dium (*12*). Cells were washed with saline-EDTA solution once, and incubated with 1 mg of egg-white lysozyme per milliliter at 37°C for 15 minutes. The lysis of cells was completed by adding sodium lauryl sulfate to the cell suspension (final concentration, 2 percent) with an additional incubation at 37°C for 5 minutes. The procedure for isolation of DNA was similar to the one described by Marmur (*11*). The column was prepared according to Mandell and Hershey (*6*) except that the column was half the scale described. Elution was performed by applying a linear concentration gradient of NaCl (*13*). NaCl was dissolved in 0.05*M* sodium phosphate buffer (*p*H 6.7).

Table 1. Analysis of distribution of calf-thymus DNA in CsCl gradient.*

Average density † (gm/cm³)	Average GC-content $(\bar{p})$ ‡	$10^{-2}\sigma$ § (p)	$S_{20,w}$ ||	10^6 MW ¶
		Total		
1.707	0.437	5.9	22.8	8.8
		Fraction I		
1.712	0.485	6.6	14.4	2.8
		Fraction II		
1.707	0.437	4.7	20.3	6.5
		Fraction III		
1.704	0.408	4.4	25.0	11.0

* See Figs. 1*A* and 2. † DNA samples were centrifuged in 7.7 molal CsCl solution at 44,770 rev/min at 25°C for 20 hrs with DNA labeled with N^{15} from *Ps. aeruginosa* for reference. The density of the reference DNA (1.746) was previously determined with reference to *E. coli* DNA, whose density was taken as 1.713 (*6*). ‡ Average mole fraction of GC content $(\bar{p})$ was calculated from the density profile (*17*). § Standard deviation (σ) of DNA distribution in CsCl density gradient field was calculated from GC content scale (p) (*17*). \|\| Sedimentation coefficients ($S_{20,w}$) were obtained by centrifuging DNA from the three fractions previously dialysed against 500 volumes of saline-citrate solution. The concentration of DNA in the centrifuge cell was 9, 22, and 10 μg per milliliter for fractions I, II, and III, respectively. ¶ Weight-average molecular weights were calculated from $S_{20,w}$ (*18*).

Table 2. Analysis of distribution of mouse DNA in CsCl gradient.*

Sample	Average density (gm/cm³)	Average GC-content $(\bar{p})$
Total	1.705	0.417
Fraction I	1.709	0.456
Fraction II	1.706	0.427
Fraction III	1.703	0.398

* See Figs. 1*B* and 3 and the legend of Table 1.

Table 3. Analysis of distribution of *B. subtilis* DNA in CsCl gradient.*

Average density (gm/cm³)	$(\bar{p})$	$10^{-2}\sigma$ (p)	$S_{20,w}$	10^6 MW †
		Total		
1.707	0.436	2.23	29.8	16.8
		Fraction I		
1.708	0.446	3.47	16.9	3.6
		Fraction II		
1.707	0.437	2.07	28.9	16.0
		Fraction III		
1.706	0.430	2.22	36.1	27.8

* See Figs. 1*C* and 4 and the legend of Table 1. † The concentration of DNA in the centrifuge cell for sedimentation coefficient measurement was 7, 23, and 10 μg per ml, for fractions I, II, and III, respectively.

Elution profiles of DNA from calf thymus, mouse testis, and *B. subtilis* are shown in Fig. 1*A*, 1*B*, and 1*C*. Samples of DNA (1 to 2 μg) from three fractions, leading, middle, and rear, were centrifuged in 7.7 molal CsCl solution (*14*). Equilibrated DNA distributions are shown in Figs. 2, 3, and 4 for calf thymus, mouse testis, and *B. subtilis*, respectively. Extra components in DNA from calf thymus and mouse testis were observed also. Since there is a positive correlation between the guanine-cytosine (GC) content and density of DNA (*1, 2*) our result is consistent with a property of the column, that is, DNA with higher GC content elutes first (*7*). The average molecular weight of DNA of each fraction was estimated from the sedimentation coefficient for DNA from calf thymus and *B. subtilis*. The fractionation by size is also clear (Tables 1 and 3). The quantitative analysis of the result is summarized in Tables 1, 2, and 3. In the case of calf thymus and *B. subtilis*, sedimentation coefficients of DNA fractions were also measured (Tables 1 and 3).

The extra component of DNA from calf thymus and mouse (Figs. 2 and 3) deserves some comments. These extra components have been reported (*3, 8*). Our results indicate that the extra band (heavy band) of calf thymus DNA behaves normally in the elution pattern; namely, it is eluted in a lower concentration of NaCl. This is most reasonably interpreted as a result of the higher content of guanine and cytosine of the component. On the other hand, the extra band (light band) of DNA from mouse testis behaves abnormally in this respect. It is eluted before the main DNA in spite of its lighter density. Since the band width of the light band indicates a molecular weight of approximately 19 million, the anomaly of elution behavior cannot be attributed to the smallness of its molecular size. One possible explanation is that the low density of the extra DNA from mouse may be due to the presence of an unusual base. For example, a high content of an unusual base like methylcytosine should lower the density because of the low density of the methyl group (*15*).

