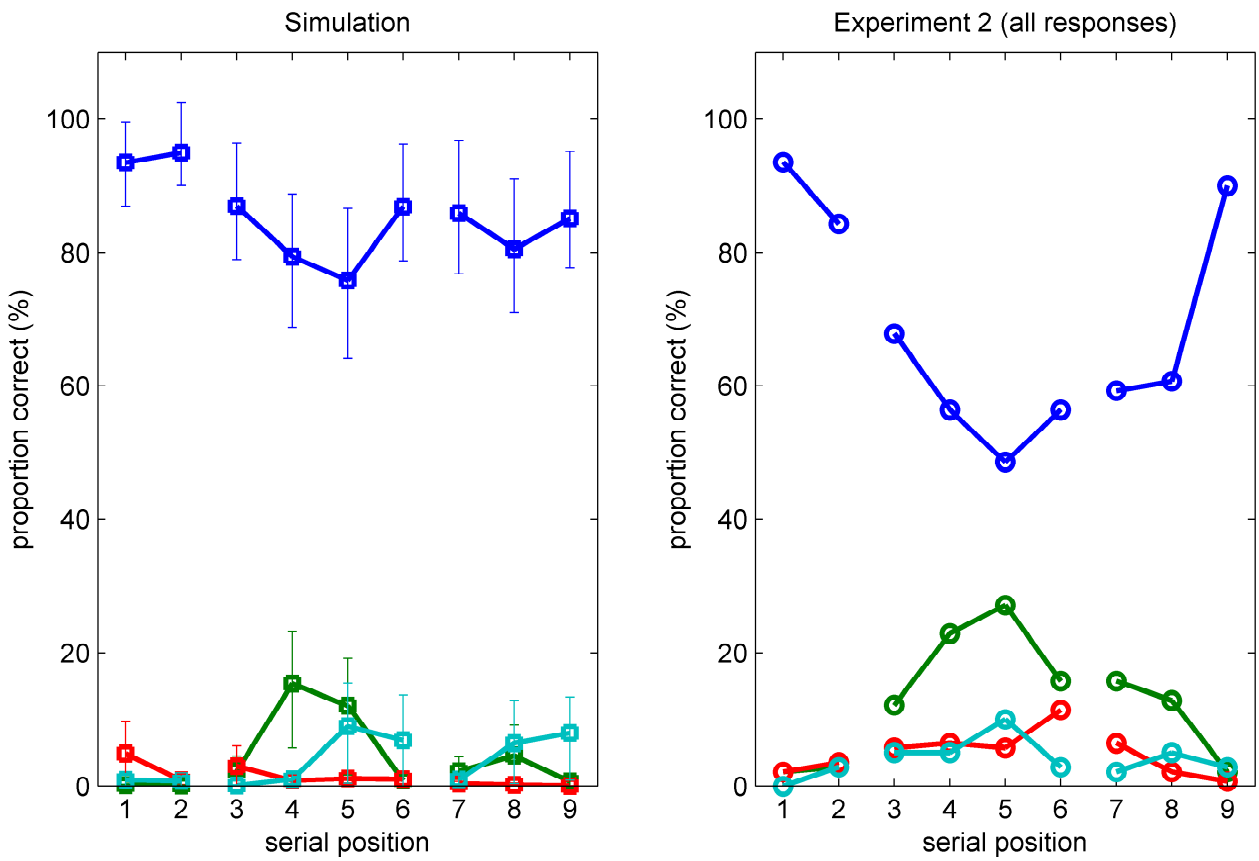
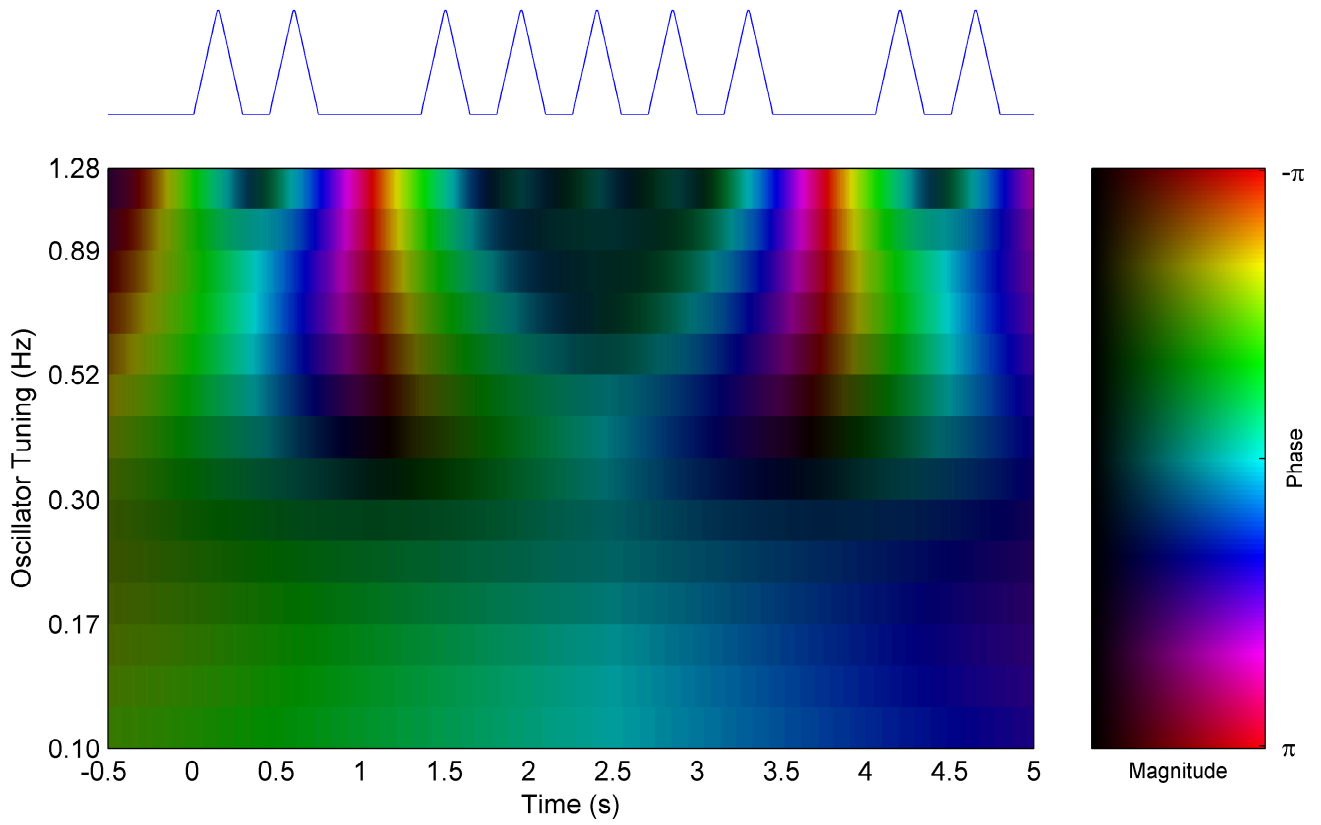


Figure S12: grouping pattern 2-5-2

a)



b)

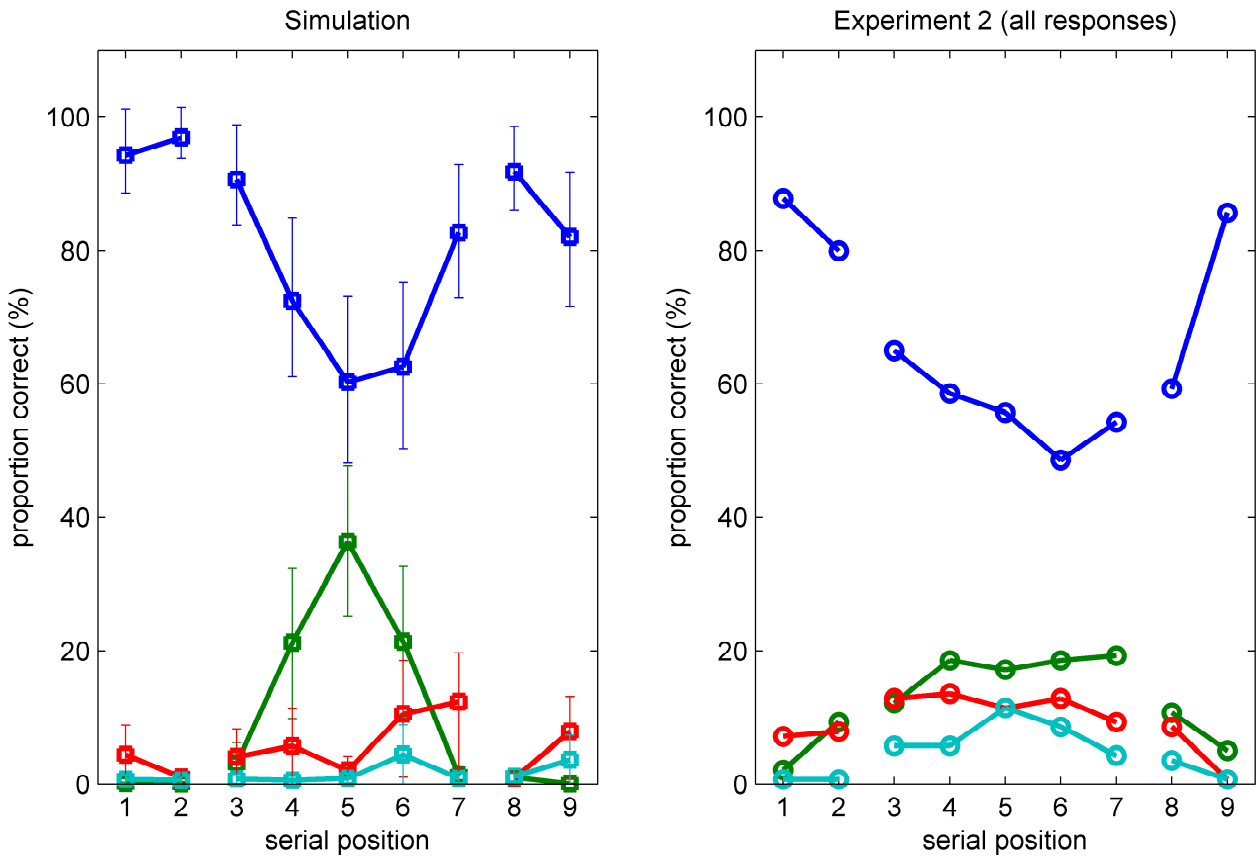
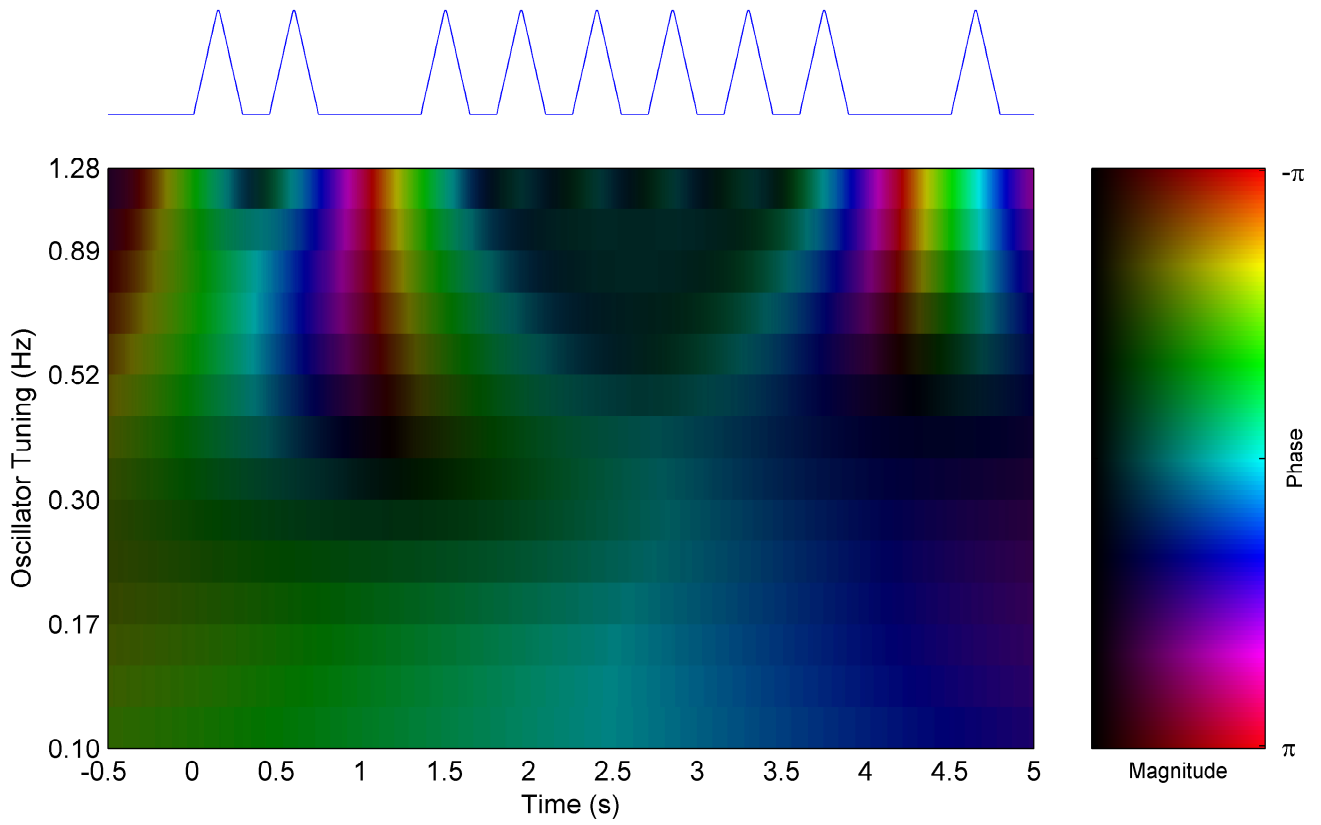


Figure S13: grouping pattern 2-6-1

a)



b)

