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PSYCHOLOGY

Tests Show Effect of Noise on Nerves

By **EMILY C. DAVIS**

Jing-ng-ng-ng, goes the telephone. Rattle, rattle, rattle go the typewriters. Br-r-r-r-r (magnified 100 or so times)—that's the roar of traffic in the street below. Squeeeeeeek—as the cars slow down near the corner. A shrill indescribable toot is the siren of an automobile in a hurry.

"Where's that telegram from Williams?"

"I don't know. Look in the files."

"And he said to me—"

Conversation isn't so noisy, but it distracts a worker. Or doesn't it?

What do such noises do to the mind and body of individuals?

In the opinion of Thomas Edison, noise is bound to increase, in cities at any rate, and he foresees that the city dweller will adapt himself to the situation by becoming comfortably deaf, just deaf enough not to care. But Mr. Edison takes a long view of the situation.

Scientists in the meantime are beginning to measure the exact effect of noises on a worker's speed and accuracy, on his energy output, and on his nerves.

A twelve-day experiment showing what noise does to a good typist has just been completed by Dr. Donald Laird and his assistants in the psychological laboratory at Colgate University. For five years Dr. Laird has been conducting investigations to measure the human energy that is used up in various kinds of mental work. He has studied causes of fatigue and ways of stalling off the weariness that comes from using up too much energy in a job that might be much more simply done. He has looked around offices and factories and shown ways in which environment can make a huge difference in an individual's effi-

ciency, and in the wear and tear on his body machinery.

In this latest test, Dr. Laird determined to measure the differences between typing in a room where noises reverberate from ordinary brick walls and typing in a room with walls which deaden the thundering echoes and vibrations.

The typist of the experiment was Miss Elsie Keller, a young woman who finds turning out 100 words a minute a comfortable speed, and who can do 158 a minute if the boss is in a hurry.

Each week-day for two weeks Miss Keller sat in Dr. Laird's laboratory and typed the same letter over and over for two hours, without a stop, while the staff of experimenters watched the apparatus of the experiment and took notes and made computations.

Miss Keller went into a special kind of training for this psychological investigation. For two weeks she dedicated all of her energy to the experiment. She did no walking except to enter a taxicab at her house and to walk from the taxi into the

laboratory. Each morning she ate a standard breakfast. Each morning she was weighed in, like a prize fighter, to find out whether her weight was changing during the typing ordeal.

Before she started rattling out letters she was asked each day to sit quietly at rest in the laboratory for half an hour. This enabled the scientists to measure the rate at which her body expends its energy at approximately its lowest waking level.

Then, she seated herself before a noiseless typewriter, while the laboratory men prepared to turn on the noise. This important part of the experiment was furnished by an electrically run machine. The versatile noise machine was prepared to produce a steady hum like the din of traffic. It would ring a telephone bell at irregular intervals. It sounded a shrill automobile horn from time to time. Sometimes the whirr of office machinery was added to its assortment of sounds. Conversation was about the only noise left out of the

(Just turn the page)



NO GUM CHEWING FOR THIS TYPIST. The gas mask helps in measuring the amount of energy she uses, while the psychologist with the stop watch keeps up with her speed

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Noise and Nerves

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machine's repertoire, and this was supplied by a phonograph which ground out a recitation occasionally on request.

This machine saw to it that throughout the two-hour stretches of typing, one noise or another was constantly banging at Miss Keller's ears. Though even at the worst, Dr. Laird says, the noise was no greater than in many offices and not so bad as in some offices.

When the noises were turned on about five feet away from her, and a rubber mask was fitted over her nose and mouth to collect her breath, the typist was ready for work.

During the first three days she worked in a room in which the sound was partially absorbed by wall coverings, so that they did not re-echo through the room in prolonged vibrations. In these circumstances, the noise machine did not disturb her, the typist reported, except for the shrill auto siren which caused her to make mistakes when it blared in her ears.

