SUPPLEMENTARY MATERIALS

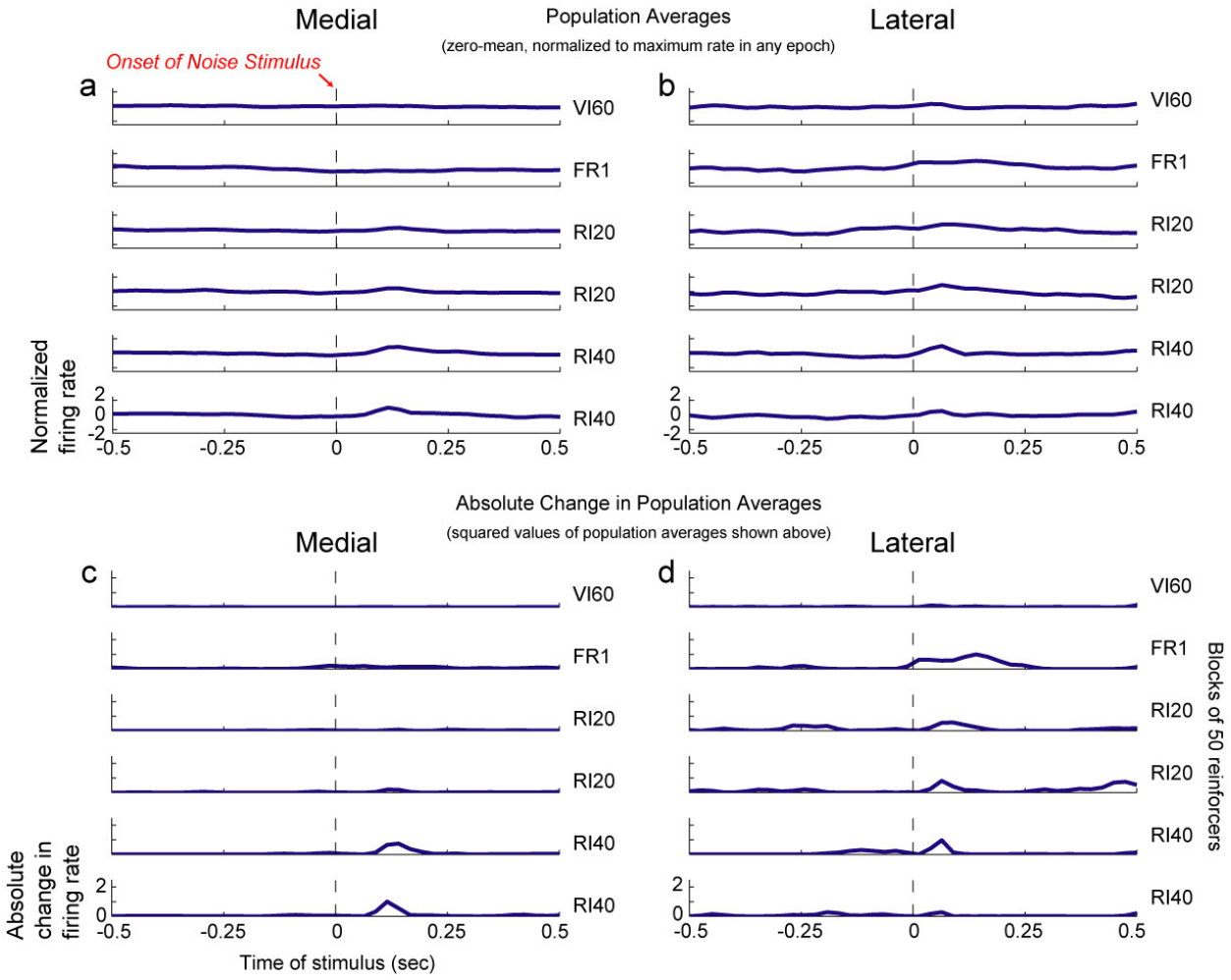
Neuronal correlates of instrumental learning in the dorsal striatum

Eyal Y Kimchi[1], Mary M Torregrossa[2],
Jane R Taylor[1,2], and Mark Laubach[1,3]

[1]Interdepartmental Neuroscience Program, Yale University,
333 Cedar Street, New Haven, Connecticut 06510, USA.
[2]Division of Molecular Psychiatry, Yale University,
Connecticut Mental Health Center, Abraham Ribicoff Research Facilities,
34 Park Street, New Haven, Connecticut 06508, USA.
[3]John B. Pierce Laboratory, 290 Congress Avenue,
New Haven, Connecticut 06519, USA.

Correspondence should be addressed to:
M.L. (mlaubach@jbpierce.org)

Supplementary Figure 1



Habit formation was associated with changes in striatal firing rates during movements made in response to the conditioned stimulus. There were progressive changes in population activity during the peri-stimulus epoch, with modulation of firing rates occurring after the onset of the noise stimulus (i.e., conditioned reinforcer). In (**a**) and (**b**), population averages are shown for neurons in the medial and lateral portions of the dorsal striatum. Activity is shown for each block of 50 reinforcers during the initial training sessions (VI60, FR1, RI20, RI40). For these plots, firing rates were normalized to have a mean of zero and divided by the maximal average rate over all blocks of training. In (**c**) and (**d**), absolute changes in population activity are shown. Here, firing rates were normalized to have a mean of zero and then squared. This analysis was done to account for changes in firing rates independent of whether the neurons showed increased or decreased firing rates. Note that neurons in the medial striatum became modulated during the post-stimulus period only after the devaluation studies (Figure 2 in main body of paper) showed that the animals were responding in a habitual manner.

Supplementary Table 1

Medial Striatum

Reinforcers	50	100	150	200	250	300	350	400	450	500	550	600	650	700
Neurons	45	40	42	42	45	45	37	37	34	34	37	37	40	40
Increase	3	1	3	2	1	3	1	3	3	1	4	7	5	4
Decrease	0	0	3	1	0	2	2	1	1	1	3	2	3	4
No change	42	39	36	39	44	40	34	33	30	32	30	28	32	32

Lateral Striatum

Reinforcers	50	100	150	200	250	300	350	400	450	500	550	600	650	700
Neurons	29	32	29	29	35	35	37	37	39	39	34	34	23	23
Increase	1	1	2	4	6	7	7	6	8	9	5	5	4	5
Decrease	0	0	2	1	1	2	2	2	4	3	6	3	3	3
No change	28	31	25	24	28	26	28	29	27	27	23	26	16	15

A summary of the numbers of neurons recorded in each block of trials (50 reinforcers each) and in each part of the striatum is provided. The fractions of neurons with modulations of firing rate during a narrow time window around the onset of the acoustic noise stimulus (-30 ms to +20 ms compared to +20 ms to +70 ms) are noted as a function of the number of rewards earned. Neurons that showed a statistically significant change in firing rate (ranksum, $p < 0.05$) are split according to whether this change was an increase or decrease.