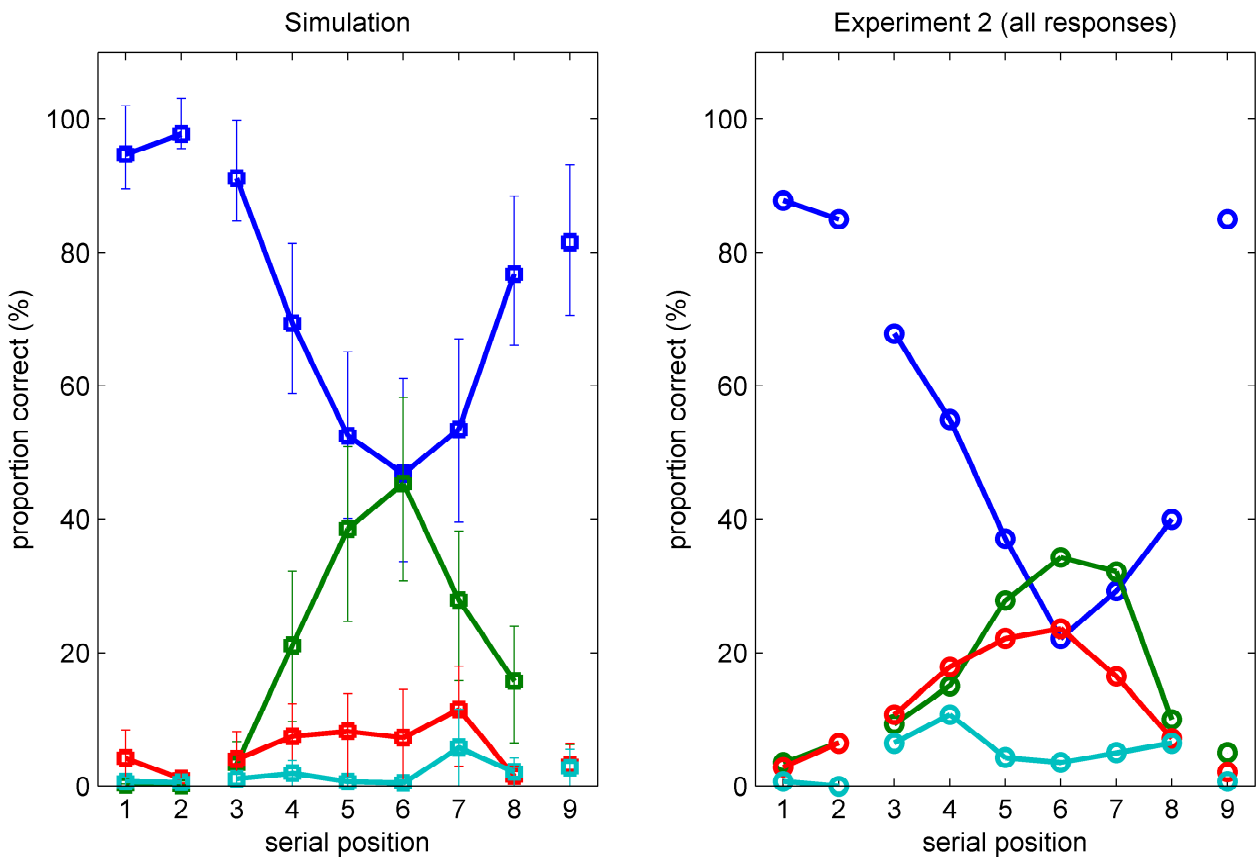
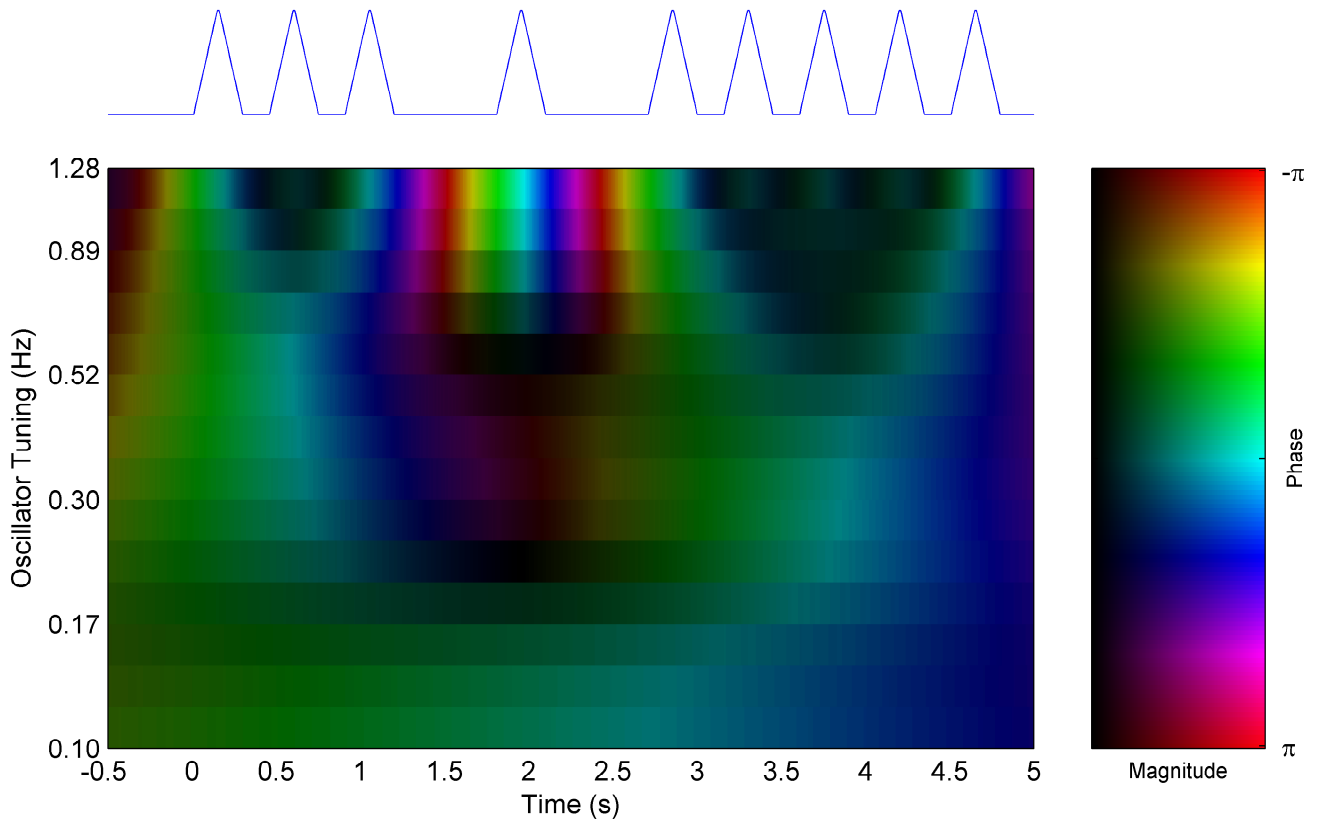




Figure S14: grouping pattern 3-1-5

a)



b)

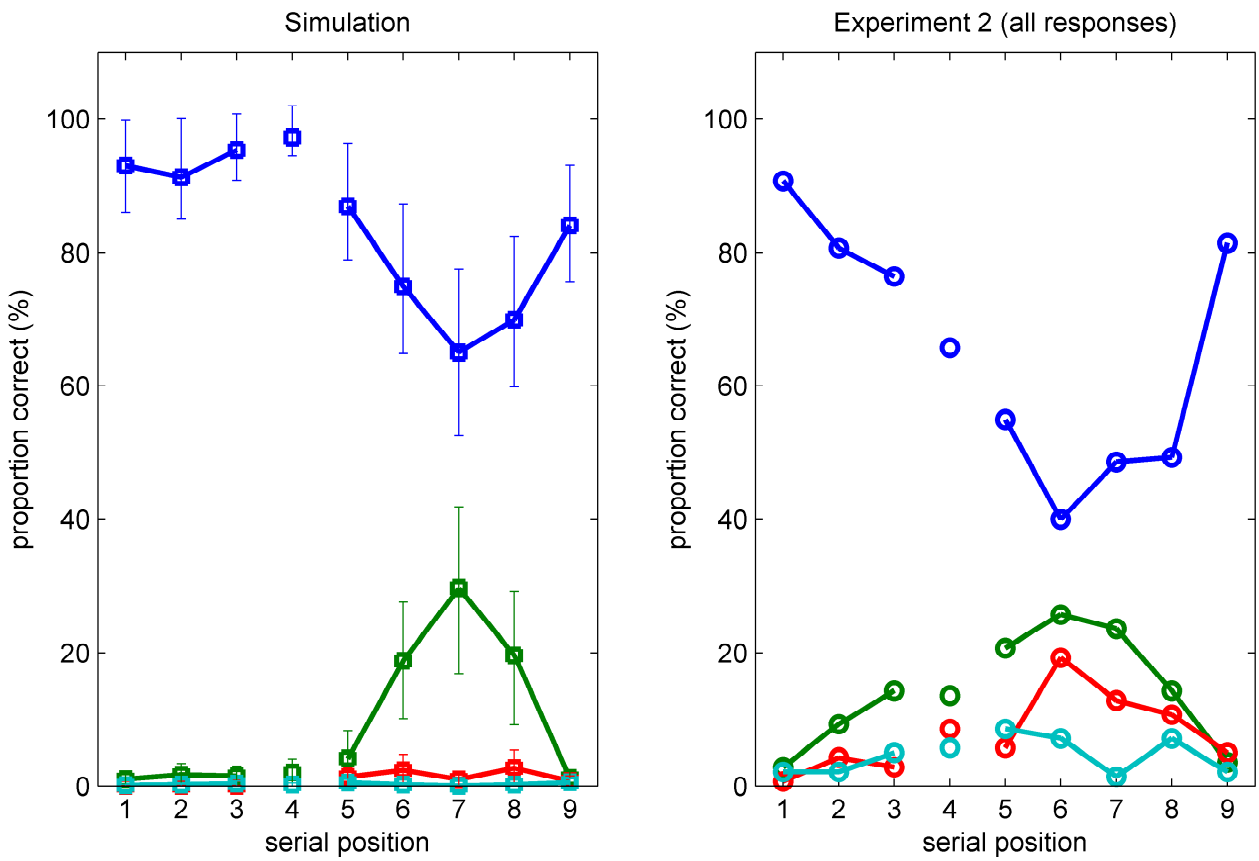
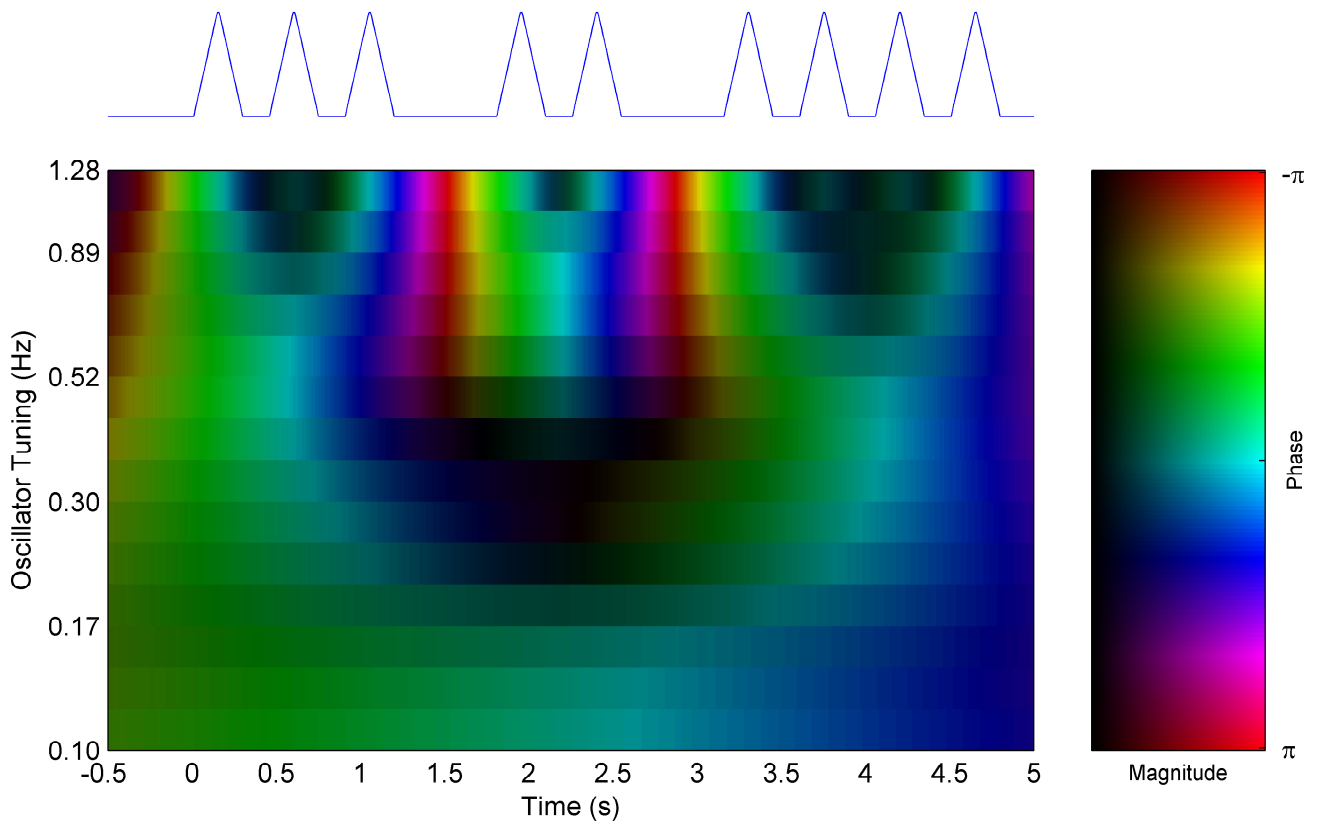


Figure S15: grouping pattern 3-2-4

a)



b)

