

The Pathology of Boredom

Aviators sometimes suffer hallucinations during long, monotonous flights. The phenomenon is illuminated by a general examination of the effect of prolonged exposure to a monotonous environment

by Woodburn Heron

If you shake the surface on which a snail is resting, it withdraws into its shell. If you shake it repeatedly, the snail after a while fails to react. In the same way a sea anemone which is disturbed by a drop of water falling on the water surface above it ceases to be disturbed if drops continue to fall; a bird stops flying away from a rustling motion if the motion is steadily repeated. Most organisms stop responding to a stimulus repeated over and over again (unless the response is reinforced by reward or avoidance of punishment). Indeed, the higher organisms actively avoid a completely monotonous environment. A rat in a maze will use different routes to food, if they are available, rather than the same one all the time. It will tend to avoid areas in which it has spent considerable time and to explore the less familiar areas.

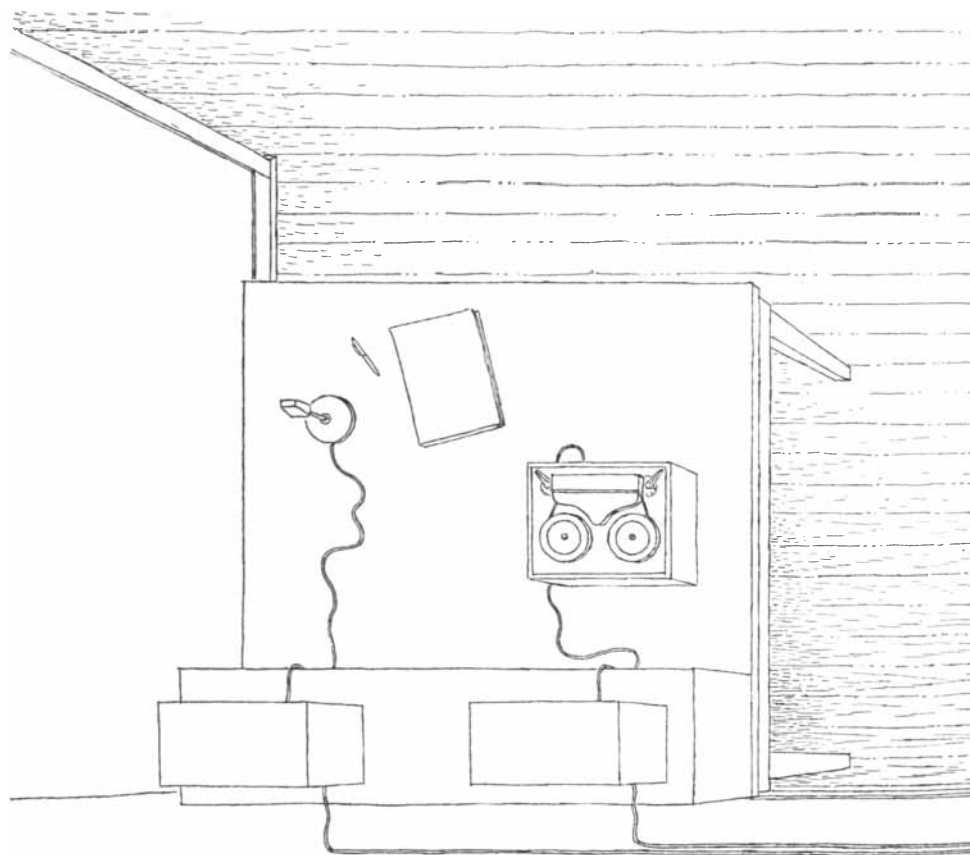
Monotony is an important and enduring human problem. Persons who have to work for long periods at repetitive tasks often complain of being bored and dissatisfied with their jobs, and frequently their performance declines. During the last war N. H. Mackworth of England made a series of researches for the Royal Air Force to find out why radar operators on antisubmarine patrol sometimes failed to detect U-boats. The operators usually worked in isolation, watching a radar screen hour after hour. Mackworth set up a comparable laboratory situation, requiring subjects to watch a pointer moving around a graduated dial and to press a button whenever the pointer made a double jump. The subjects' efficiency declined in the surprisingly short time of half an hour. As a result of this and other research the radar operators' tour of duty was shortened.

