Report.

The same technique is used for new data in order to define 3s-window free of artifacts. Analysis of 3s-windows free of artifacts based on AC and Striatum channels data, we chose the 3s 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 3s-windows for different days. It is necessary to mention that the number of trials with the 3s-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 "3s windows" are denoted by two hyphens in the table 1. (Trials with shock are marked by yellow in the table 1).

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 1, 10 and 26. Additionally, Striatum channels are considered. The Striatum channels that were considered are 11, 13, 14, 16, 25, 27, 30, 32. Thus, the total number of channels is 25.

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 25 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 25-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.

140714		140715		140716		140717		140718		140721	
Go	NoGo	Go	NoGo	Go	NoGo	Go	NoGo	Go	NoGo	Go	NoGo
1	3	1	3	1	3	--1	3	1	3	--1	--3
--2	4	2	4	2	4	2	4	2	4	--2	--4
5	8	5	8	5	8	5	8	5	8	--5	--8
6	9	6	9	6	9	6	9	6	9	--6	--9
7	10	7	10	7	10	7	10	7	10	--7	--10
11	12	11	12	11	12	11	12	11	12	--11	--12
14	13	14	13	14	13	14	13	14	13	--14	--13
15	17	15	17	15	17	15	17	15	17	--15	--17
16	18	16	18	16	18	16	18	16	18	--16	--18
20	19	20	19	20	19	20	19	20	19	--20	--19
22	21	22	21	22	21	22	21	22	21	--22	21
23	24	23	24	23	24	23	24	23	24	--23	--24
25	27	25	27	25	27	25	27	25	27	25	27
26	28	26	28	26	28	26	28	26	28	26	28
29	32	29	32	29	32	29	32	29	32	--29	32
30	33	30	33	30	33	30	33	30	33	--30	33
31	34	31	34	31	34	31	34	31	34	31	--34
35	36	35	36	35	36	35	36	35	36	--35	--36
38	37	38	37	38	37	38	37	38	37	--38	37
39	41	39	41	39	41	39	41	39	41	--39	41
40	42	40	42	40	42	40	42	40	42	--40	42
44	43	44	43	44	43	44	43	44	43	--44	43
46	45	46	45	46	45	46	45	46	45	--46	45
47	48	47	48	47	48	47	48	47	48	--47	48
49	51	49	51	49	51	49	51	49	51	49	51
50	52	50	52	50	52	50	52	50	52	--50	52
53	56	53	56	53	56	53	56	53	56	53	56
54	57	54	57	54	57	54	57	54	57	54	57
55	58	55	58	55	58	55	58	55	58	55	58
59	60	59	60	59	60	59	60	59	60	--59	60
--62	--61	62	61	62	61	62	61	62	61	62	61
--63	--65	63	65	63	65	63	65	63	65	--63	65
--64	--66	64	66	64	66	64	66	64	66	64	66
--68	--67	68	67	68	67	68	67	68	67	--68	67
--70	--69	70	69	70	69	70	69	70	69	--70	69
--71	72	71	72	71	72	71	72	71	72	71	--72
73	75	73	75	73	75	73	75	73	75	--73	--75
74	76	74	76	74	76	74	76	74	76	--74	--76
77	80	77	80	77	80	77	80	77	80	--77	--80
78	81	78	81	78	81	78	81	78	81	--78	--81
79	82	79	82	79	82	79	82	79	82	--79	--82
83	84	83	84	83	84	83	84	83	84	--83	--84

86	85	86	85	86	85	86	85	86	85	--86	--85
87	89	87	89	87	89	87	89	87	89	87	--89
88	90	88	90	88	90	88	90	88	90	--88	90
92	91	92	91	92	91	92	91	92	91	--92	91
94	93	94	93	94	93	94	93	94	93	94	93
95	96	95	96	95	96	95	96	95	96	95	96