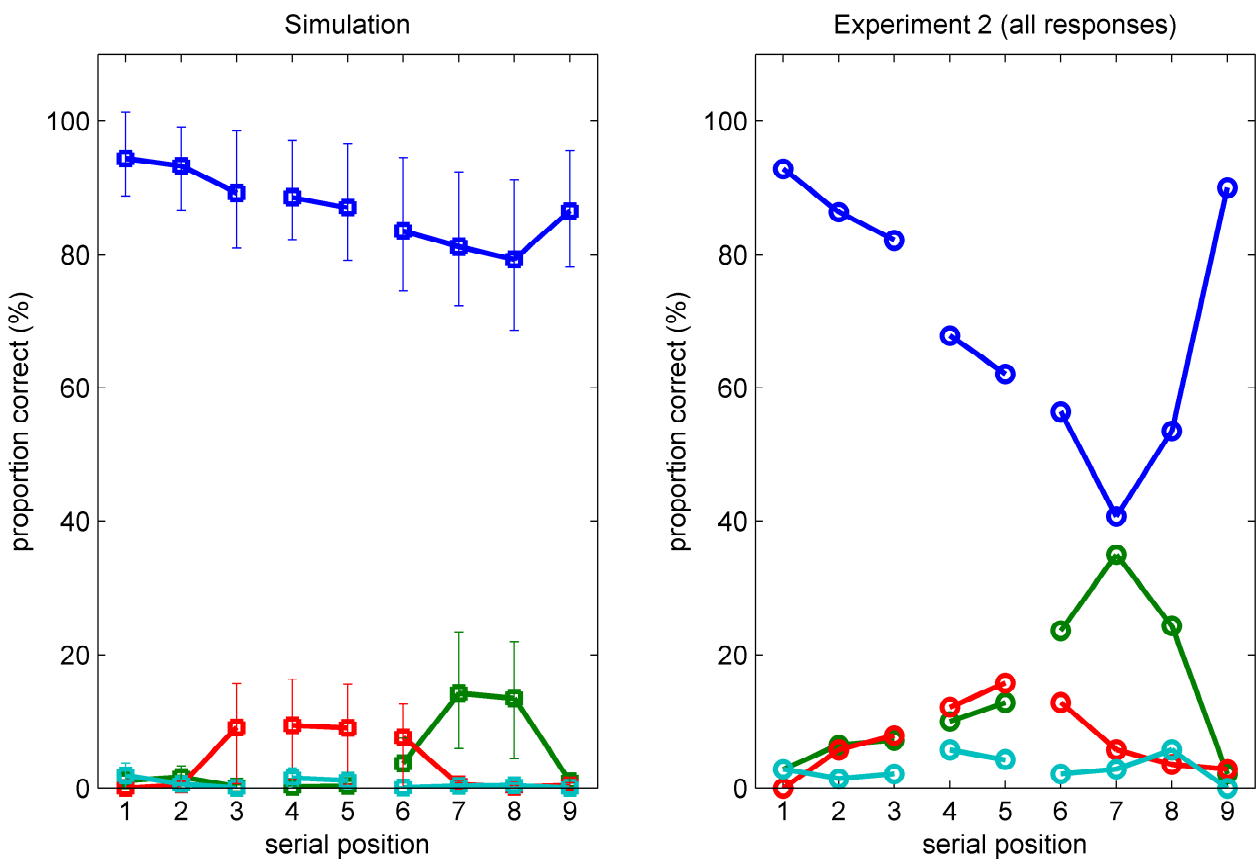
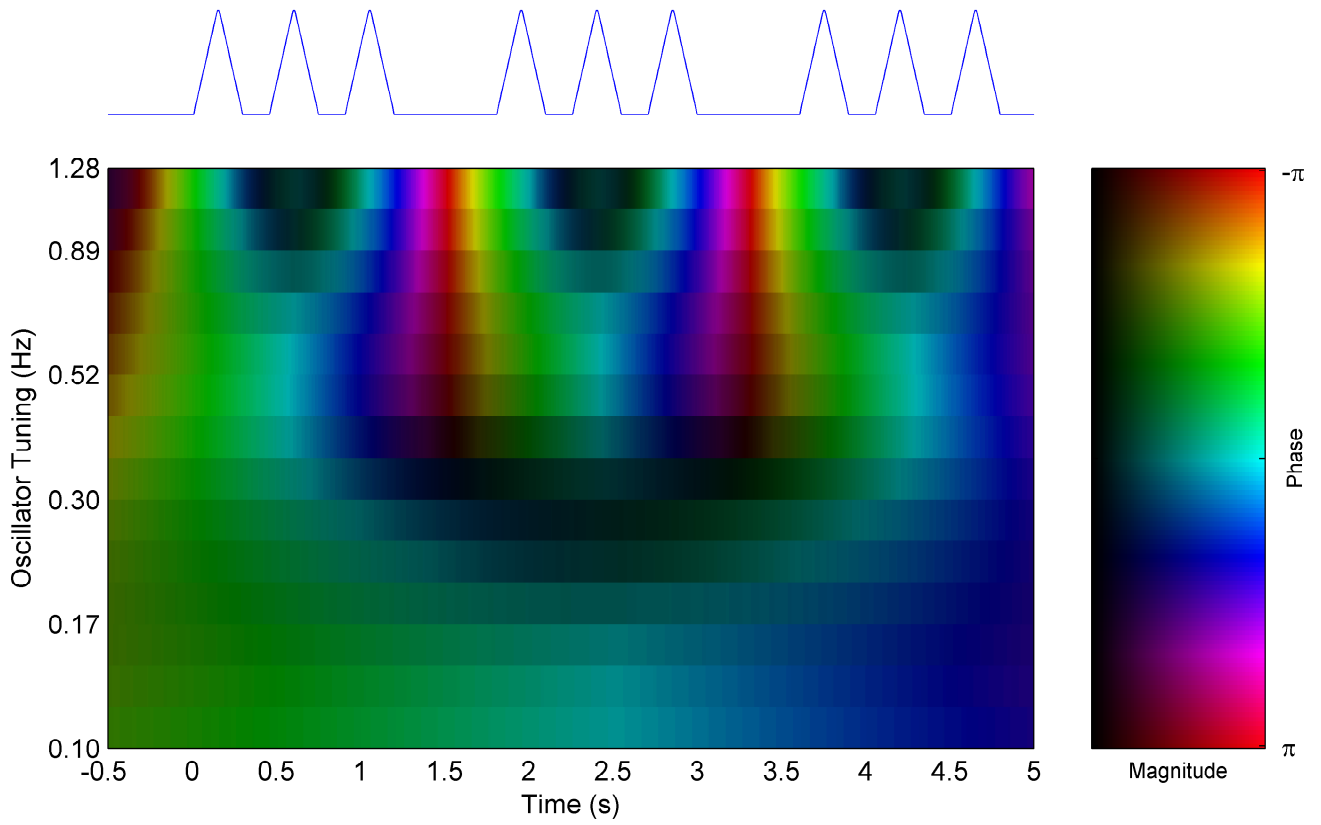


Figure S16: grouping pattern 3-3-3

a)



b)

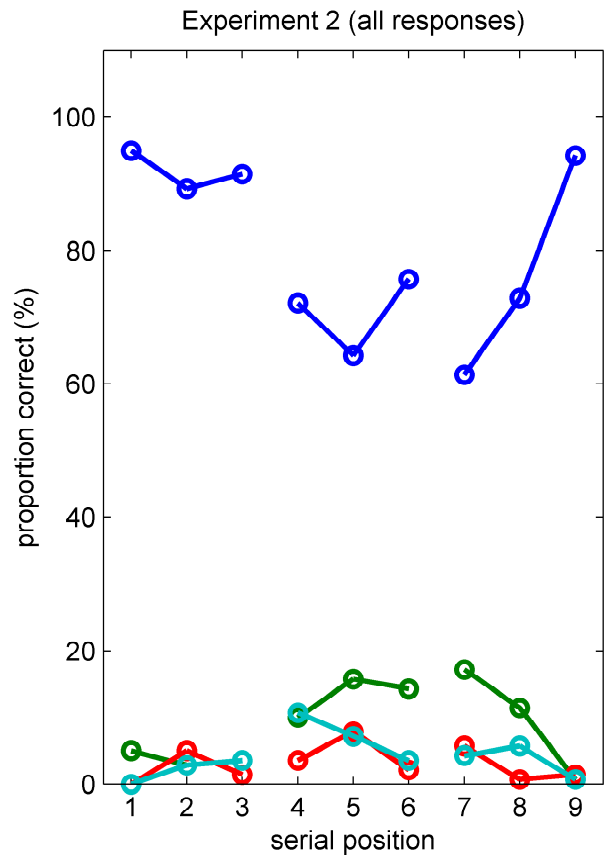
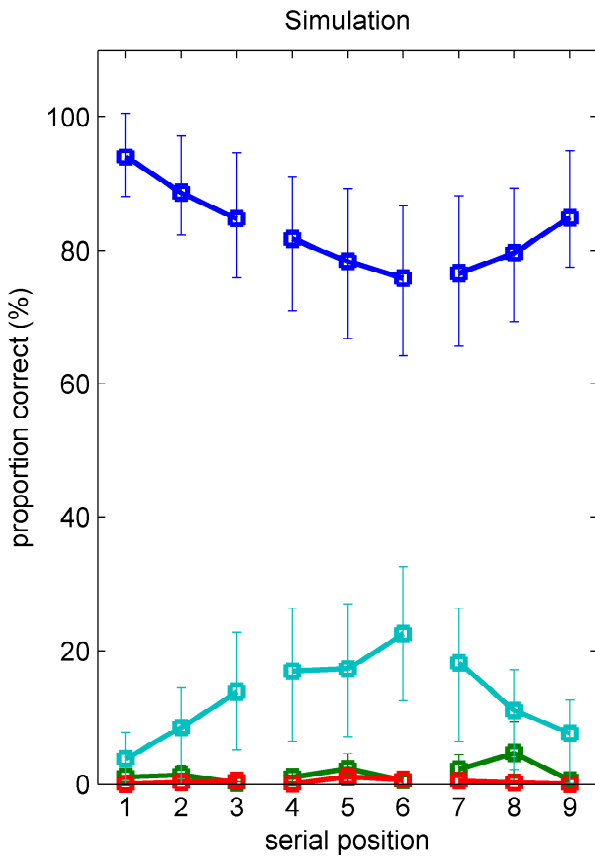
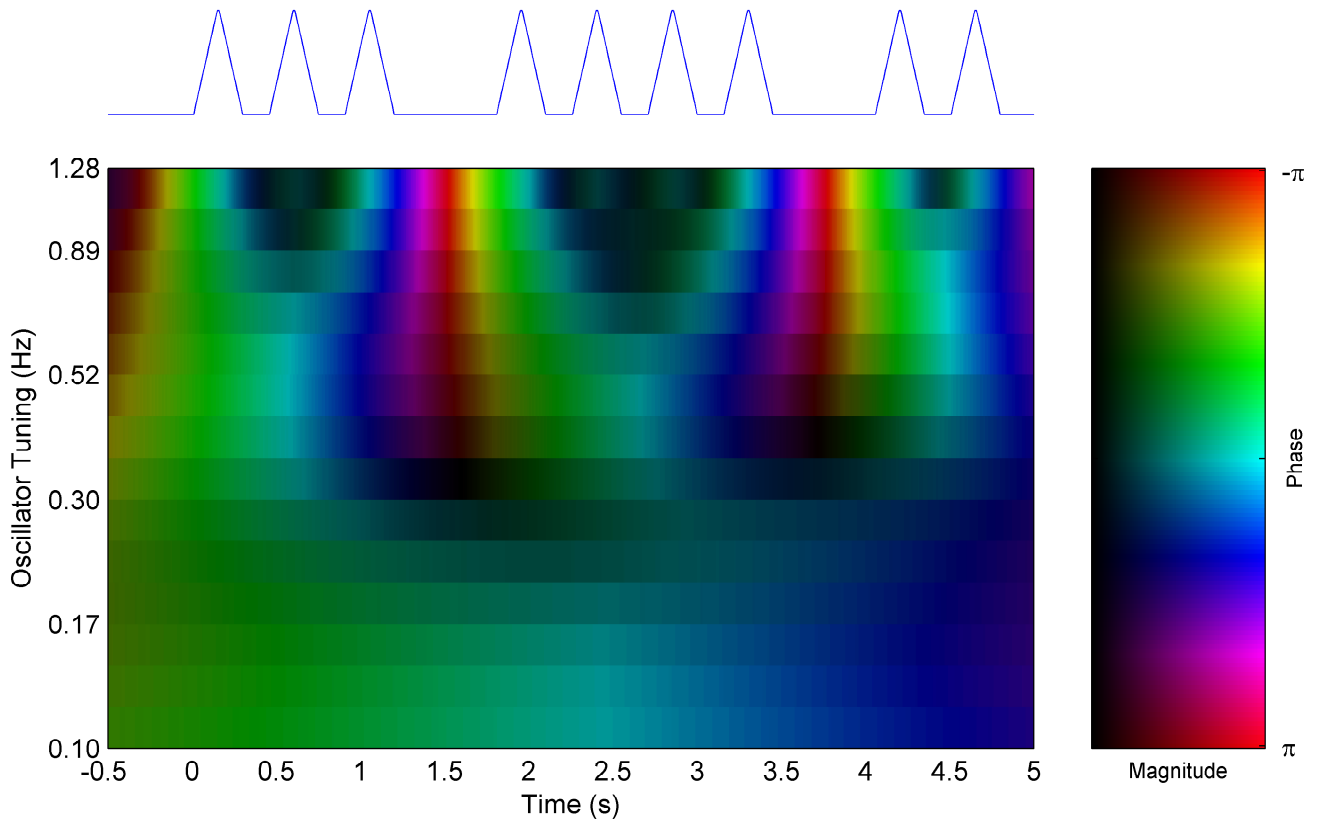


Figure S17: grouping pattern 3-4-2

a)



b)