In this age of semi-automation, when

not only military personnel but also many industrial workers have little to do but keep a constant watch on instruments, the problem of human behavior in monotonous situations is becoming acute. In 1951 the McGill University psychologist D. O. Hebb obtained a grant from the Defence Research Board of Canada to make a systematic study

of the effects of exposure for prolonged periods to a rigidly monotonous environment. Hebb's collaborators in the project were B. K. Doane, T. H. Scott, W. H. Bexton and the writer of this article.

The aim of the project was to obtain basic information on how human beings would react in situations where



EXPERIMENTAL CUBICLE constructed at McGill University in Montreal to study the effects of perceptual isolation is at the right in this semischematic drawing from above. The subject lies on a bed 24 hours a day, with time out for meals and going to the bathroom. The room is always lighted. The visual perception of the subject is restricted by a translucent barrier.

nothing at all was happening. The purpose was not to cut individuals off from any sensory stimulation whatever, but to remove all patterned or perceptual stimulation, so far as we could arrange it.

The subjects were male college students, paid \$20 a day to participate. They lay on a comfortable bed in a lighted cubicle 24 hours a day for as long as they cared to stay, with time out only for meals (which they usually ate sitting on the edge of the bed) and going to the toilet. They wore translucent plastic visors which transmitted diffuse light but prevented pattern vision. Cotton gloves and cardboard cuffs extending beyond the fingertips restricted perception by touch. Their auditory perception was limited by a U-shaped foam rubber pillow on which their heads lay and by a continuous hum of air-conditioning equipment which masked small sounds.

When we started the research we were not at all sure what aspects of behavior it would be most profitable to investigate. Accordingly we began with a preliminary run in which we merely