Table 2: Trials without shock for each day

140714		140715		140716		140717		140718		140721	
Go	NoGo	Go	NoGo	Go	NoGo	Go	NoGo	Go	NoGo	Go	NoGo
1/48	47/48	0/48	43/48	5/48	47/48	27/48	44/48	30/48	43/48	32/48	44/48
2%	97.9%	0%	89.5%	10.4%	97.9%	56.25%	91.6%	62.5%	89.5%	66.7%	91.6%
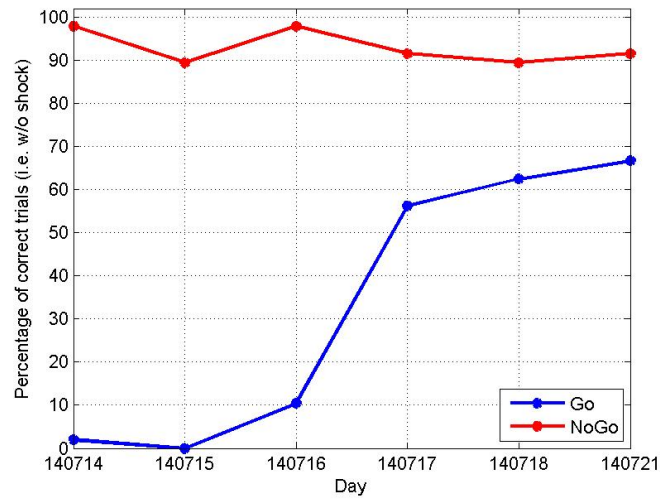
Fig. 2: Percentage of trials without shock.

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

- AC + Striatum

Day 140714: 25x41 Go, 25x43 NoGo;   training: 23 Go and NoGo,

Day 140715: 25x48 Go, 25x48 NoGo;   training: 28 Go and NoGo

Day 140716: 25x48 Go, 25x48 NoGo;   training: 28 Go and NoGo

Day 140717: 25x47 Go, 25x48 NoGo;   training: 27 Go and NoGo

Day 140718: 25x48 Go, 25x48 NoGo;   training: 28 Go and NoGo

Day 140721: 25x13 Go, 25x26 NoGo;   training: 8 Go and NoGo

- Striatum

Day 140714: 8x41 Go, 8x43 NoGo;   training: 23 Go and NoGo

Day 140715: 8x48 Go, 8x48 NoGo;   training: 28 Go and NoGo

Day 140716: 8x48 Go, 8x48 NoGo;   training: 28 Go and NoGo

Day 140717: 8x47 Go, 8x48 NoGo;   training: 27 Go and NoGo

Day 140718: 8x48 Go, 8x48 NoGo;   training: 28 Go and NoGo

Day 140721: 8x13 Go, 8x26 NoGo;   training: 8 Go and NoGo

    The rest of the data was used for testing.

Thus, in our classification analysis we considered four cases:
1. data from AC and Striatum channels, frequency band 20-80Hz
2. data from AC and Striatum channels, frequency band 3-43Hz
3. data only from Striatum channels, frequency band 20-80Hz
4. data only from Striatum channels, frequency band 3-43Hz

Classification results for each case are described below.

1. AC + Striatum ~[20-80] HZ, "3-second windows"

Results of the testing are summarized in A_1, …, A_6 confusion matrices:

- Day 140714

$$A_1 = \begin{bmatrix} 14.1 & 3.9 \\ 3 & 15 \end{bmatrix}$$

Correct classification of patterns with Go trials is 78%, and with NoGo trials is 83%.

- Day 140715

$$A_2 = \begin{bmatrix} 18.7 & 1.13 \\ 0.06 & 19.4 \end{bmatrix}$$

Correct classification of patterns with Go trials is 93.5%, and with NoGo trials is 97%.

- Day 140716

$$A_3 = \begin{bmatrix} 19.8 & 0.02 \\ 2.1 & 17.9 \end{bmatrix}$$

Correct classification of patterns with Go trials is 99%, and with NoGo trials is 89.5%.

- Day 140717

$$A_4 = \begin{bmatrix} 19.1 & 0.9 \\ 0.9 & 19.1 \end{bmatrix}$$

Correct classification of patterns with Go trials is 95.5%, and with NoGo trials is 95.5%.

- Day 140718

$$A_5 = \begin{bmatrix} 20 & 0 \\ 5.2 & 14.8 \end{bmatrix}$$

Correct classification of patterns with Go trials is 100%, and with NoGo trials is 74%.

- Day 140721

$$A_6 = \begin{bmatrix} 3.4 & 1.6 \\ 1.5 & 9.5 \end{bmatrix}$$

Correct classification of patterns with Go trials is 68%, and with NoGo trials is 86%.

2. AC + Striatum ~[3-43] HZ, "3-second windows"

Results of the testing are summarized in A_1, …, A_6 confusion matrices:

- Day 140714

$$A_1 = \begin{bmatrix} 14.7 & 3.3 \\ 4.1 & 13.9 \end{bmatrix}$$

Correct classification of patterns with Go trials is 78%, and with NoGo trials is 83%.