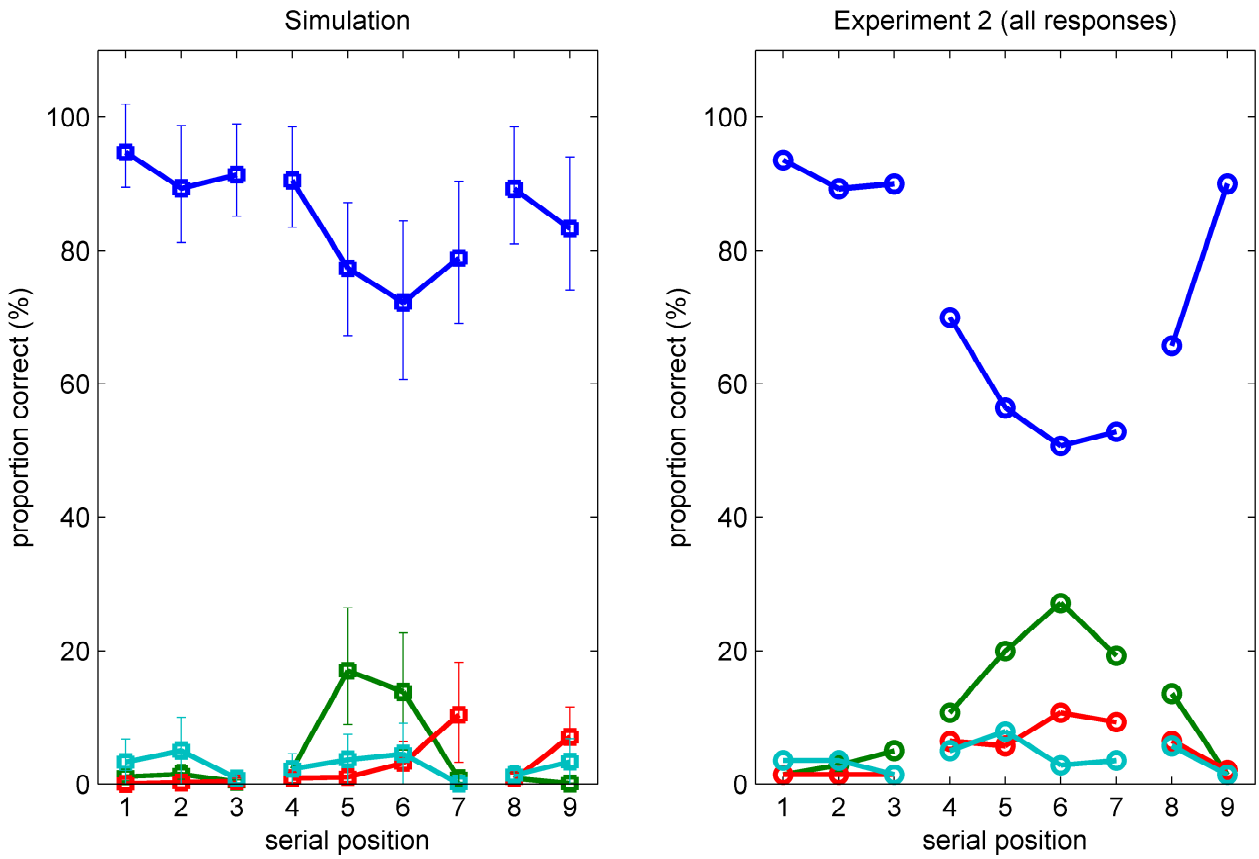
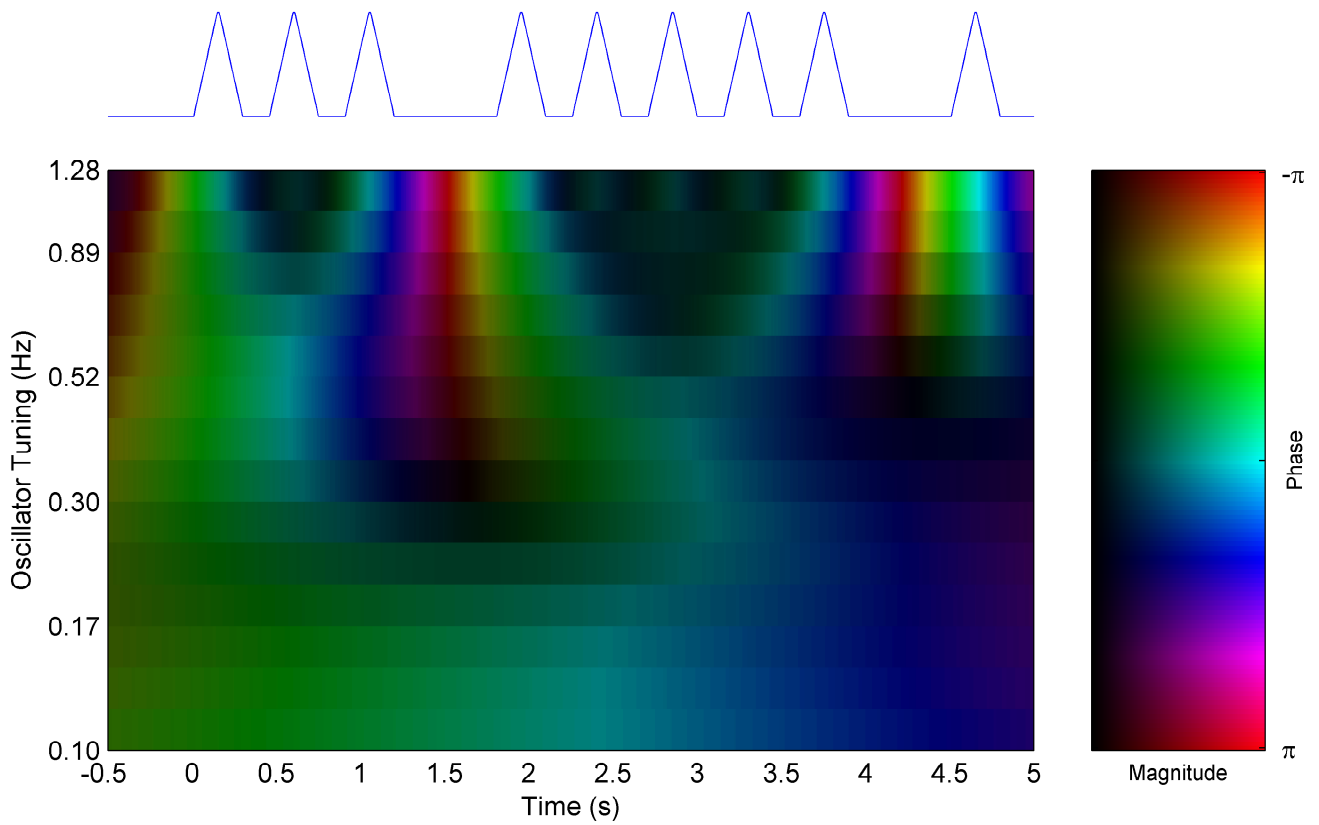


Figure S18: grouping pattern 3-5-1

a)



b)

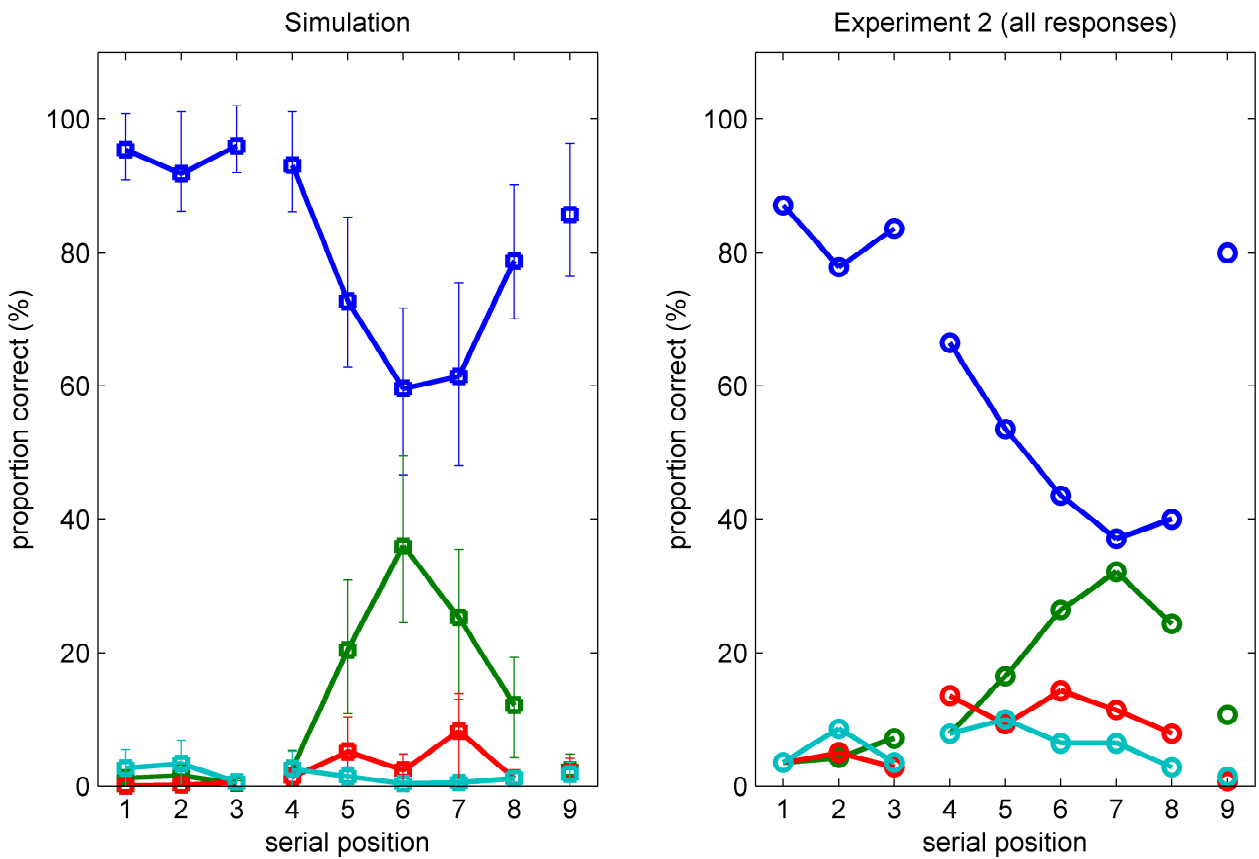
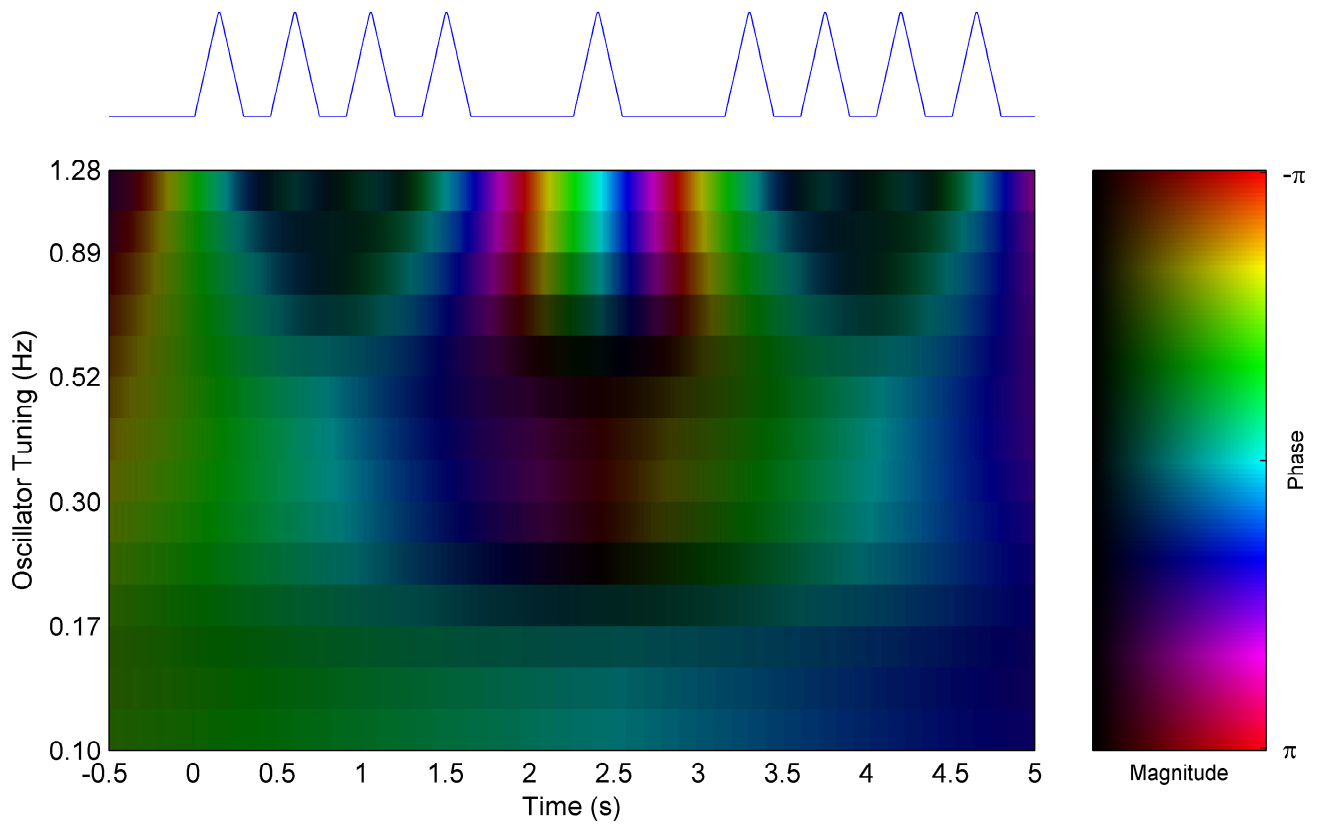


Figure S19: grouping pattern 4-1-4

a)



b)

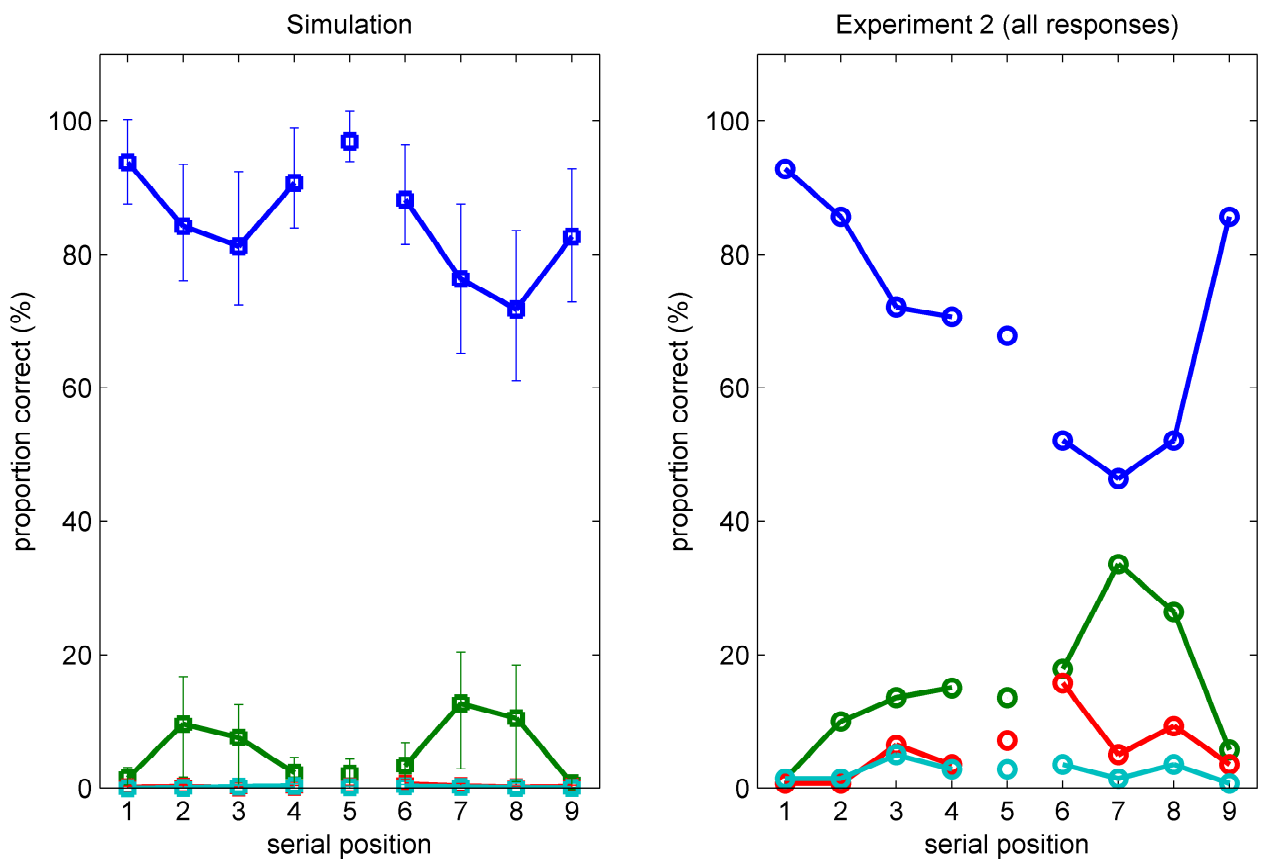
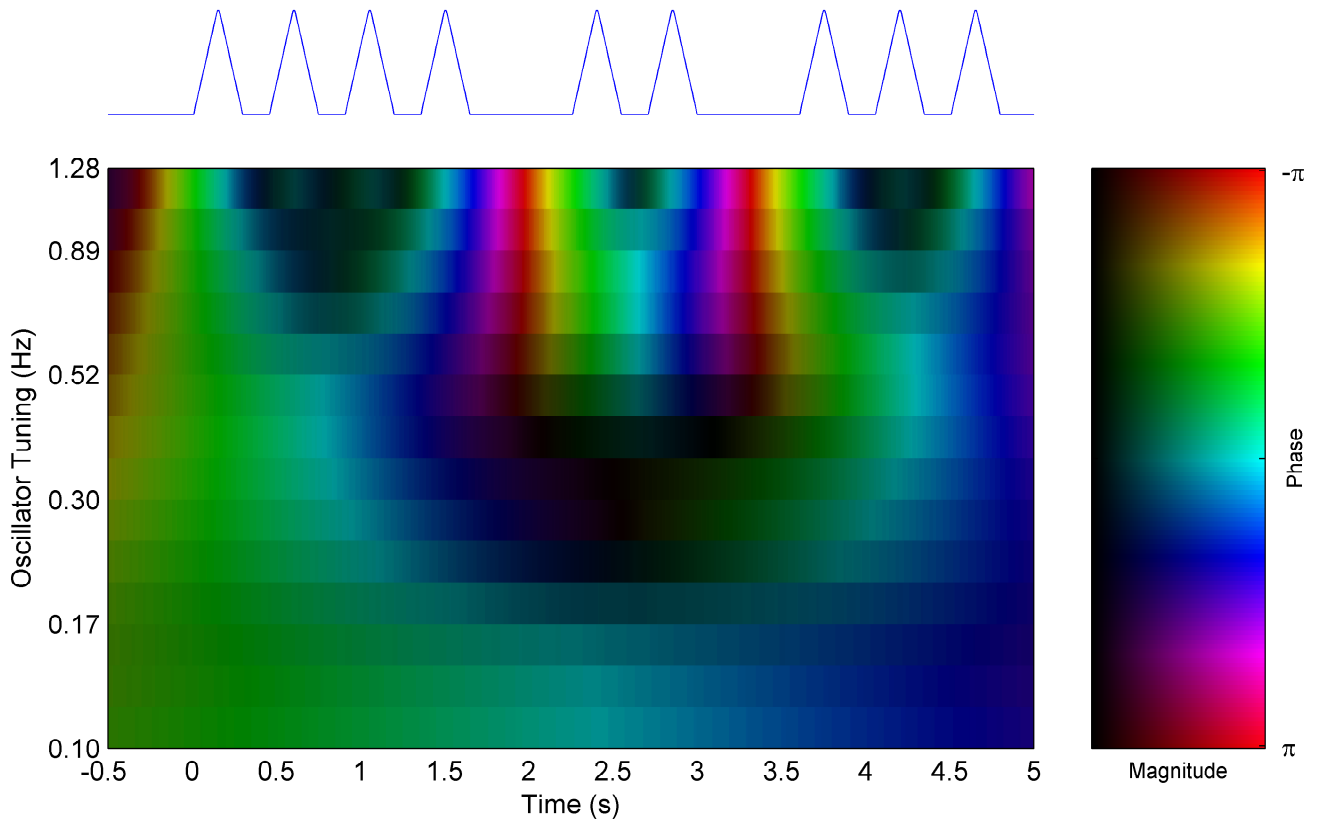


