Supplementary Information

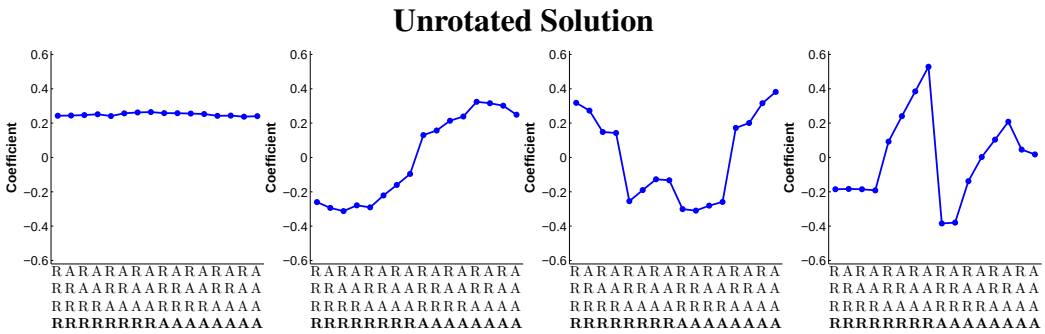
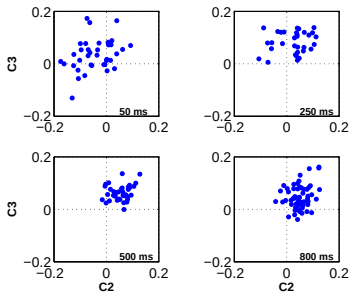
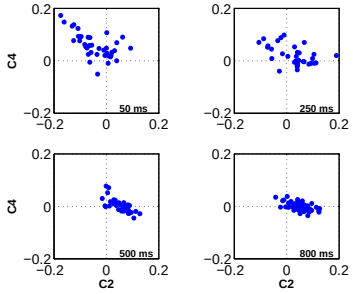


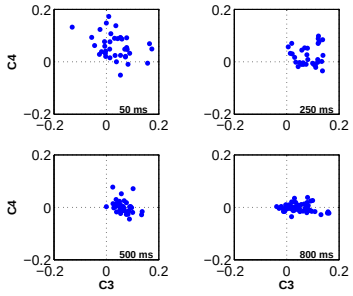
Figure 1: Unrotated latent structure. Coefficient patterns of the four first components extracted with PCA, before rotation. From left to right, components are ordered by amount of variance explained: 78%, 12%, 4.9% and 1.25%; variance explained by the remaining components goes 0.9%, 0.54%, 0.39%,...,0.089%. The first component is clearly interpretable the effect of overall individual mean RT; the second and third components - C2 and C3 - can be interpreted as the effects of the last and second-to-last events respectively; the fourth component exhibits an approximate dependence on the second-to-last independently of the last event, visible as an overall similarity between the left and right halves of the plot.



a) c12



b) c24



c) c34

Figure 2: Individual scores for all 158 participants on the three latent components related to sequential effects.(a)-(b) panels with scores on one particular component plotted against those on another component. Within each panel, individual RSI subgroups are plotted separately. Details of how the scores were calculated are detailed in the text. Note that the scores were those obtained from the global PCA analysis including all participants. Note that, for a 500 and 800 ms RSI, most subjects have a score on C4 close to zero, reflecting the absence of this component for long RSI values (panels (b) and (c)). In addition, note the correlation between C2 and C4 score for low RSI (middle panel, 50 and 250 ms subgroups) discussed in the main text. Finally, observe the single subject which exhibits a significantly negative score on both C2 and C3 (top panel, 50 ms subgroup); note that the good qualitative nature of the fit to this subject (not shown) is indicative that these negative scores may not be spurious. In other words, it might be possible - yet rare - to have a negative score on both C2 and C3.

