EFFECT OF CONTINUOUS TRAFFIC NOISE ON PERCENTAGE OF DEEP SLEEP, WAKING AND SLEEP LATENCY.*

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A. BACKGROUND

Our original experiments tested the disturbing effect on sleep of individual truck passages with the intervals between them being relatively quiet (30 to 35 decibels due to the air conditioner). Being awakened was, of course, considered a disturbance but so was a shift from a deeper level of sleep to a shallower level. (The depth of sleep was monitored by means of an electroencephalograph which measured the brain waves from electrodes attached to the forehead of the subjects). The result showed that disturbances started at peak noise levels of 20 to 30 decibels and increased with the level until at 75 decibels a single truck passing through a city would disturb 80 percent of the sleepers on its route.

These results do not, of course, prove that the disturbances are harmful. The quiet periods between passages of trucks may be used to make up for the disturbance if the body has an appropriate mechanism for such adjustment. We therefore tried to measure the effect of the truck noise on the percentage of deep sleep that was obtained by the subjects. For this purpose the usual five stages of sleep (six if waking is included) were divided into only two stages "deep" sleep (stage 2, 3 and 4) and "shallow" sleep which included all the rest. This division was chosen because "spindles", which are clearly audible on a speeded up magnetic tape recording of the brain waves as chirping noises, occur in this "deep" sleep. This makes measurement simple, fast and objective. No subjective judgments confound the results.

As expected we found that the percentage of deep sleep was lower for the nights with truck noise than during the alternating quiet nights when only the air conditioning system could be heard. The amount was not great, being only about 3 percent, but quite consistent. Of 12 subjects only one showed an increase of deep sleep and that was only a fraction of one percent.

B. PRESENT EXPERIMENTS

Intermittent truck noise with quiet periods in between is, of course, quite different from the random noise of free flowing

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traffic. So the present experiments were conducted using a recording of actual traffic noise in a busy street. Again the noise-nights alternated with quiet nights when only the air conditioner could be heard.

When the average noise level of the traffic was 47 dB the effect on percentage of deep sleep for 12 subjects was 2.5 percent but this time in the opposite direction. That is, there was more deep sleep during the noisy nights. Only three subjects showed a small decrease.

Another group of 12 subjects was then subjected to average levels of 60 dB. The response was now a 4.8 percent increase in deep sleep and all subjects were in the same direction (although the variation was great among individuals).

These results probably will not surprize mothers who sing their infants to sleep. But there is a seeming contradiction here since, when the number of wakings are counted, it is found that they behave in the expected way - they are greater during the nights with the truck noise. The group subjected to 47 dB had nearly 13 percent more wakings on noise nights while the group with the 60 dB noise had an increase of 36 percent.

But, as was found before and confirmed in the present work, the waking reaction adapts to the noise. After two weeks the number of wakings drops by a half. In a couple of months one would expect them to be essentially zero.

People often complain that noise interferes with their falling asleep. Accordingly this was also measured by timing the interval between lights-out and the onset of spindles (the latency of "deep" sleep onset). To within experimental error it was found to be nil for both groups.

So we may well ask: what is the harm - if any - that noise can have on sleep? For certain individuals it is clear. But for the population in general we cannot answer that question. In a way this is not surprizing since we do not yet even know the function of sleep.

Why do we have to sleep?