Figure S20: grouping pattern 4-2-3

a)



b)

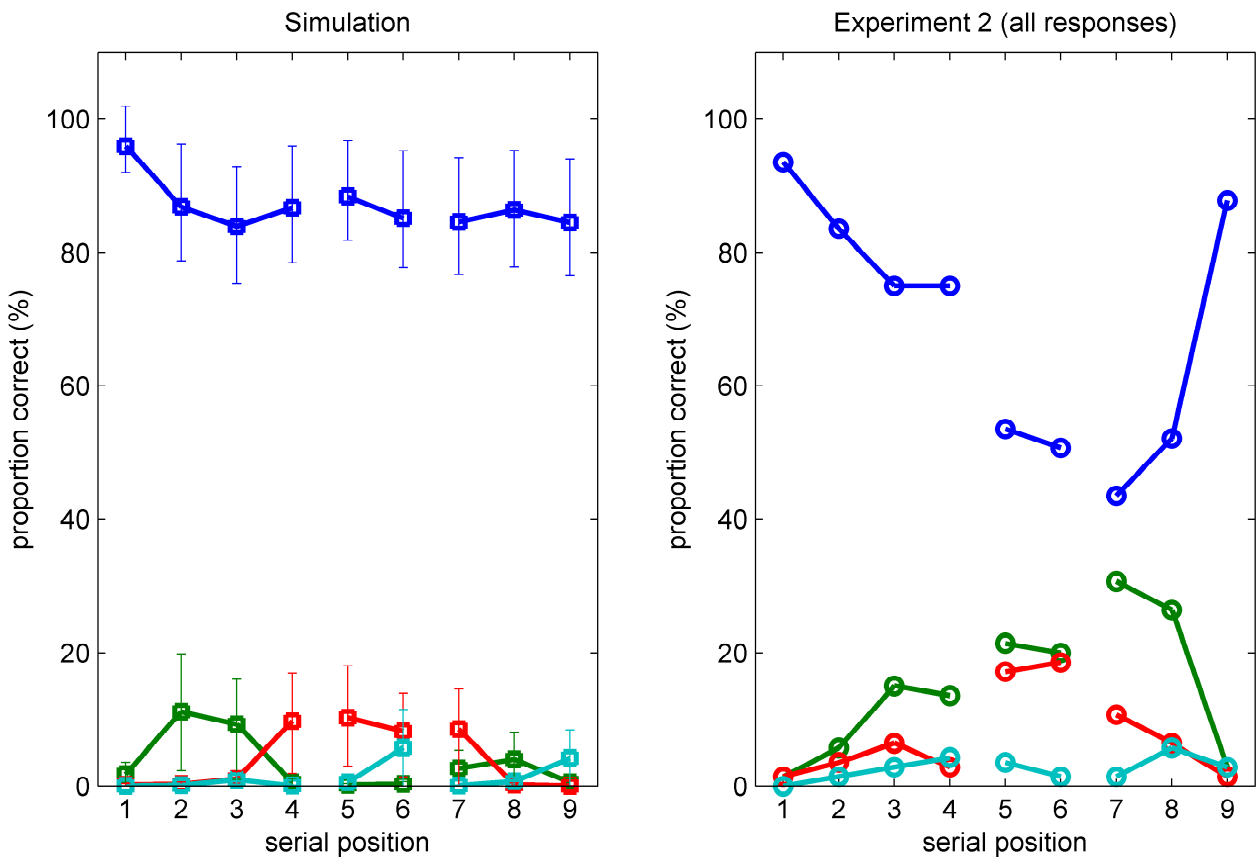
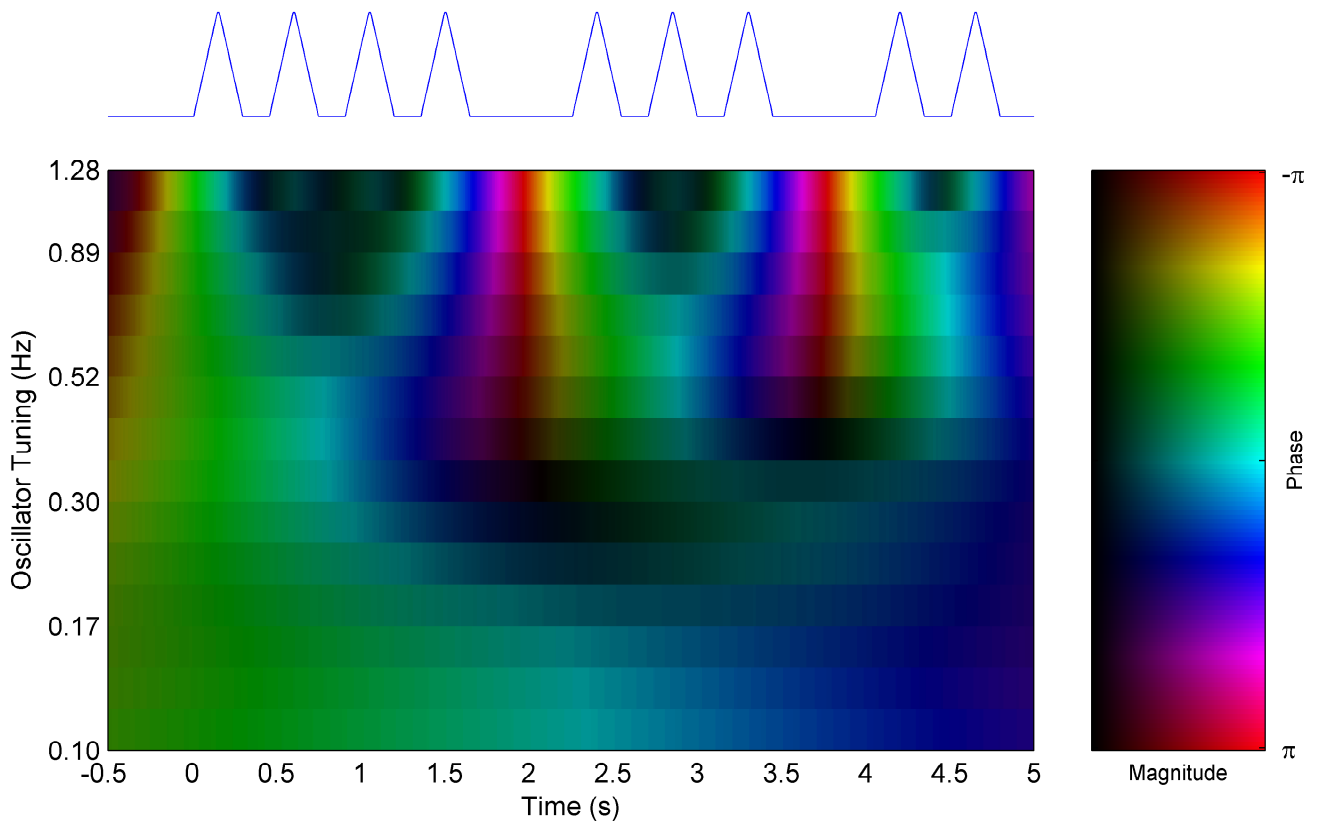


Figure S21: grouping pattern 4-3-2

a)



b)

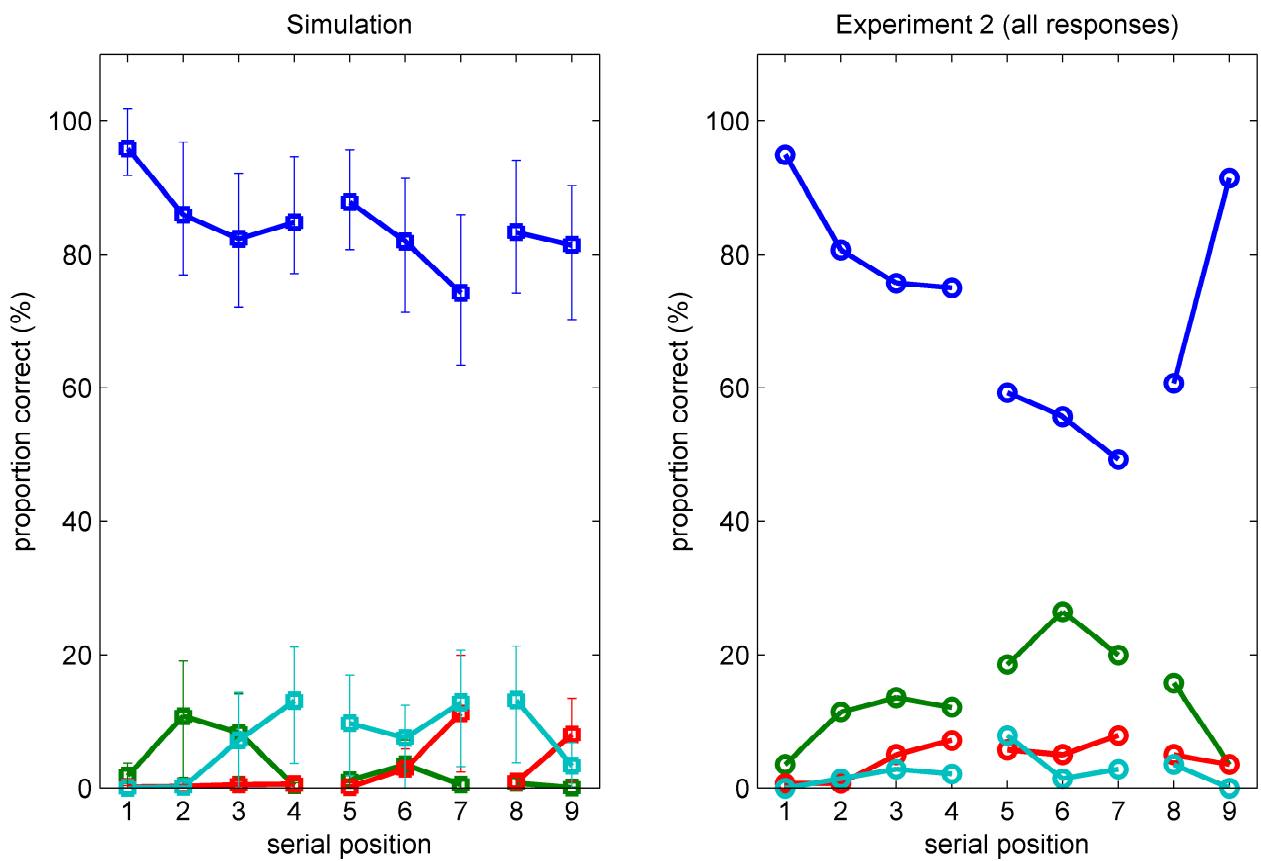
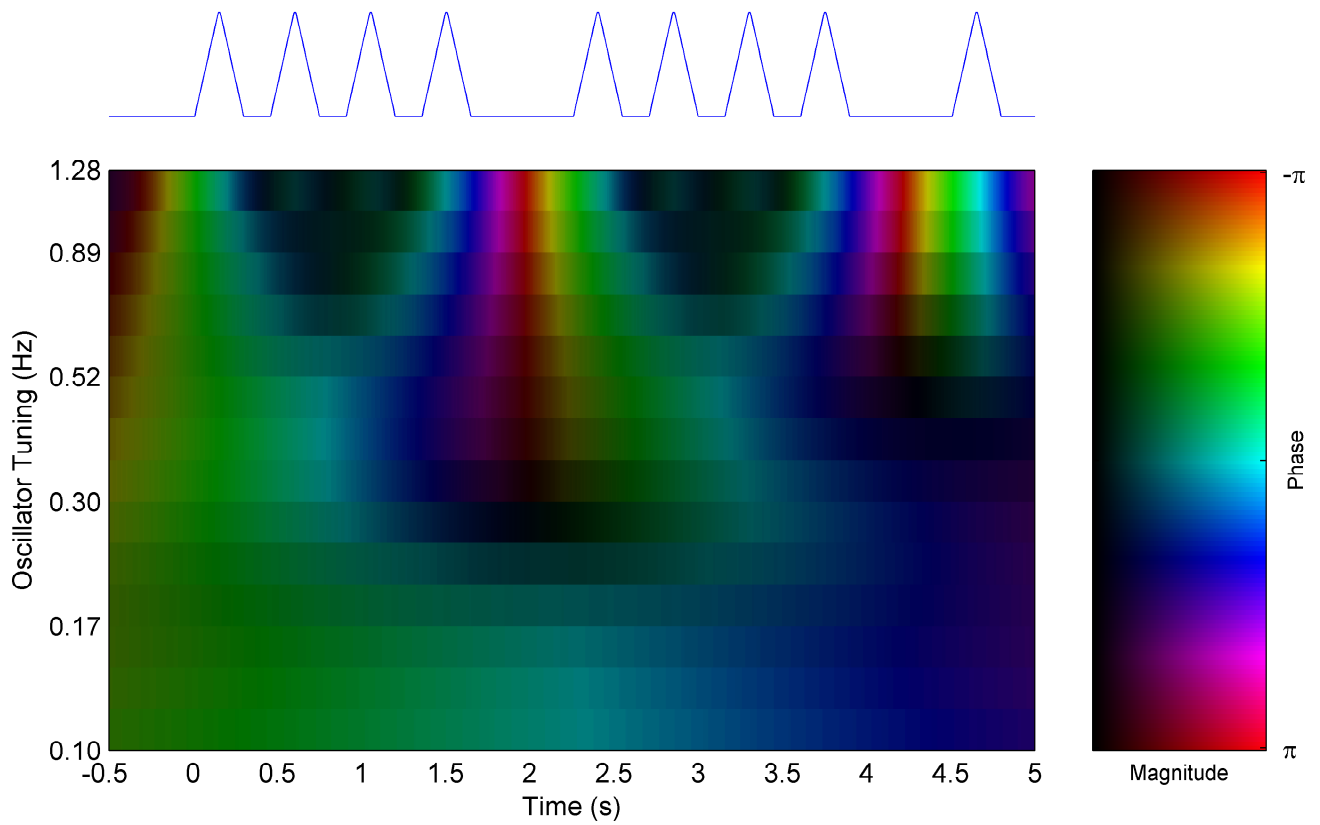