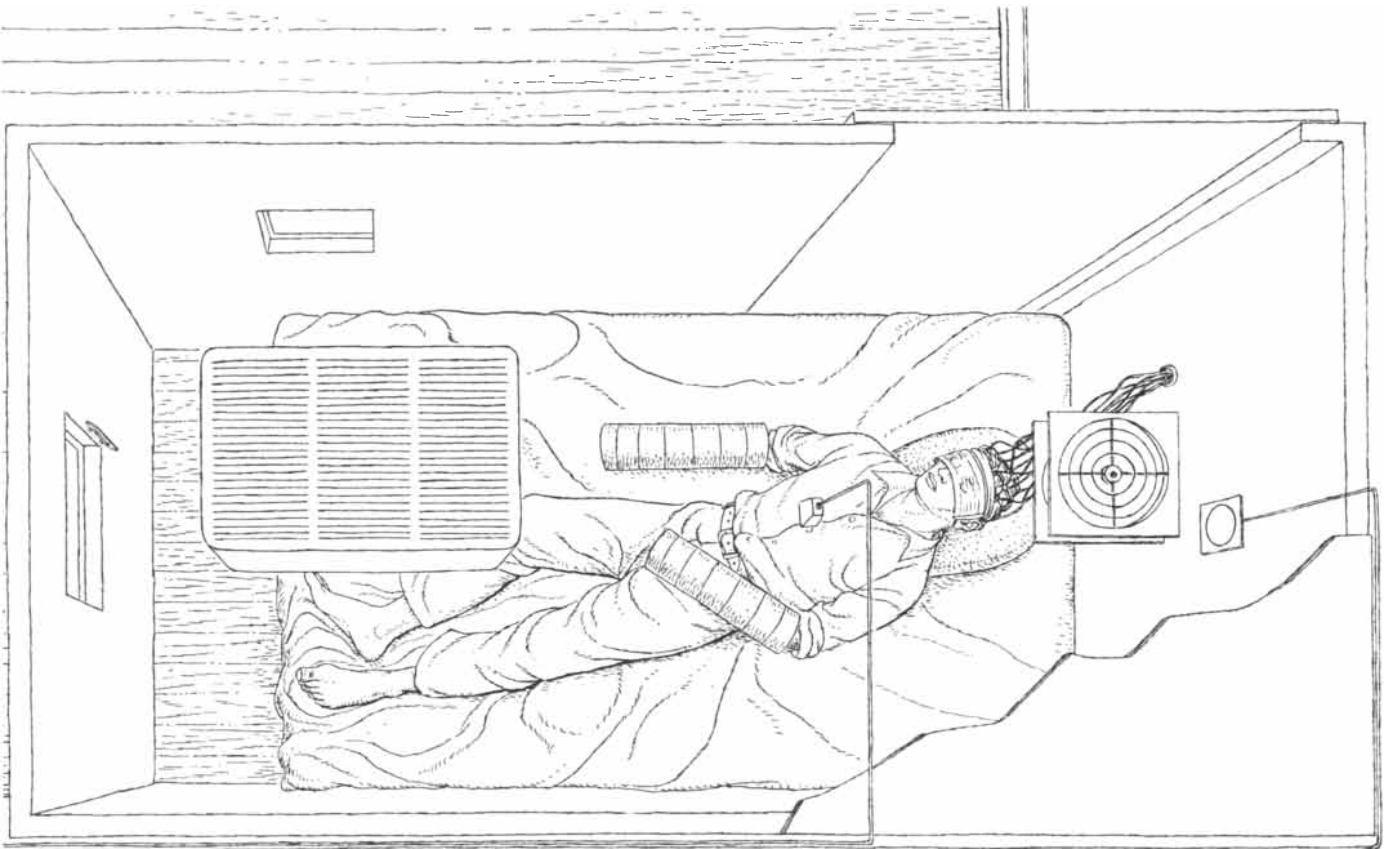
observed the subjects' behavior and interviewed them afterward. Most of these subjects had planned to think about their work: some intended to review their studies, some to plan term papers, and one thought that he would organize a lecture he had to deliver. Nearly all of them reported that the most striking thing about the experience was that they were unable to think clearly about anything for any length of time and that their thought processes seemed to be affected in other ways. We therefore decided that the first thing to do was to test effects on mental performance.

We used three main methods of investigating this. One was a battery of oral tests involving simple arithmetic, anagrams, word association and so on. This battery was given before the experiment, at 12, 24 and 48 hours during the isolation and finally three days afterward. Another battery of tests, given two days before and immediately after the isolation period, included copying a design with blocks, speed of copying a prose paragraph, substituting symbols for numbers, picking out what was odd

in each of a series of pictures (for instance, one picture showed a man in a canoe using a broom instead of a paddle) and recognizing patterns embedded in a complex background. The third test used a recording of a talk arguing for the reality of ghosts, poltergeists and other supernatural phenomena. It was played to each subject during his isolation. We examined the individual's attitude toward supernatural phenomena before he entered isolation and after he had emerged.

On almost every test the subjects' performance was impaired by their isolation in the monotonous environment (and was poorer than that of a control group of students). The isolation experience also tended to make the subjects susceptible to the argument for the existence of supernatural phenomena. Some of them reported that for several days after the experiment they were afraid that they were going to see ghosts.

