Report (Koz7):

The same technique is used for new data in order to define 2.5s-window free of artifacts. Analysis of 2.5s-windows free of artifacts based on AC and Striatum channels data, we chose the 2.5s windows only from time when the bell was ringing, i.e. during first 6s of Go trials and 10s of NoGo trials. We determine windows free of artifacts in a similar way as it's done before, that is, movement artifacts is defined by amplitude size, i.e. if it is $> 0.0005V$.

In average, there are different numbers of trials with such 2.5s-windows for different days. It is necessary to mention that the number of trials with the 2.5s-window is different for each channel during one day. Therefore, we took the maximum number of common trials. Trials that were not considered in the analysis due to absence of "2.5s windows" are denoted by two hyphens in the table 1. (Trials with shock are marked by yellow in the table 1). The duration of trials is written in parenthesis that is based on the number of tones (the real duration can be even shorter). Thus, it is possible to know approximately when the animal made the task, and understand (in some sense) the nature of artifacts.

In general we have 20 AC channels with spatial arrangement of surface array electrodes as shown in fig. 1. We included only 17 in the following studies due to significant movement artifacts in channels 10, 17 and 19. Additionally, Striatum channels are considered. The Striatum channels that were considered are 9, 11, 13, 16, 27, 32. Thus, the total number of channels is 23.

28	12	26	10	24
8	22	6	20	4
18	2	23	7	21
5	19	3	17	1

Fig. 1: Spatial arrangement of the electrodes
over the auditory cortex on the gerbil.

Using data selected following Table 1, power spectral density (PSD) functions were determined for each channel using standard FFT-based method. Once the PSD were determined, we calculated the power in the frequency band 20-80Hz (and 3-43Hz) by summing up the amplitudes and determined the RMS using the formula:

$$\text{RMS}_{\{i\}} = \sqrt{\sum_{k=20Hz}^{80Hz} \text{PSD}_{\{i\}}(k)} \, ,$$

where i is a channel among 23 channels that were considered in the analysis (see fig. 1). Finally, amplitude modulation (AM) patterns were created for each trial by using RMS values of each channel. These will be the AM patterns in the 23-dimensional space.

After these preprocessing steps we trained a MLP for each day separately. Useing standard Levenberg Marquart learning, with about 120 training iterations. At the end of the training, all training examples were classified correctly. The testing results are after the tables.

Table 1.

140814		140815		140816		140817	
Go	NoGo	Go	NoGo	Go	NoGo	Go	NoGo
1	--3	--1 (1)	3 (2.5)	1	3	1	3
2	--4	2 (1)	4 (2.5)	--2	4	--2	4
5	8	--5 (1)	8	--5	8	5	8
6	9	--6 (1)	9	--6	9	--6	9
7	10	--7 (2.5)	10	7	10	7	10
11	12	11	12	11	12	11	12
14	13	--14 (3)	13	--14	13	14	13
15	17	15 (1.5)	17	15	17	15	17
16	18	--16 (5.5)	18	16	18	16	18
20	19	--20 (3)	19	20	19	20	19
22	21	22	21	22	21	22	21
23	--24	23	24	23	24	--23	24
25	27	25	27	25	27	--25	27
26	--28	26	28	26	28	26	28
29	32	29	32	--29	32	--29	32
30	33	--30	33	--30	33	30	33
31	34	31	34	31	34	31	34
35	36	35	36	35	36	35	36
38	37	38	37	--38	37	38	37
--39 (5.5)	--41	--39	41	39	41	39	41
--40 (5.5)	--42	--40	42	40	42	40	42
44	--43	--44	43	44	43	44	43
46	45	--46	45	46	45	46	45
47	48	--47	48	47	48	47	48
49	51	--49	51	49	51	49	51
50	52	50	52	50	52	--50	52
53	56	53	56	53	56	53	56
54	57	--54	57	54	57	54	57
55	58	55	58	55	58	55	58
59	60	59	60	59	60	59	60
62	--61	62	61	62	61	62	61
63	65	63	65	63	65	63	65
64	66	64	66	64	66	64	66
68	67	68	67	68	67	68	67
--70 (4)	69	--70	69	70	69	70	69
71	72	--71	72	71	72	71	72
--73 (2)	75	73	75	73	75	73	75
74	76	--74	76	74	76	74	76
77	80	77	80	77	80	77	80