Recalculation of component scores

Under normal circumstances the PCA model's prediction for the j-th individual is obtained through $\mathbf{x_j} = \boldsymbol{\mu} + \sum_{i=1}^{N} s_i^j \mathbf{C_i}$, where μ is the grand mean array, N is the number of components retained, $\mathbf{C_i}$ is the coefficient pattern for each component and s_j^i is the the score of subject j on component i. If we replace the grand mean with a simple constant, our model becomes $\mathbf{x_j} = b_j + \sum_{i=1}^{N} s_i^j \mathbf{C_i}$, with b equal to individual overall mean RT. If we further discount the mean RT by subtracting it from each individual, we can set the baseline RT at zero for all subjects, in which case our model further reduces to $\mathbf{x_j} = \sum_{i=1}^{N} c_i^j \mathbf{V_i}$, where the notation has been changed to highlight the fact that the scores are now linear coefficients and the coefficient patterns simply vectors equal to the coefficient patterns identified with PCA. Individual scores will be estimated by fitting a linear combination of coefficient patterns to each individual's data with the overall mean subtracted. As expected, the linear coefficients thus obtained are almost perfectly correlated to the scores obtained with PCA ($r = 0.92$, $r = 0.97$ and $r = 0.89$ respectively for C2, C3 and C4, $p << 1e-3$ in all cases). It is to these linear coefficients that we refer throughout as individual 'scores'.

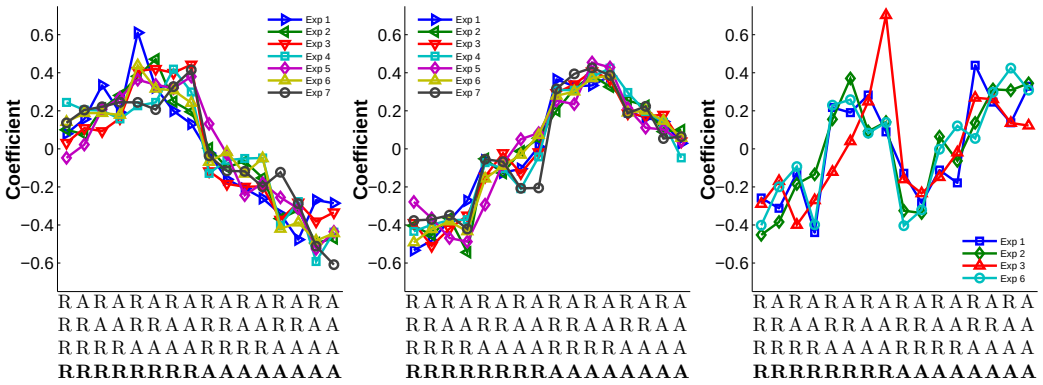


Figure 3: Coefficient patterns obtained by performing a PCA on different subgroups of participants performing different experiments. Plots show, from left to right, C2, C3 and C4. All experiments considered (1 through 7) yielded a C2 and C3 significantly similar to those obtained in the global analysis including all subjects. Only experiments 1, 2, 3 and 6 yielded a C4 significantly similar to the global components. The reason for this is probably the small number of participants in each subgroup together with the fact that C4 explains a relatively small amount of variance. Together, these results clearly indicate that the latent structure obtained with the global analysis is not an artifact of grouping different experiments.

Invariance of latent structure with RSI and Experiment

The non-standard approach of analysing data from multiple experiments together might raise concerns regarding whether the latent structure is constant across conditions. For instance, it would be possible in principle for a component to be present exclusively in one experiment in which case our results would be an artefact of mixing qualitatively different results. In order to dispel these doubts extra care was taken to demonstrate that the latent structure of sequential effects is invariant with respect to both RSI as well as experimental design. This is particularly relevant in the case of different RSI values, given the prevalent view that short and long RSI sequential effects are qualitatively different. In order to evaluate how the latent structure varies, the same analysis which was conducted for all subjects together will be performed in different subgroups separated according to RSI, irrespective of experiment, and according to experiment performed, collaps-

ing across RSI. Different latent structures were obtained, one for each subgroup, and four components were retained each case. It was then necessary to evaluate whether these components were the same as the ones in the global pool of subjects, and this was done with recourse to Tucker index of similarity [2] according to the following procedure: the index was calculated between all putative components of the same type (say C1), one at a time, and the global corresponding component (C1 in this case), and similarly for the remaining three components. The significance of the calculated coefficient values was assessed by holding one vector fixed and randomly permuting the other, allowing a p value to be estimated [1].

