USE OF CORRELATION TO ASSESS THE SIGNAL CONTENT OF PATTERNS OF SPIKE ACTIVITY REFLECTING THE POPULATION RESPONSE OF RELAYS OF THE CENTRAL AUDITORIMOTOR SYSTEM OF CATS. **Woody, C.D.** Mental Retardation Research Center, Departments of Psychiatry and Biobehavioral Sciences and Neurobiology, UCLA Medical Center, Los Angeles, CA 90024

Correlation analyses have been used to examine the signal content of PST histogram averages of spike trains from neurons along central auditorimotor pathways [1,2]. The results suggest that correlation can be used to assess the meaning of patterns of activity reconstituted from the discharges of many single units at auditorimotor transmission relays in the sense of defining objective, stochastic representations of a CS and an incipient CR (see Table 1 below). Patterns of spike activity reflecting transmission of a 70dB click CS (1 ms pulse to loudspeaker) can be distinguished from patterns reflecting generation of an incipient conditioned movement in cats trained to respond to the CS with a Pavlovian blink CR.

The approach does not allow one to distinguish information chunks as brief as 4 ms that were found earlier to contain important signal information [3]. To attempt this separate analyses are being pursued using a metric-space, cost efficiency approach [4]. Additional algorithms are sought. The limitations of the correlation analyses do not preclude successful discrimination of transmissions reflecting the CS from those reflecting generation of the incipient CR over broad time ranges (Table 1) or the successful use of the correlation approach to trace central pathways over which these messages are transmitted [5]. The database includes selections from a set of recordings from more than 5000 single units recorded in earlier studies and now available on CDs.

Table 1. Pearson correlation coefficients between the sound of the click CS and the mean pattern of unit activity in response to the click at the dorsal cochlear nucleus (DCN), inferior colliculus (IC), subcerebellar dentate nucleus (SDN), auditory receptive cortex (A_I Ctx), medial geniculate nucleus (MGN), rostral thalamus (RT), and pericruciate cortex (Motor Ctx) in cats conditioned to blink to a 70 dB click CS. Below are the Pearson correlation coefficients between the same data and the electromyographically recorded (orbicularis oculis) pattern of the conditioned motor response. Values of the correlation coefficients were calculated over the period from 80 ms before to 320 ms after the click in fifty, 8 ms bins and over the period from 320 ms before to 1280 ms after the click in fifty, 32 ms bins.

	DCN	IC	SDN	A_I Ctx	MGN	RT	Motor Ctx
-80 to 320ms, 8 ms bins							
Sound	.62	.60	.88	.24[a]	-.02*	.14*	.00*
Motor Resp.	-.05*	-.30	-.42	.18*	.54	.46	.52
# of Cells	182	132	158	302	92	128	152
-320 to 1280ms, 32 ms bins							
Sound	.57	.74	.94	.63	.30	.14*	.29
Motor Resp.	.11*	.24[a]	-.28	.55	.46	.79	.28
# of Cells	182	132	158	302	92	128	152

*not significant [a] p<.10

1. Woody, C.D., Becker K.E., and Raheja, A.A. Patterns of neuronal spike activity reflecting the transformation of an acoustic CS into a conditioned motor response. Proc. World Cong. on Neuroinformatics, (CD) Vienna: Vienna University of Technology, 2001, pp.188-196.
2. Becker, Karl E., Raheja, Amit A., and Woody, Charles D. A glimpse of the brain transforming a sensory signal into a motor response. Somatosensory & Motor Res. 19:296-301, 2002.
3. Zotova, E., Woody, C.D., and Gruen, E. Multiple representations of information in the primary auditory cortex of cats: II. Stability and change in early (<32 ms) components of activity after conditioning with a click conditioned stimulus. Brain Res. 868:66-78, 2000.
4. Victor, J.D. and Purpura, K.P. Metric-space analysis of spike trains: theory, algorithms and application. Network: Comput. Neural Syst. 8:127-164, 1997.
5. Woody, C.D. A neuroinformatic analysis of transmission of a click CS in the auditorimotor system. Abstr. Soc. Neurosci. 28, 2002. (CD)

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