As the subjects lay in isolation, cut off from stimulation, the content of their thought gradually changed. At first



cent plastic visor; his auditory perception, by a U-shaped pillow covering his ears and by the noise of an air conditioner and a fan (ceiling of cubicle). In the experiment depicted here a flat pillow is used to leave room for the wires attached to the subject's scalp,

which are connected to an electroencephalograph in an adjacent room. The subject's sense of touch is restricted by cotton gloves and long cardboard cuffs. The experimenter and the subject can communicate by means of a system of microphones and loud speakers.

they tended to think about their studies, about the experiment, about their personal problems. After a while they began to reminisce about past incidents, their families, their friends and so on. To pass the time some tried to remember in detail a motion picture they had seen; others thought about traveling from one familiar place to another and would try to imagine all the events of the journey; some counted numbers steadily into the thousands. (Incidentally, such experiences are commonly reported by persons who have been in solitary confinement for long periods.) Eventually some subjects reached a state in which it took too much effort to concentrate, and they became "content to let the mind drift," as one subject put it. Others said: "My mind just became full of sounds and colors, and I could not control it"; "I just ran out of things to think of"; "I couldn't think of anything to think about." Several subjects experienced "blank periods" when they did not seem to be thinking at all.

Not surprisingly, the subjects became markedly irritable as time went on and often expressed their irritation. Yet they also had spells when they were easily amused. In the interview afterward many of the subjects expressed surprise that their feelings could have oscillated so much, and that they could have behaved in such a childish way. They also said that they seemed to lose their "sense of perspective" while in the cubicle, and some subjects mentioned that at times they felt that the experimenters were against them, and were trying to make things exceptionally tough for them.

The subjects reported something else to which we at first paid no particular attention, but which was to emerge as the most striking result of the experiments. Many of them, after long isolation, began to see "images." One man repeatedly saw a vision of a rock shaded by a tree; another kept on seeing pictures of babies and could not get rid of them. Several subjects seemed to be "having dreams" while they were awake. Not until one of the experimenters himself went through the isolation experience for a long period did we realize the power and strangeness of the phenomenon. His report, and a review of the literature on other experiments in monotony, made clear that the experimental situation induced hallucinations.

The visual phenomena were similar to those experienced after taking the intoxicating drug of the mescal plant (mescal buttons), which is a ceremonial practice of some Indian tribes in the

Southwest. They have also been reported in experiments in which subjects were exposed for long periods to blank visual fields or flickering light.

Our subjects' hallucinations usually began with simple forms. They might start to "see" dots of light, lines or simple geometrical patterns. Then the visions became more complex, with abstract patterns repeated like a design on wallpaper, or recognizable figures, such as rows of little yellow men with black caps on and their mouths open. Finally there were integrated scenes: *e.g.*, a procession of squirrels with sacks over their shoulders marching "purposefully" across the visual field, prehistoric animals walking about in a jungle, processions of eyeglasses marching down a street. These scenes were frequently distorted, and were described as being like animated movie cartoons. Usually the subjects were at first surprised and amused by these phenomena, looked forward eagerly to see what was going to happen next and found that the "pictures" alleviated their boredom. But after a while the pictures became disturbing, and so vivid that they interfered with sleep. Some of the subjects complained that their eyes became tired from "focusing" on the pictures. They found sometimes that they could even scan the "scene," taking in new parts as they moved their eyes, as if they were looking at real pictures.

The subjects had little control over the content of the hallucinations. Some kept seeing the same type of picture no matter how hard they tried to change it. One man could see nothing but dogs, another nothing but eyeglasses of various types, and so on. Some subjects were able to realize visions of objects suggested by the experimenter, but not always in the way they were instructed. One man, trying to "get" a pen, saw first an inkblot on a white tablecloth, then a pencil, then a green horse, finally a pen.