Figure																
3	46	58	68	67	76	59	72	72	81	71	65	79	71	48	85	66
3	43	59	79	68	93	78	73	68	60	71	63	73	82	66	84	69
3	70	58	78	50	81	103	179	135	63	72	83	115	133	117	97	122
3	39	40	50	55	67	89	76	72	50	44	70	75	72	88	85	86
3	44	46	53	52	46	54	50	55	70	58	61	64	56	41	55	40
3	42	62	51	58	57	66	57	72	55	63	63	62	87	77	61	73
9	52	51	50	44	45	56	50	42	68	71	93	102	69	40	45	39
9	68	101	110	102	86	102	96	112	89	119	118	110	107	127	114	94
9	35	33	55	49	68	73	49	60	84	66	62	76	61	72	59	56
10	43	48	55	56	55	71	75	61	69	75	64	60	50	49	53	55
10	68	62	70	71	77	80	71	82	28	44	50	57	78	54	58	68
11	77	73	102	93	142	156	142	110	58	101	92	161	114	140	147	132
11	55	66	69	91	111	134	103	112	54	68	70	118	94	83	72	97
11	48	71	61	65	73	94	108	120	63	83	115	112	117	127	141	130

Table 1: Standard deviation values for all the individual subjects shown in the main text. Columns are the 16 variables (i.e. sequences) as ordered in the plots throughout. Subjects are ordered from top to bottom on the table as they are shown on the article from left to right.

Figure																
3	1593	2072	815	829	865	2252	788	-27	450	237	621	480	1324	1434	1158	1764
3	973	1752	1487	1739	911	1391	582	983	597	699	458	1970	1532	1622	1664	1749
3	2427	2315	1515	1036	2359	1782	1728	1626	588	191	1502	2155	756	1096	1223	1503
3	957	1869	816	2221	1351	1374	2078	1045	3122	1154	1770	3526	1729	853	2095	1870
3	1881	1716	482	-389	373	218	617	175	926	59	694	934	1111	265	1188	458
3	1705	2538	2662	1724	1829	1110	2192	1962	933	1254	1036	1085	860	887	2717	1232
9	-863	1122	-224	88	1241	1074	2814	1570	1059	1076	1257	1662	1328	1255	924	317
9	1742	2058	1558	1236	1342	682	648	1185	1729	1702	1243	603	317	1183	1088	1414
9	2488	1281	1539	2296	1416	1145	1465	1584	712	587	2110	2008	708	2449	1298	779
10	-264	719	2385	1028	729	1319	1002	123	-93	955	106	234	-69	-388	-223	-464
10	451	-240	3458	1191	3501	409	8	573	-2469	-528	3587	2649	1478	-512	23	3110
11	1162	1699	1278	952	1178	735	1671	619	871	1822	1979	2119	1232	1557	1433	1680
11	1422	902	1742	2155	2462	1403	1459	1655	3038	3262	2217	1451	1963	1414	2541	1478
11	1481	2794	1405	1930	3163	2428	1190	1245	737	2274	1369	1639	687	787	655	860

Table 2: Skewness values for all the individual subjects shown in the main text. Columns are the 16 variables (i.e. sequences) as ordered in the plots throughout. Subjects are ordered from top to bottom on the table as they are shown on the article from left to right.