78	81	78	81	78	81	78	81
79	82	79	82	79	82	79	82
--83 (2)	84	83	84	83	84	83	84
86	85	86	85	86	85	86	85
87	89	--87	89	87	89	87	89
--88 (3)	90	88	90	88	90	88	90
--92	91	92	91	92	91	92	91
--94	93	--94	93	94	93	94	93
95	96	95	96	95	96	95	96

Table 2: Trials without shock for each day

140814		140815		140816		140817	
Go	NoGo	Go	NoGo	Go	NoGo	Go	NoGo
8/48	44/48	44/48	31/48	43/48	44/48	44/48	39/48
16.7%	91.7%	91.7%	64.6%	89.6%	91.7%	91.7%	81.3%
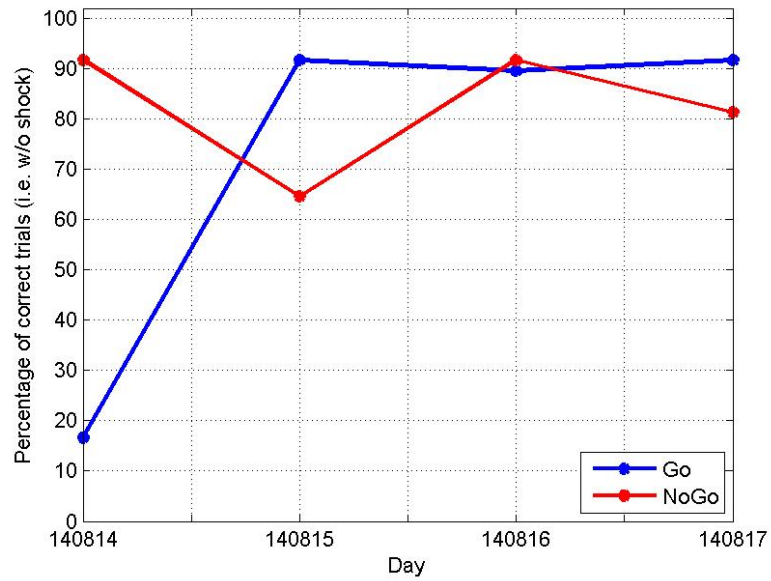
Fig. 2: Percentage of trials without shock.

After such preprocessing, we obtained a data blocks as follows:

- AC + Striatum

Day 140814: 23x34 Go, 23x40 NoGo;   training: 21 Go and NoGo,

Day 140815: 23x28 Go, 23x48 NoGo;   training: 14 Go and NoGo

Day 140816: 23x41 Go, 23x48 NoGo;   training: 27 Go and NoGo

Day 140817: 23x42 Go, 23x48 NoGo;   training: 27 Go and NoGo

The rest of the data was used for testing.

Thus, in our classification analysis we got:

1. AC + Striatum ~[20-80] HZ, "2.5-second windows"

Results of the testing are summarized in A_1, …, A_4 confusion matrices:

- Day 140814

$$A_1 = \begin{bmatrix} 11.2 & 1.8 \\ 1 & 18 \end{bmatrix}$$

Correct classification of patterns with Go trials is 86%, and with NoGo trials is 94.7%.

- Day 140815

$$A_2 = \begin{bmatrix} 12.1 & 1.9 \\ 3 & 29 \end{bmatrix}$$

Correct classification of patterns with Go trials is 86.4%, and with NoGo trials is 90.6%.

- Day 140816

$$A_3 = \begin{bmatrix} 12.3 & 1.7 \\ 0.8 & 19.2 \end{bmatrix}$$

Correct classification of patterns with Go trials is 87.8%, and with NoGo trials is 96%.

- Day 140817

$$A_4 = \begin{bmatrix} 13.9 & 1.1 \\ 0.3 & 19.7 \end{bmatrix}$$

Correct classification of patterns with Go trials is 92.6%, and with NoGo trials is 98.5%.