The hallucinations were not confined to vision. Occasionally a subject heard people in the "scene" talking, and one man repeatedly heard a music box playing. Another saw the sun rising over a church and heard a choir singing "in full stereophonic sound." Several subjects reported sensations of movement or touch. One had a feeling of being hit in the arm by pellets fired from a miniature rocket ship he saw; another, reaching out to touch a doorknob in his vision, felt an electric shock. Some subjects reported that they felt as if another body were lying beside them in the cubicle;

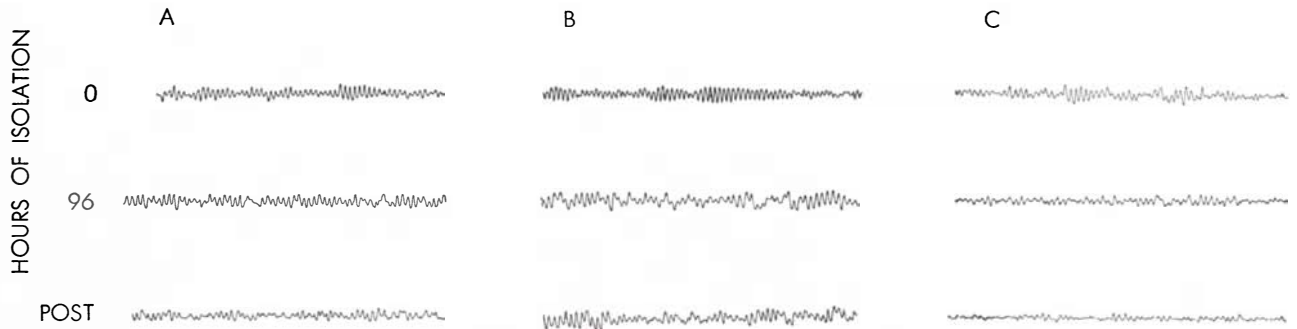
in one case the two bodies overlapped, partly occupying the same space. Some reported feelings of "otherness" or "bodily strangeness"; trying to describe their sensations, they said, "my mind seemed to be a ball of cotton wool floating above my body," or "something seemed to be sucking my mind out through my eyes."

After emerging from isolation, our subjects frequently reported that "things looked curved," "near things looked large and far things looked small," "things seemed to move," and so on. We therefore made some systematic tests of their visual perception. The most striking finding was that when subjects emerged after several days of isolation, the whole room appeared to be in motion. In addition there was a tendency for surfaces to appear curved, and for objects to appear to be changing their size and shape. Asked to match a disk that was handed to them to one in a row of disks of various sizes 12 feet away, the subjects consistently chose a larger disk than did control subjects.

We recorded changes in the electrical activity of the brain in these subjects by means of electroencephalograms made before, during and after the isolation period. There was a tendency for some slow waves, which are normally present in sleep but not when an adult is awake, to appear after a period of isolation. In addition, the frequencies in the region of the principal brain rhythm slowed down [*see charts on opposite page*].