Figure																
3	7198	8795	3312	2827	3810	8595	3938	2208	3855	2813	3344	2797	4476	6339	4418	6913
3	4177	7216	4781	6514	3254	7075	2829	3692	4074	3945	3330	8791	5454	5957	5492	6069
3	9925	10096	5304	4728	10300	6271	5858	5552	4249	2786	8913	9590	3507	4914	4303	5347
3	3923	9066	4290	9811	4961	4420	8454	4297	19507	4658	7330	19162	7603	3614	8924	7588
3	11475	7396	3385	3284	3333	2961	2973	2671	6719	1970	3573	4100	4103	4160	4266	3471
3	8820	12990	12129	6209	9889	4982	10321	10412	4242	5558	3789	4777	3507	4740	14116	5268
9	3500	10240	5158	4084	10417	5598	12065	7504	4777	4955	4179	5796	6673	8287	5917	7516
9	7022	8283	5487	4970	6634	3762	3120	3870	6528	5944	5411	3089	2851	4601	4353	5553
9	11084	5584	5822	12051	5916	5554	6277	6009	3259	3728	10775	8627	3354	11397	5291	3388
10	4173	5491	15525	5445	7355	6043	5762	4615	4381	6469	4383	4475	5750	3963	3716	4081
10	4212	2061	21827	6922	25431	2915	1891	4019	11685	2777	18507	10515	5213	3593	2467	17684
11	5915	7272	5066	4431	3850	2610	5880	2912	4144	6880	8415	7091	4549	6543	5975	6413
11	5784	4146	9993	9722	10410	5187	5509	6778	17703	16220	8921	5446	9184	6514	14125	5914
11	9211	15487	6418	8680	19513	11468	3999	4288	3203	12456	4790	6501	3001	3763	2930	3734

Table 3: Kurtosis values for all the individual subjects shown in the main text. Columns are the 16 variables (i.e. sequences) as ordered in the plots throughout. Subjects are ordered from top to bottom on the table as they are shown on the article from left to right.

Figure																
3	52	60	67	67	82	88	81	81	73	76	80	80	95	101	95	96
6	92	92	100	93	107	137	121	126	73	86	105	123	133	157	169	178
6	72	70	80	80	81	95	90	92	75	80	98	97	112	122	115	116
6	66	73	73	80	81	88	86	86	86	88	90	90	97	93	92	86
6	61	64	70	71	75	80	77	78	84	85	89	86	84	85	82	80

Table 4: Standard deviation values for all the groups of subjects shown in the main text. Columns are the 16 variables (i.e. sequences) as ordered in the plots throughout. Groups of subjects are ordered from top to bottom on the table as they are shown on the article from left to right.

Figure																
3	1672	1983	1508	1310	1756	1569	2130	1728	508	378	1077	1918	822	1033	1308	1529
6	2121	1691	2018	1574	1980	2720	2508	1959	1293	1854	1892	2266	1941	2002	2074	2489
6	389	184	881	827	819	1432	1186	1149	796	649	1108	943	1201	1314	1324	1514
6	1235	1436	1333	2312	1182	1528	1809	1505	886	1097	1078	1129	1371	1384	1224	1511
6	674	1090	1358	1333	1247	1398	1685	1175	1119	1115	1338	1267	1311	1689	1425	1243

Table 5: Skewness values for all the groups of subjects shown in the main text. Columns are the 16 variables (i.e. sequences) as ordered in the plots throughout. Groups of subjects are ordered from top to bottom on the table as they are shown on the article from left to right.

Figure																
3	9040	9549	6624	6398	8194	6728	10160	8817	4944	3694	6873	10944	3963	4999	6320	6694
6	13629	9934	12550	8750	11698	16235	15084	12957	5656	9354	9285	12576	9255	9547	10238	12879
6	6367	4855	6691	6920	5750	7559	6808	6037	4521	3692	6156	4846	5827	6066	6065	6956
6	7653	8498	7183	21495	6258	8050	11329	7462	4234	5359	5015	5519	6982	6228	5142	6512
6	5375	7838	7296	7211	5666	6847	9791	5792	5223	5368	5938	5941	6102	9579	6112	5806

Table 6: Kurtosis values for all the groups of subjects shown in the main text. Columns are the 16 variables (i.e. sequences) as ordered in the plots throughout. Groups of subjects are ordered from top to bottom on the table as they are shown on the article from left to right.

References

[1] Hervé Abdi. Rv coefficient and congruence coefficient. *Encyclopedia of measurement and statistics*, pages 849–853, 2007.

[2] Richard L Gorsuch. *Factor analysis*. L. Erlbaum Associates, Hillsdale, N.J., 1983.