Figure S22: grouping pattern 4-4-1

a)



b)

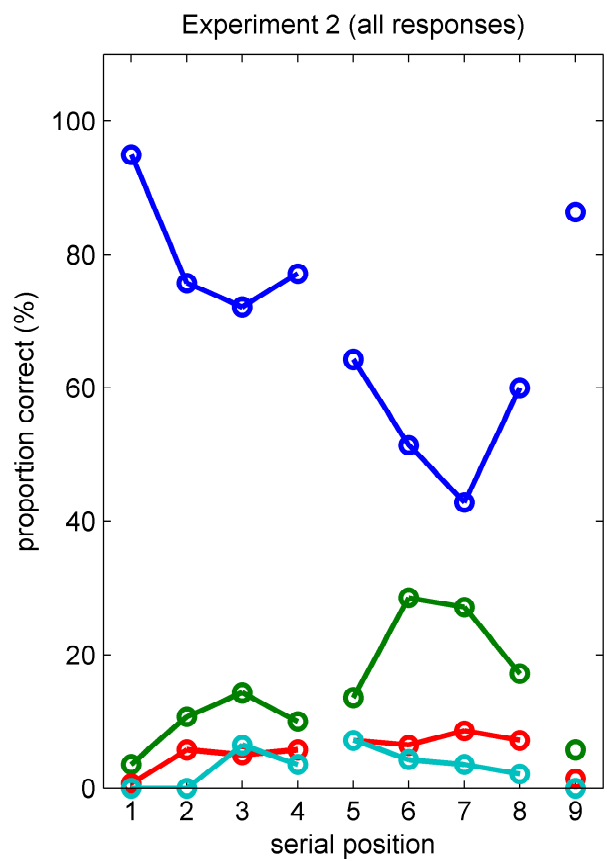
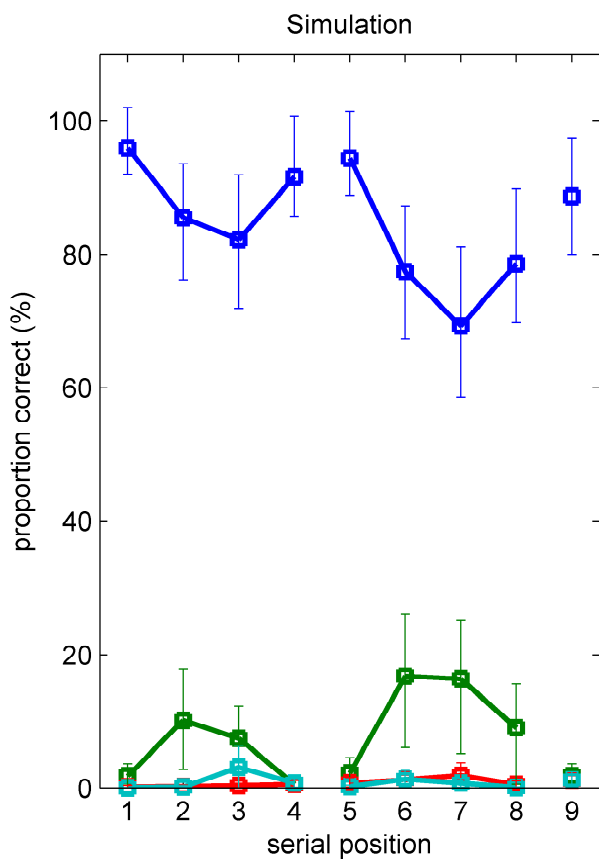
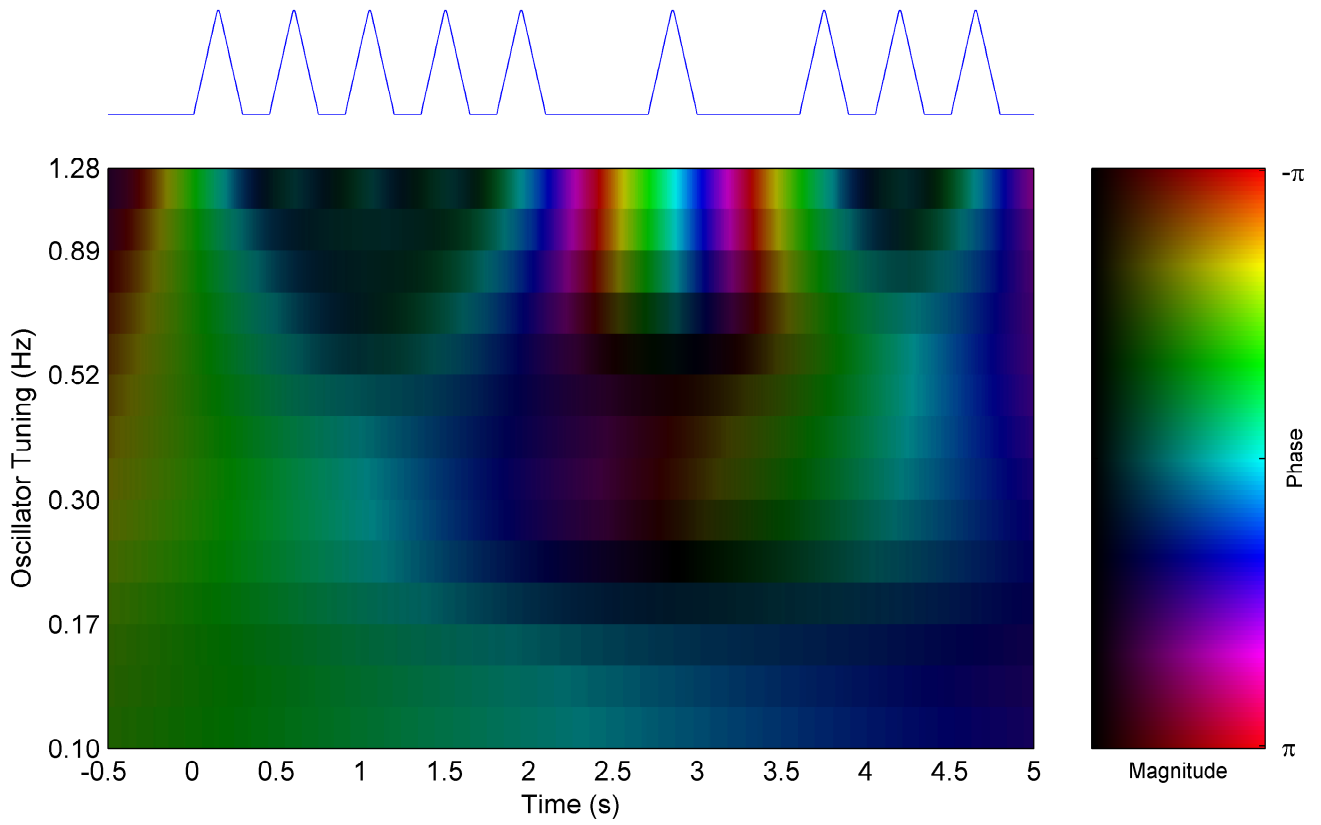


Figure S23: grouping pattern 5-1-3

a)



b)

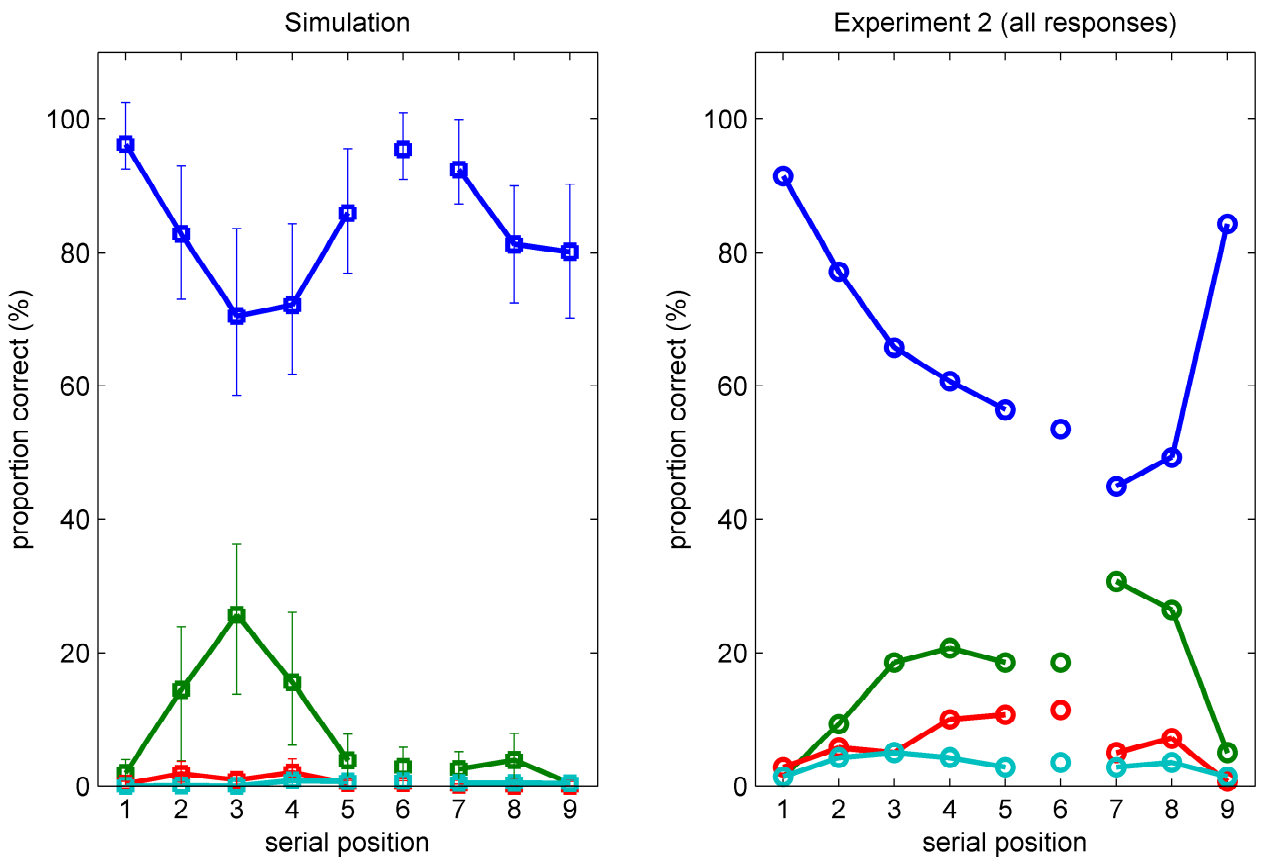
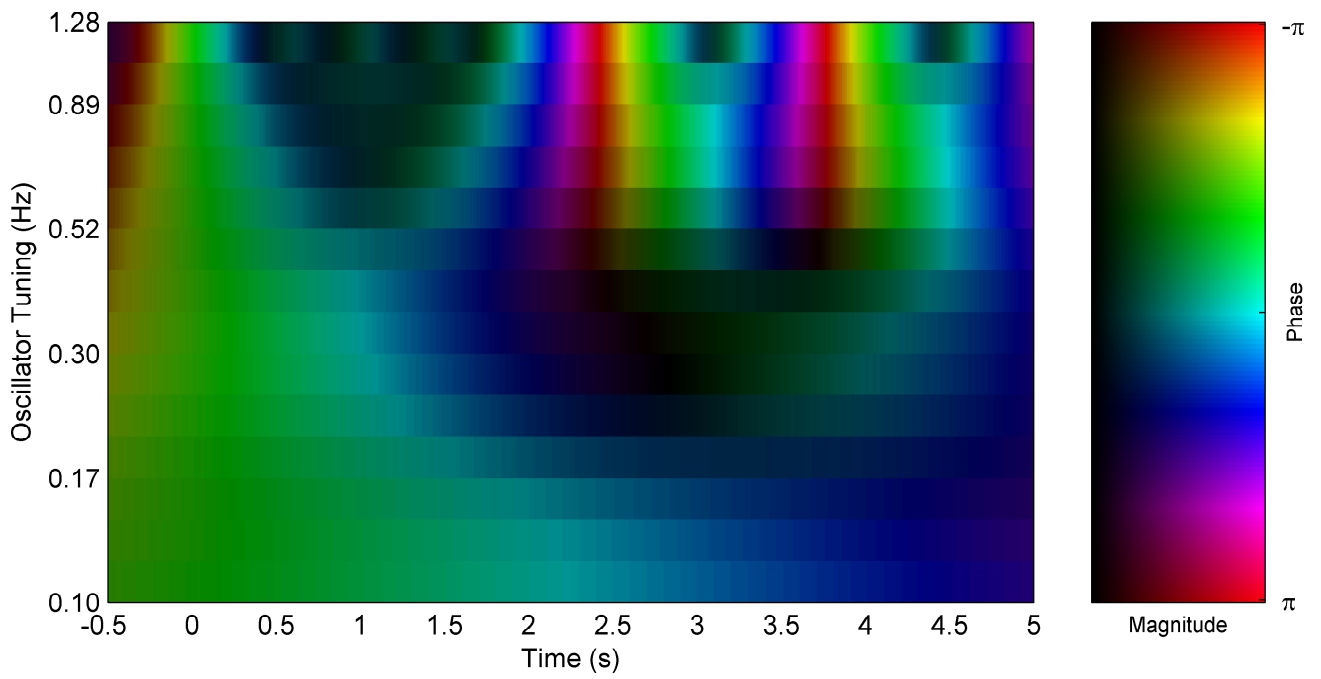
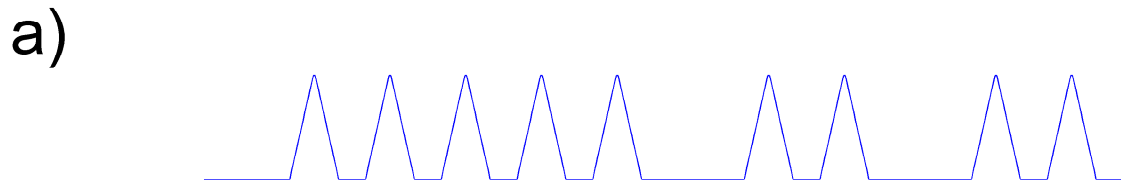