On the fourth day, the experiment was changed to a laboratory with brick walls, where the noises could reverberate and each sound wave echoed undisturbed, so that the effect piled up and each noise seemed to be multiplied.

Here the typist declared that she was still not consciously disturbed by office noises. The telephone bell, and the sounds like typewriters and mimeographs were accustomed racket, and did not seem to distract her. The automobile horn, on the other hand, continued to annoy her, and mistakes followed its alarming sound.

Dr. Laird and his associates, meanwhile, were making their measurements. These showed that a human being's report of how he feels is not the most accurate gauge of the state of his own mechanism, in spite of the fact that he has inside information.

In the pile of neatly typed letters

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Noise and Nerves

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which accumulated each day beside Miss Keller's machine, there was no difference in the number of errors made, whether the room was full of echoing sounds or whether the sounds were deadened. This may explain why the typist herself thought she was not being disturbed by the noises. But Dr. Laird's figures show that the typist was keeping up her accuracy at the expense of speed and only by an increasing drain on her energy.

When the really noisy conditions were in full swing, the energy demand quickly mounted 20 per cent higher than it had been with the vibrations deadened. And as the experiment progressed the drain on the typist's energy increased as she tried to overcome the bombardment of echoes from the brick walls.

This energy output was measured, Dr. Laird explained, by analyzing the typist's breath. The gas mask into which she breathed carried the breath out through a long tube into the next room, where it was measured in a gas meter. Every fifteen minutes a laboratory assistant examined the air sent through the tube and reported the percentages of oxygen and carbon dioxide it contained. From this the greater energy output in the noisy room was shown.

The psychologist's stop watch showed equally marked contrasts in the typist's speed. In quiet conditions, her speed steadily increased for two hours, it was found. But in noisy conditions, her speed fell off after about 45 minutes.

Even the time taken to slip a new sheet of paper in the typewriter increases when a room is full of noise and confusion, Dr. Laird's tests indicate. And if accuracy is kept up, as Miss Keller kept it up by considerable skill at concentration, the mental effort causes fatigue to set in rapidly.

On the second morning of typing in the noisy room, this speed typist, who is used to working under stresses and strains, became exhausted before the test period was up and had to be helped out of the room by an assistant. Yet she went back later, and Dr. Laird pronounced that she stood up well under the experiment.

On the last day of the test, the noise machine was turned off, and the typist worked in an absolutely quiet room. Results of this day's work did not differ appreciably from the results in the room with covered walls, Dr. Laird found.

This may indicate that some noise is not harmful to the individual's efficiency or physical condition, he suggests.

It might be said that this is only one individual, and that other people may be affected differently, or not at all. But Dr. Laird points out that somewhat similar tests which he has recently made with typists of average ability show the same general tendencies. Some, who had less power of concentration than the speed typist, ran up a high record for making mistakes when the telephone bells and the phonograph filled the brick-walled room. All of the "just average" typists lost speed, and most of them spent about 35 per cent more energy in fighting the noise.

From such experiments and from experiments of other scientists, Dr. Laird concludes that "in general, the better typist the more she is adversely affected by noise; amateur typists in such tests have not been measurably bothered by noisy surroundings."

Other psychologists have been struck by the importance of the same problem of what noise can do to fingers at work or to a brain that is trying to struggle with an idea.

Dr. Linus W. Kline, working in the Harvard psychological laboratory, tied tin cans together and dragged them back and forth across a room, while obliging students helping him with the experiment tried to concentrate on mental problems. The noise of the tin cans, the professor found, interfered appreciably with the students' progress in learning.

Another psychologist, Dr. John J. B. Morgan, working at Columbia University, rigged up a typewriter, so that the amount of pressure on the keys was recorded. While students typed he ran off a Noah's Ark phonograph record, and found that the animal sounds bothered the typists and caused them to use up more energy and exert more pressure on the keys.