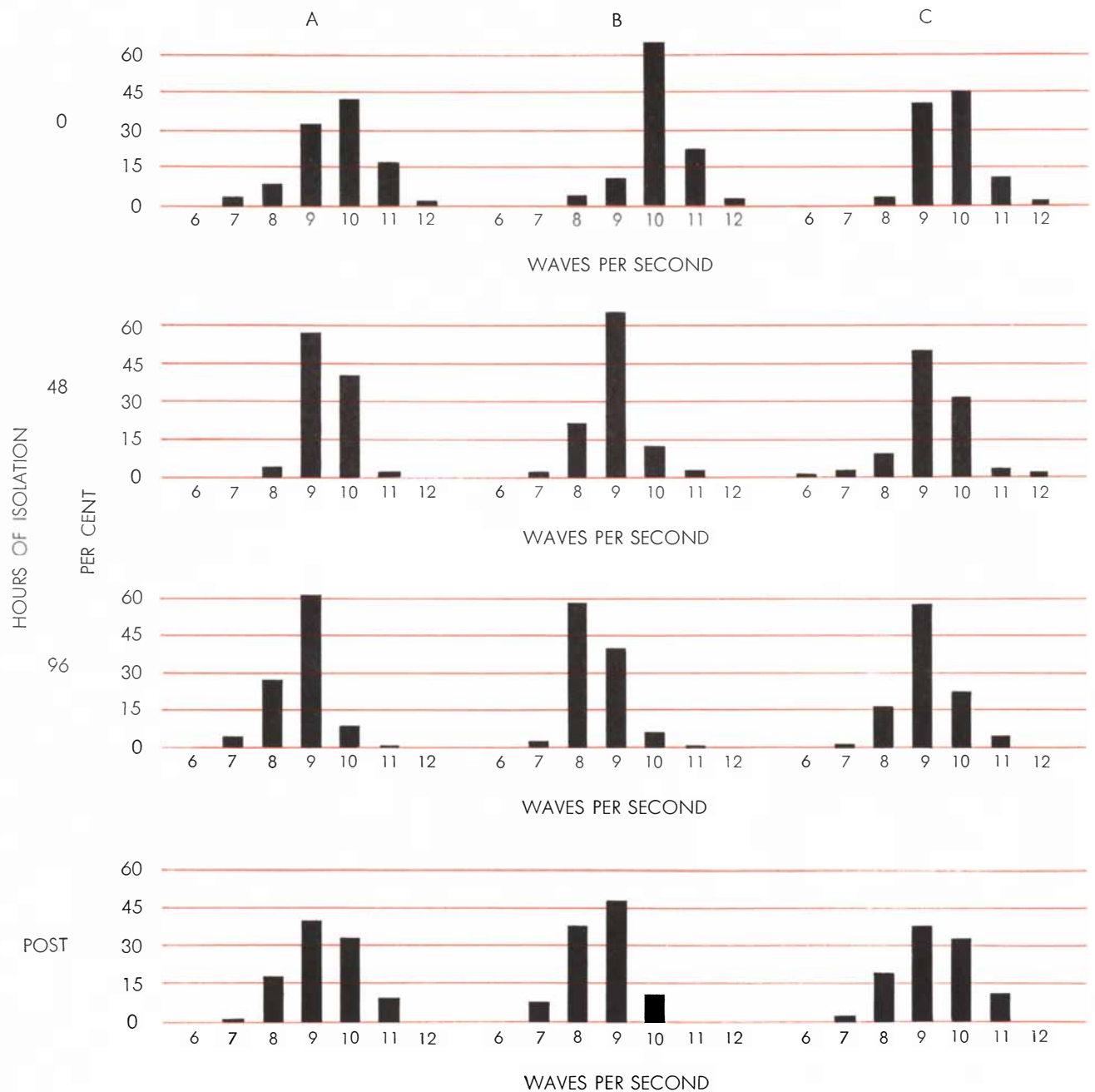
The overt behavior of the subjects during the experiment was, of course, carefully recorded. Most of the subjects went to sleep fairly soon after they had been placed in the cubicle. After waking they showed increasing signs of restlessness. This restlessness was not continuous but came in more and more intense spells, which were described as being very unpleasant. The subjects appeared eager for stimulation, and would talk to themselves, whistle, sing or recite poetry. When they came out for meals, they tended to be garrulous and attempted to draw the experimenters into conversation. In moving about, as when they were led to the toilet, they appeared dazed and confused, and had increasing difficulty in finding their way about the washroom.