TS'AI-YING CHENG*
NOBORU SUEOKA
Department of Biology, Princeton University, Princeton, New Jersey

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Signal Duration as a Factor in Vigilance Tasks

Abstract. *Short signals in a vigilance test generated an inferior initial performance, as compared with longer signals, and resulted in a steeper decrement in performance. A short (1-minute) and a long (2-hour) vigilance task was undertaken by each subject.*

It can be hypothesized from the expectancy theory of vigilance (*1*) that the shorter the signal in a vigilance task, the poorer the initial detection performance and the steeper the decrement in detection performance. To test these hypotheses, 63 housewives served as the subjects in a clock-test on two occasions one day apart. The clock was 20 cm in diameter, with a plain white face and a black second hand with a radial sweep which completed a rotation once a minute. Sig-

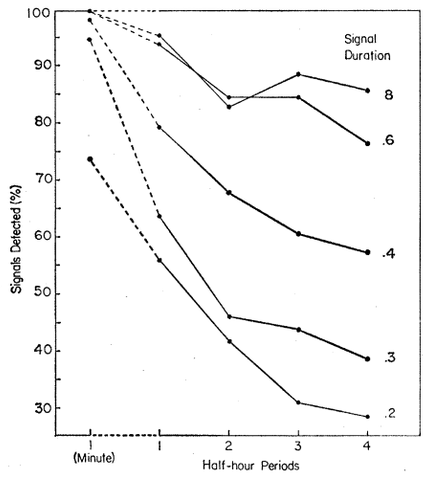

Fig. 1. The percentage of signals detected during the 1-minute task and during each half-hour of the 2-hour task, for signals of five different durations.

nals were brief stoppages of the hand. The viewing distance was 2.5 m.

On the first occasion, vigilance performance was determined over a number of 1-minute periods by having the subjects verbally indicate, after each single rotation of the clock-hand, in which of four marked and numbered 30-degree segments of the circumference the signal had occurred. Signals were stoppages of the hand for 0.2, 0.3, 0.4, 0.6, or 0.8 second. Each duration was used 10 times, 50 durations being given to each subject in random order. On the second occasion, performance was determined over a period of 2 hours with the marked segments of the clock deleted. Signals of the same durations occurred in random order and location. Signals of each duration occurred once each 15 minutes, the signal rate being 20 per hour. Subjects responded to signals by depressing a microswitch held in the hand. Some of the results are shown in Fig. 1. Since there are no "unwanted signals" in such a task, there were no false reports of signals and the problem of discriminating between true signals and unwanted signals did not arise.

Analysis of variance showed, for the 2-hour task, a significant decrement and a significant difference between signal durations (both at the 0.01 level of confidence). The signal duration times the decrement interaction was not significant. A second analysis showed detection performance on the 1-minute task differed significantly (at the 0.001 level of confidence) with signal duration. In a final analysis in which the data from both tasks were considered as having been generated in a single task, the signal duration times the tasks interaction was found to be significant at the 0.001 level of confidence—that is, there was a differential degree of decrement between performance on the first task and mean performance on the second.

These data are interpreted as being in support of the hypotheses (*2*).

C. H. BAKER

Human Factors Research, Inc., Los Angeles 19, California

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Auditory Discrimination by the Cat after Neonatal Ablation of Temporal Cortex

Abstract. *Some auditory discriminations cannot be acquired by the cat after large bilateral ablations of auditory cortex at maturity. However, if such ablations are sustained during infancy, these discriminations are readily learned. The function of the cortex in auditory discrimination depends on the age of the nervous system at the time of injury.*

Cats in which auditory cortex has been removed are able to discriminate the onset of a sound (*1*), changes in the intensity (*2*), or changes in the frequency (*3*) of a tone. On the other hand, after similar cortical damage animals are unable to distinguish between two different sound patterns (*4*) or between two sounds of different duration (*5*). These findings are based on experiments in which the animals were mature at the time of ablation. They indicate that some auditory discriminations are not cortically bound but that others are. It was the purpose of the work reported here to explore further the relationship between cortical structures and auditory discrimination by removing such structures during infancy rather than at maturity.

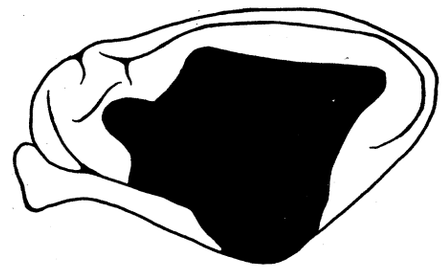

Fig. 1. Schematic representation of the lateral cortical surface of the cat brain showing the intended size and location of the lesion.

Large bilateral lesions were made in the brains of nine infant cats between the seventh and tenth postnatal days. Surgery was carried out under dilute Nembutal anesthesia and cortical tissue was removed by aspiration. The intended area of ablation is shown in Fig. 1 and includes at least the total cortical projection field of the medial geniculate body (*6*). Littermates of these animals were used as nonoperated controls. All 18 animals were reared in the laboratory until 6 months of age, at which time discrimination training was initiated. Lesions were made in another group of seven mature animals ranging in age from 6 to 9 months. In four of these cats the ablations were comparable to those made in the infant group. In the remaining three, the lesions were intentionally smaller. Training of these animals began 6 months after this surgery, as did that of a group of five nonoperated controls of the same age.

All cats were trained to avoid shock by crossing from one side to the other in a typical two-compartment shuttle box, after a change in the duration of a pulsing tone. The avoidance signal consisted of a sequence of 800-cy/sec tone pulses, each pulse lasting 1 second, with a 1 second silent interval between successive pulses. The neutral signal was an identical sequence of pulses. However, the duration of each pulse in this sequence was 4 seconds. The animal was required to cross within a 10-second period after a shift from neutral to avoidance signal if shock were to be averted. Accordingly, the learning of the avoidance response depended on the cat's ability to distinguish between two sounds of different duration. Intertrial intervals were