Figure S24: grouping pattern 5-2-2



b)

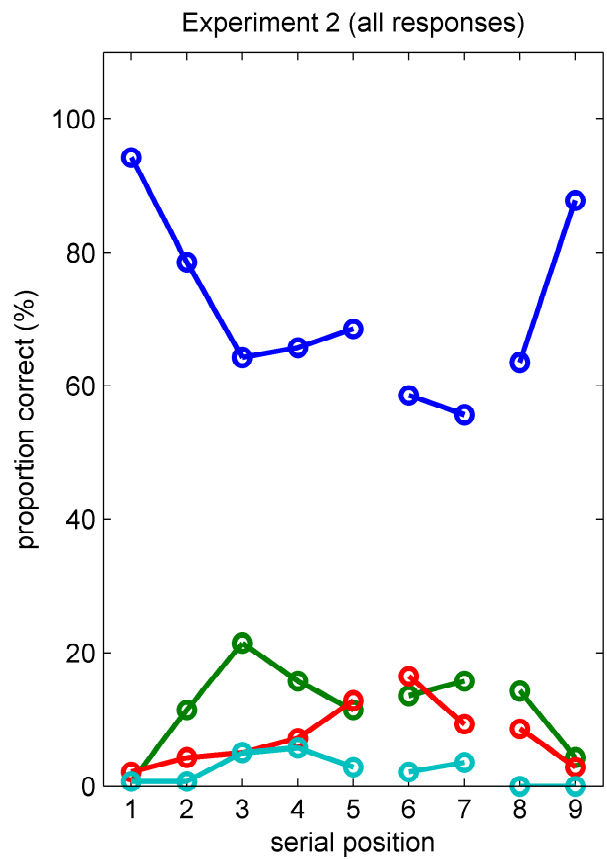
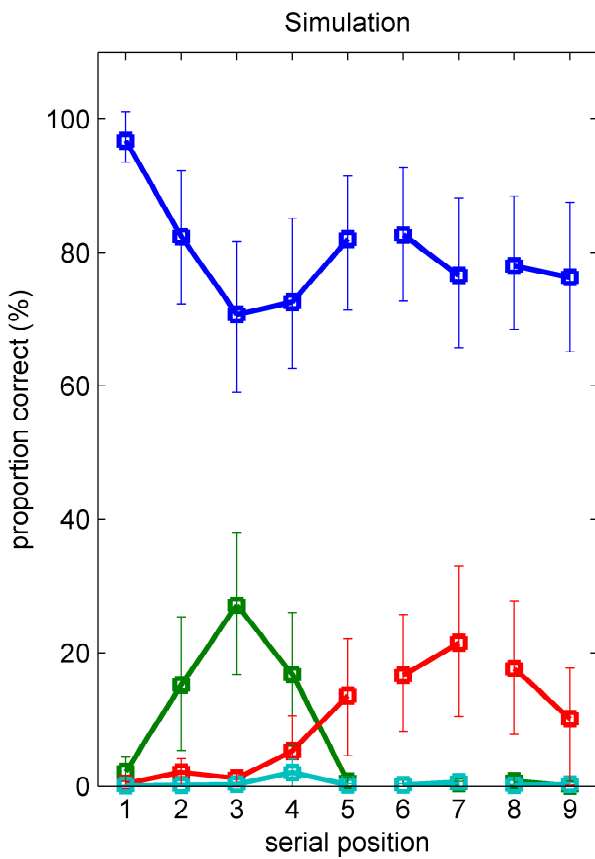
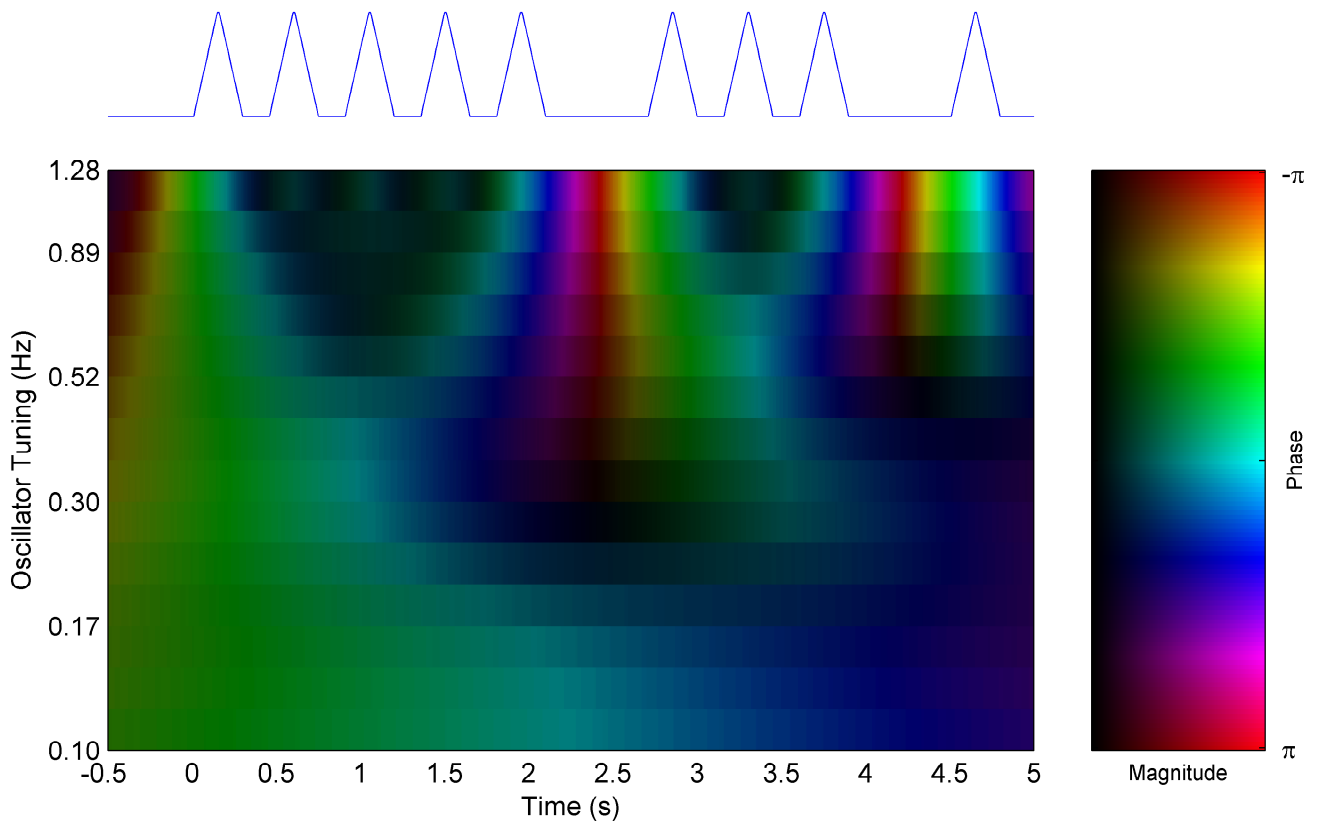


Figure S25: grouping pattern 5-3-1

a)



b)

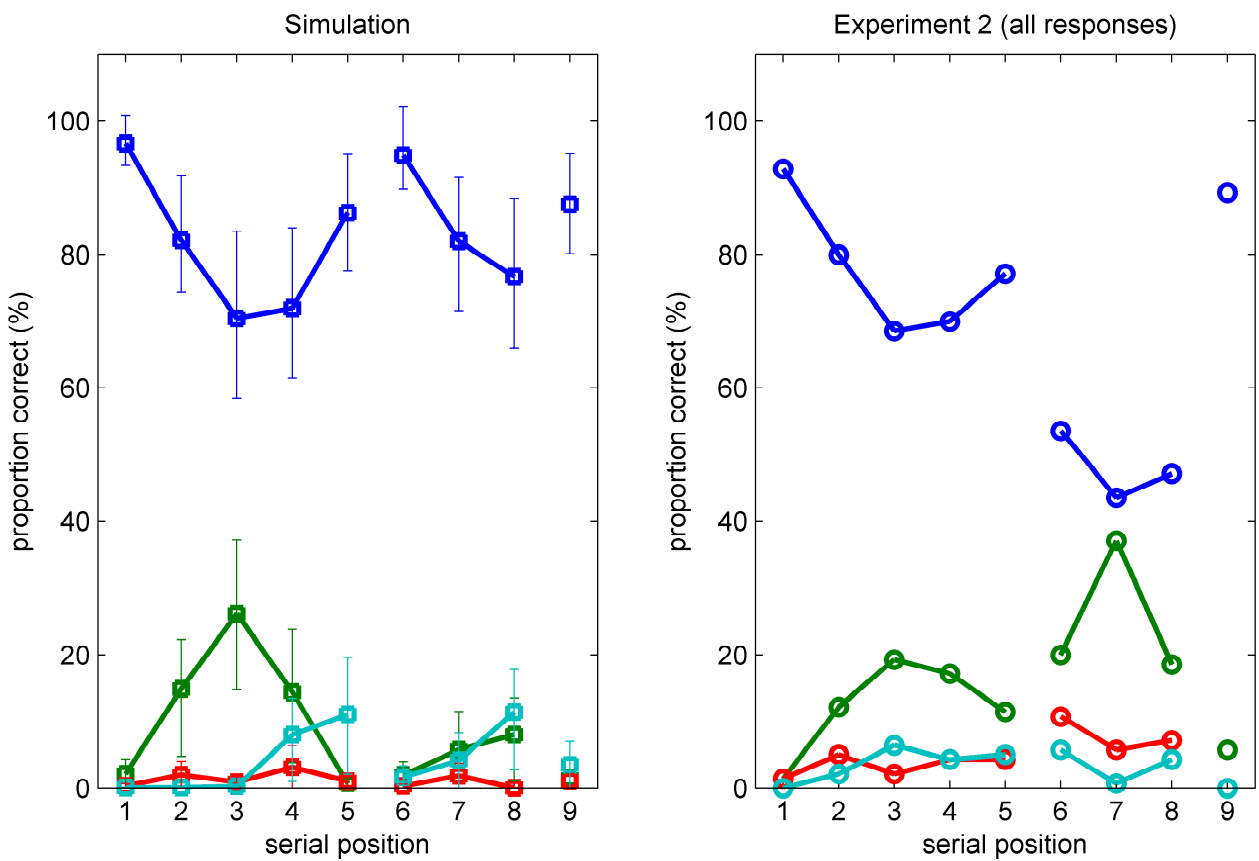
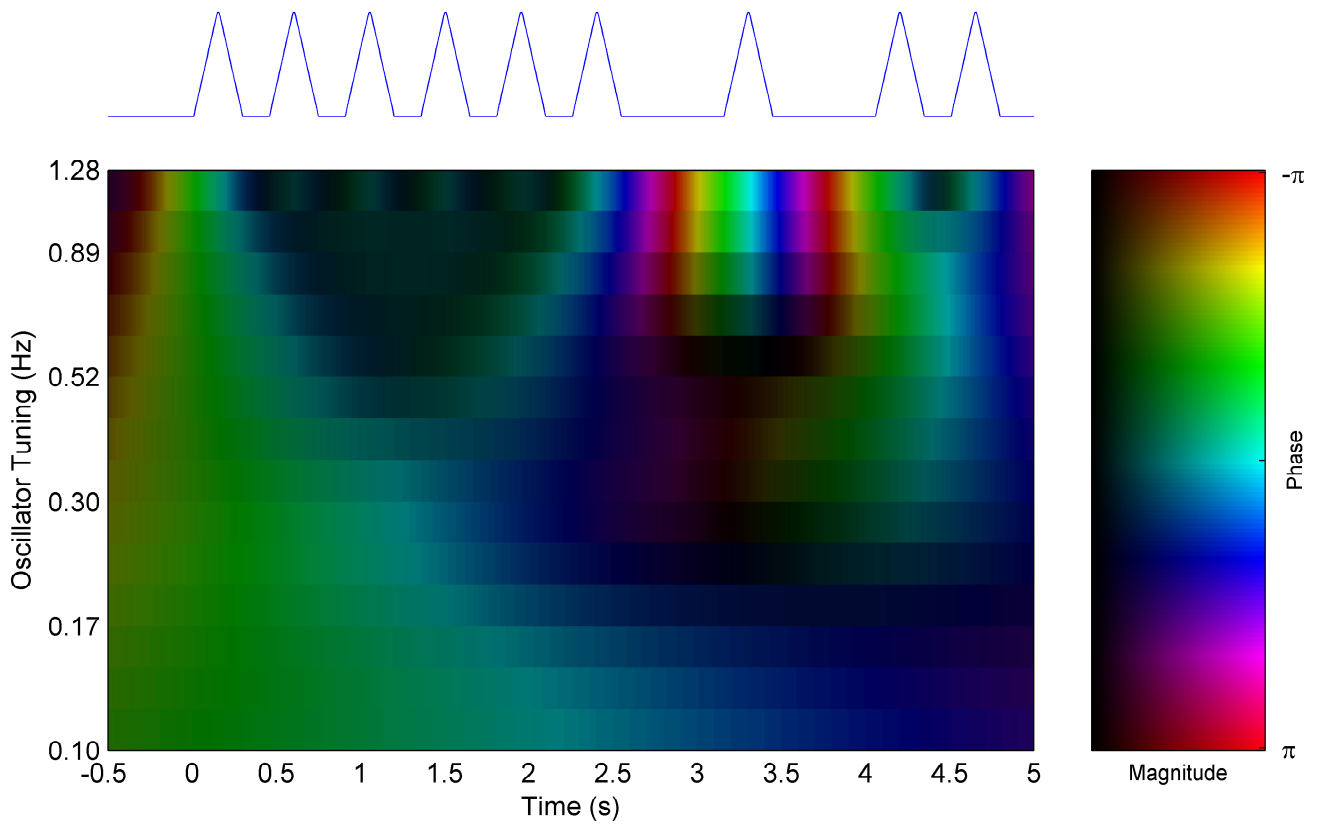