It has long been realized that copersmiths, kettlesmiths, and railroad engineers, who work all day to the accompaniment of loud noises, are apt to become gradually deafened. It is a newer idea that ears are sufficiently sensitive so that they show greater signs of fatigue after an ordinary individual's working day or at the end of the week. But this was recently demonstrated by four scientists at the University of Wisconsin, using for their apparatus only a watch mounted on a moving carriage. The distance

(Just turn the page)

"Sick" Electric Lamps

That a "disease" of electric lamps, due not to microbe, but a combined physical and chemical phenomenon, may be the clue to some diseased conditions of men and animals, is the suggestion thrown out by Sir Oliver Lodge, famous British scientist, in the magazine *Nature*.

The lamp filament "disease," he says, was called to his attention by Dr. C. C. Paterson, director of the General Electric Research Laboratories in England. Its effect is to thin the filament in one place and thicken it in another, which causes the lamp to burn out to an untimely death.

A minute amount of water vapor in the lamp is the poison that causes the effect. Water, whether in liquid or vapor form, consists of hydrogen and oxygen. Inside the electric lamp, the heat of the filament causes the molecules of water to break up into atoms of hydrogen and oxygen. The free oxygen combines with some of the tungsten of the filament to form tungsten oxide, just as oxygen in the air combines with iron to form iron oxide, or iron rust.

But when a molecule of tungsten "rust" is formed, it is soon deposited on another part of the filament, slightly cooler than the part from whence it came.

In the cooler parts of the filament, the free hydrogen atoms pull the oxygen out of the tungsten oxide, and the tungsten is left on the filament in a different place from where it started. Then the water molecule, formed of the reunited hydrogen and oxygen atoms, is free to return to the thin part of the filament to take away some more tungsten. The thin part becomes still thinner, the resistance to the current becomes greater, and this part of the filament becomes hotter, and the action is speeded up.

As the action is due to water vapor, the obvious remedy is to make sure that no water vapor is left in the bulb. Sir Oliver suggests that some similar impurity might be present in the blood or tissues which may act in such a way in building up local growths at the expense of other parts of the body. He commends this to the attention of biologists and points out that salt solutions, and liquids similar to those in the body, are known to behave in a very similar way to gases.

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Noise and Nerves

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at which the students could hear the watch tick at different times was measured, and they found that mental work always causes decrease in keenness of hearing, and strenuous physical exertion has the same temporary effect.

These scientists reported that the ears are a delicate barometer of physical fitness. In other words, diminished hearing power may give warning of approaching fatigue several hours before the individual's muscles and nerves tell his brain that he is becoming weary.

Even in sleep the ears are on guard. Dr. Laird states that the passing of a noisy trolley car or automobile beneath your bedroom window raises your blood pressure at once, though no signs of wakening may be noted.

All this does not mean that ears are so fragile that they should be protected against every loud noise and every distracting sound. It does mean that noise may be a factor in efficiency, in office and shop efficiency, and in personal efficiency as well.

Results of such tests as Dr. Laird is making are causing executives to look over their plants and offices to see whether excessive noise is making their employees inefficient, weary, and perhaps impairing their hearing. Machinery that once rocked an entire building is being put on bases which will cut down vibrations, and instead of the vibrations being prolonged, they fade away quickly. Walls and floors are being made sound absorbent, to swallow up the echoes of a battery of machine-gun typewriters. And employers are finding out how many people can, or cannot, work together effectively in a given space.

Much attention has been paid recently to providing adequate lighting conditions in offices, factories, and homes in order to conserve eyesight. Ear strain has been equally neglected, but a growing interest in the subject of saving ears indicates that perhaps, after all, city dwellers are not going to be content to grow comfortably deaf in a noisy world.

Science News-Letter, April 9, 1927

Minnesota farmers living along a trunk line railway left eight rows of corn standing to prevent snow drifts.

A group of naturalists is urging that birds of prey have good qualities and should not be slaughtered at the present rate.

More Eyes and Ears---

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