- Day 140715

$$A_2 = \begin{bmatrix} 17.3 & 2.7 \\ 1.9 & 18.1 \end{bmatrix}$$

Correct classification of patterns with Go trials is 86.5%, and with NoGo trials is 90.5%.

- Day 140716

$$A_3 = \begin{bmatrix} 16.7 & 3.3 \\ 1.5 & 18.5 \end{bmatrix}$$

Correct classification of patterns with Go trials is 83.5%, and with NoGo trials is 92.5%.

- Day 140717

$$A_4 = \begin{bmatrix} 16.1 & 3.2 \\ 1.9 & 18.1 \end{bmatrix}$$

Correct classification of patterns with Go trials is 84%, and with NoGo trials is 90.5%.

- Day 140718

$$A_5 = \begin{bmatrix} 18.2 & 1.8 \\ 0 & 20 \end{bmatrix}$$

Correct classification of patterns with Go trials is 91%, and with NoGo trials is 100%.

- Day 140721

$$A_6 = \begin{bmatrix} 2.5 & 2.5 \\ 3.9 & 7.1 \end{bmatrix}$$

Correct classification of patterns with Go trials is 50%, and with NoGo trials is 64.5%.

3. Striatum ~[20-80] HZ, "3-second windows"

Results of the testing are summarized in A_1, …, A_6 confusion matrices:

- Day 140714

$$A_1 = \begin{bmatrix} 8.5 & 9.5 \\ 4 & 14 \end{bmatrix}$$

Correct classification of patterns with Go trials is 47.2%, and with NoGo trials is 77.7%.

- Day 140715

$$A_2 = \begin{bmatrix} 16.9 & 3.1 \\ 1.1 & 18.9 \end{bmatrix}$$

Correct classification of patterns with Go trials is 84.5%, and with NoGo trials is 94.5%.

- Day 140716

$$A_3 = \begin{bmatrix} 15.6 & 4.4 \\ 3.9 & 16.1 \end{bmatrix}$$

Correct classification of patterns with Go trials is 78%, and with NoGo trials is 80.5%.

- Day 140717

$$A_4 = \begin{bmatrix} 17.9 & 2.1 \\ 1.9 & 18.1 \end{bmatrix}$$

Correct classification of patterns with Go trials is 89.5%, and with NoGo trials is 90.5%.

- Day 140718

$$A_5 = \begin{bmatrix} 19 & 1 \\ 2.4 & 17.6 \end{bmatrix}$$

Correct classification of patterns with Go trials is 95%, and with NoGo trials is 88%.

- Day 140721

$$A_6 = \begin{bmatrix} 3.9 & 1.1 \\ 2.4 & 8.6 \end{bmatrix}$$

Correct classification of patterns with Go trials is 78%, and with NoGo trials is 78%.

4. Striatum ~[3-43] HZ, "3-second windows"

Results of the testing are summarized in A_1, …, A_6 confusion matrices:

- Day 140714

$$A_1 = \begin{bmatrix} 17.2 & 0.8 \\ 4.1 & 13.9 \end{bmatrix}$$

Correct classification of patterns with Go trials is 95.5%, and with NoGo trials is 77.2%.

- Day 140715

$$A_2 = \begin{bmatrix} 16.3 & 3.7 \\ 0.2 & 19.8 \end{bmatrix}$$

Correct classification of patterns with Go trials is 81.5%, and with NoGo trials is 99%.

- Day 140716

$$A_3 = \begin{bmatrix} 15.4 & 4.6 \\ 3.4 & 16.6 \end{bmatrix}$$

Correct classification of patterns with Go trials is 77%, and with NoGo trials is 83%.

- Day 140717

$$A_4 = \begin{bmatrix} 17.1 & 2.9 \\ 1.4 & 18.6 \end{bmatrix}$$

Correct classification of patterns with Go trials is 85.5%, and with NoGo trials is 93%.

- Day 140718

$$A_5 = \begin{bmatrix} 16.1 & 3.9 \\ 2.8 & 17.2 \end{bmatrix}$$

Correct classification of patterns with Go trials is 80.5%, and with NoGo trials is 86%.

- Day 140721

$$A_6 = \begin{bmatrix} 1.6 & 3.4 \\ 2.7 & 8.3 \end{bmatrix}$$

Correct classification of patterns with Go trials is 32%, and with NoGo trials is 75.4%.