Figure S26: grouping pattern 6-1-2

a)



b)

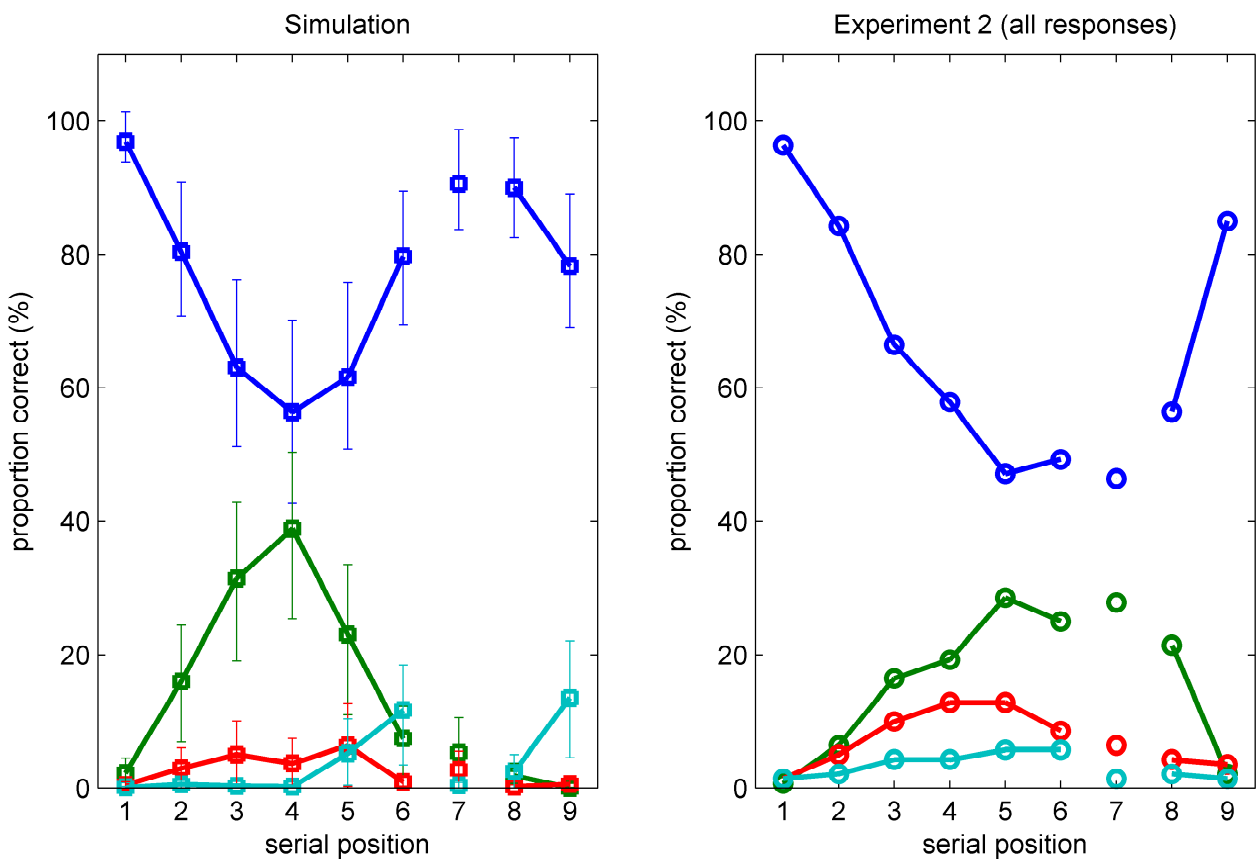
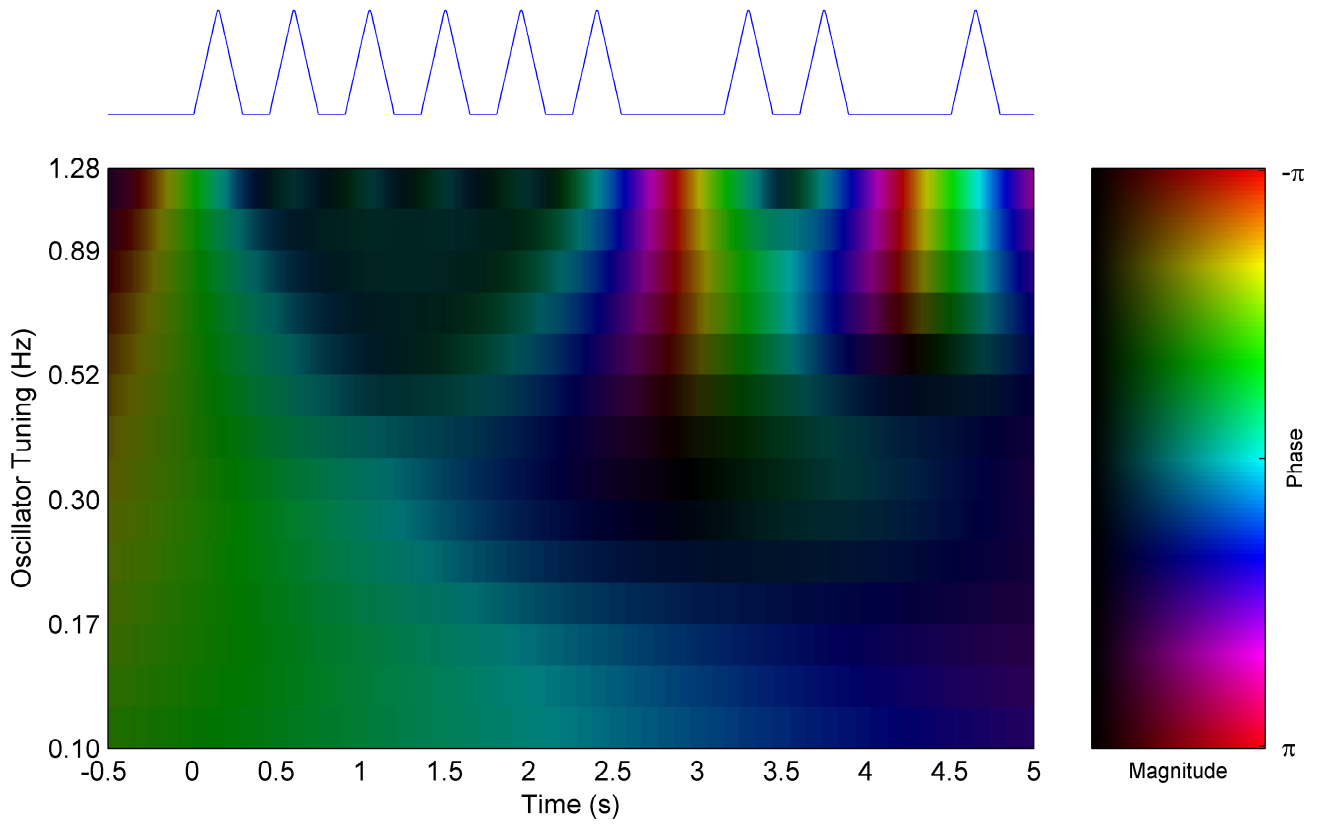


Figure S27: grouping pattern 6-2-1

a)



b)

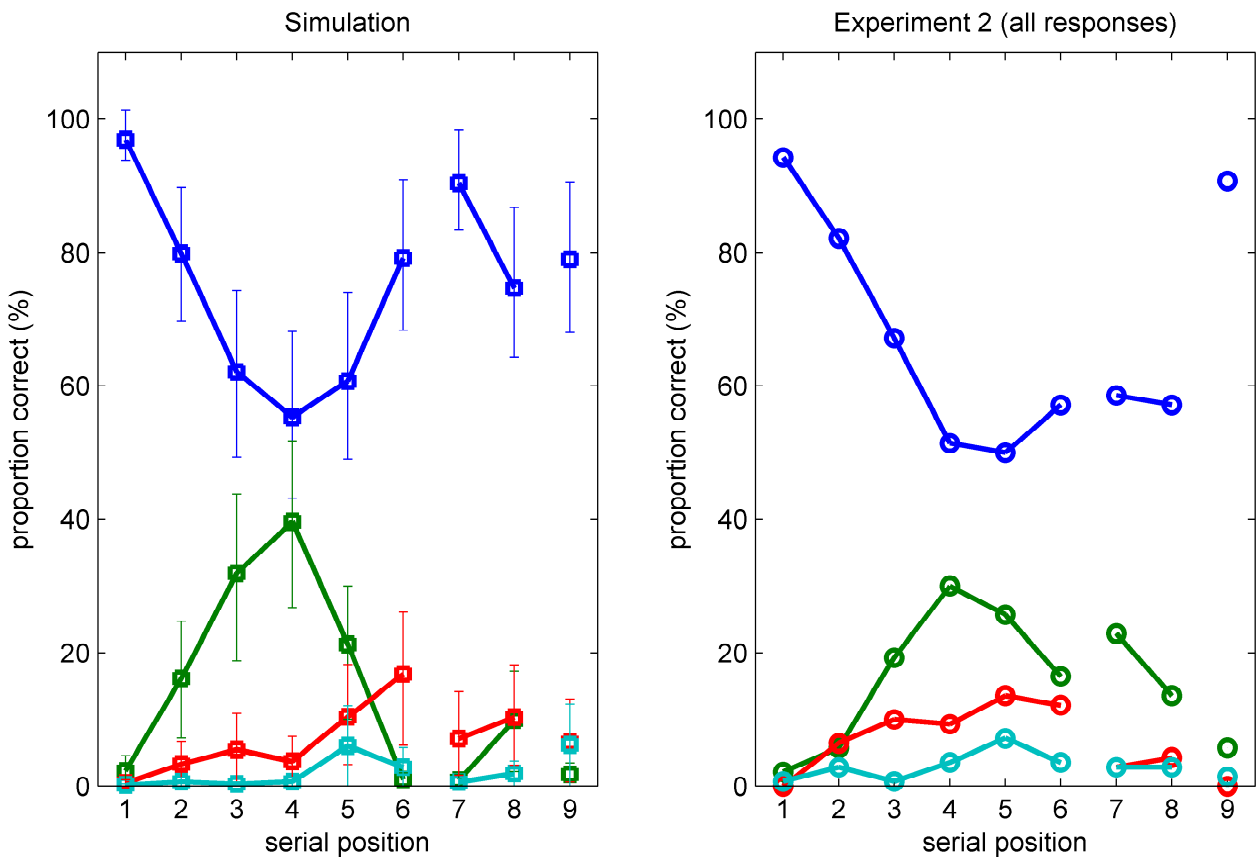
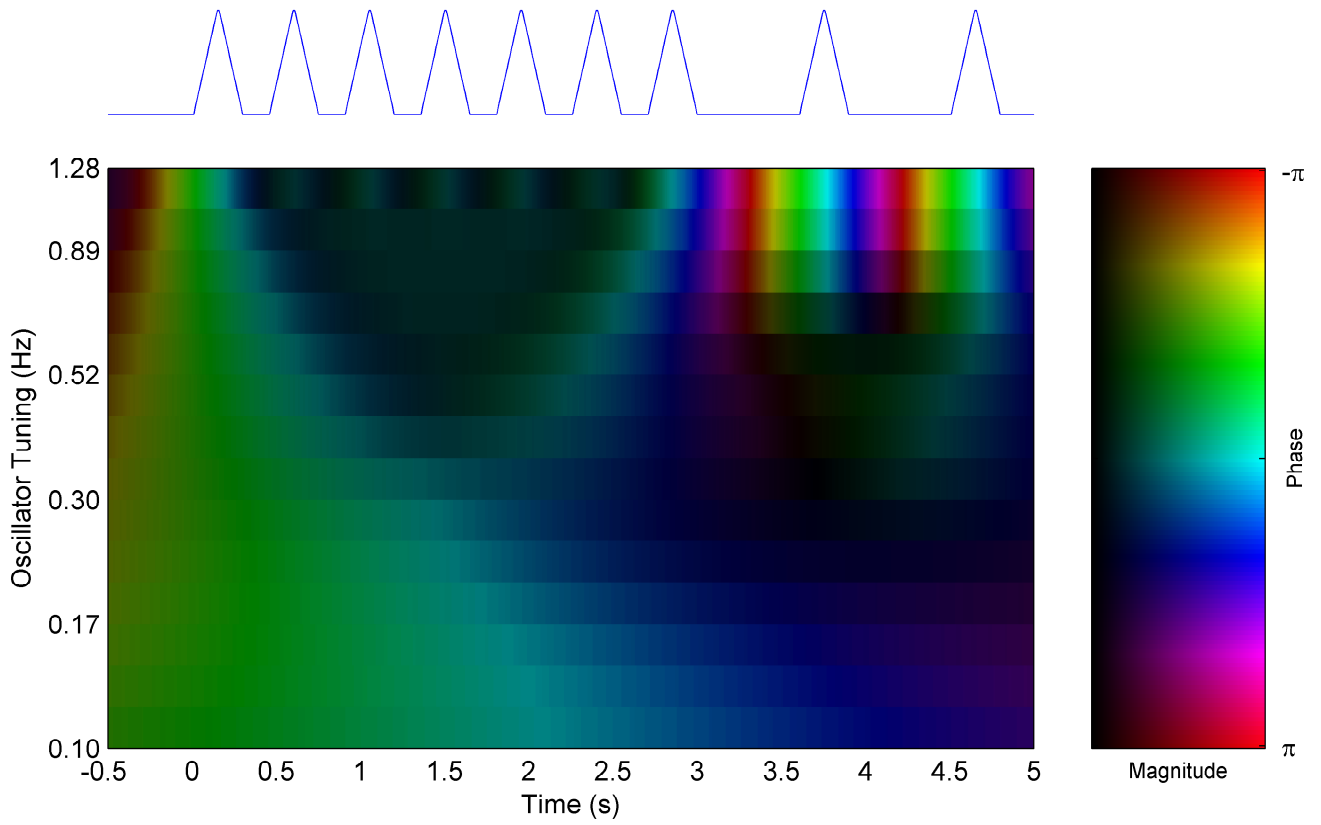


Figure S28: grouping pattern 7-1-1

a)



b)