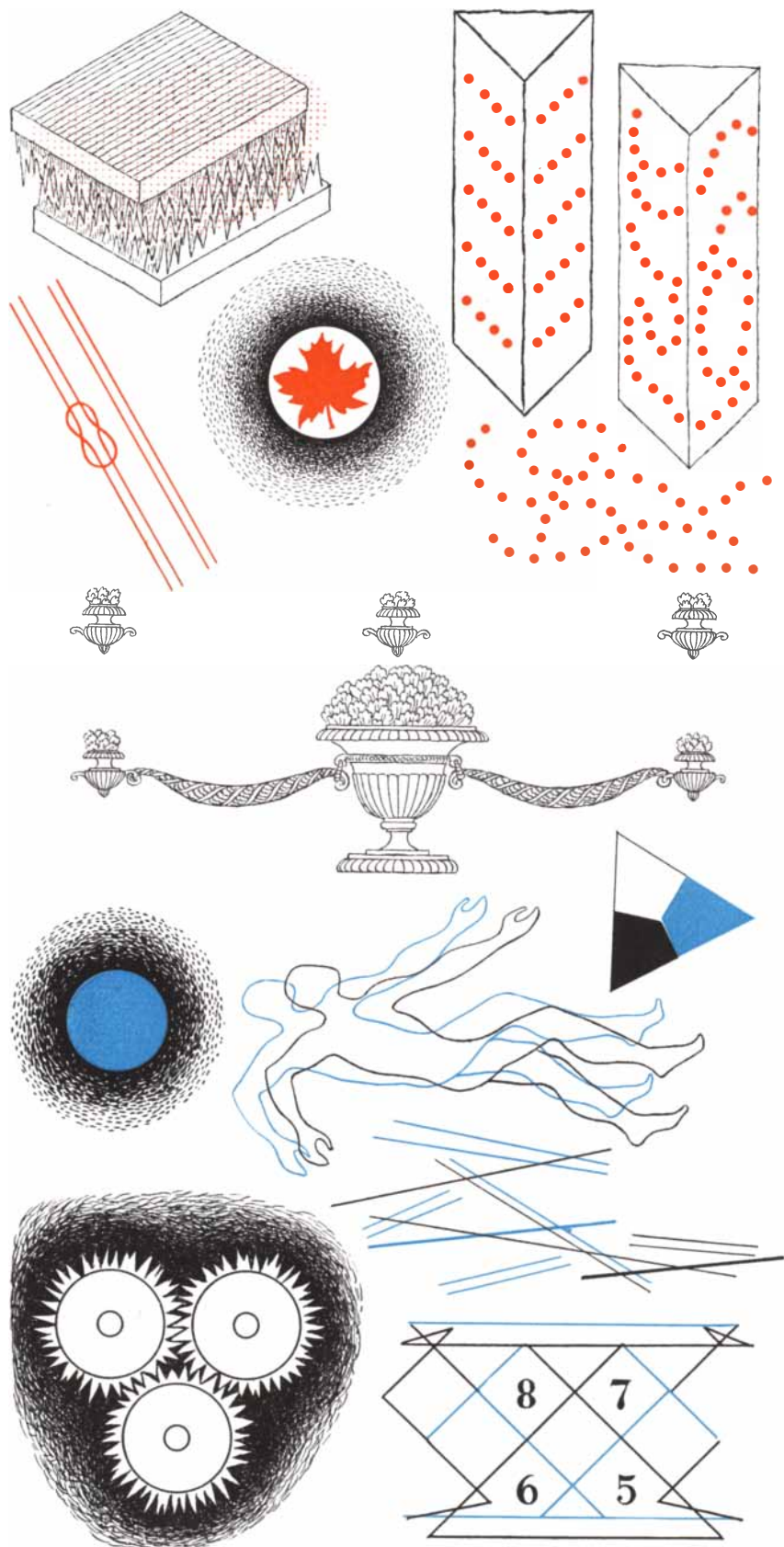
As an outgrowth of the general experiment, we have begun some tests to find out the effects of restriction of just one sense. We tested six subjects who wore the frosted visors constantly but who otherwise were allowed to pursue



BRAIN WAVES from the occipital region of three subjects of the McGill University experiments (*above*) showed some change after 96 hours of isolation and three hours after the subject had emerged from isolation (POST). Similar changes in three other subjects

are reflected in the bar charts (*bottom*). Below each bar is the number of waves counted in each one-second interval over a period of 300 seconds. The height of each bar is the percentage of all the waves during that period. Thus it indicates wave frequencies.





comparatively "normal" activities. Unfortunately the results of this experiment are not "pure," because the restriction of vision greatly restricted their movements and opportunity for other stimulation. These subjects developed visual hallucinations and also experienced some disorders of visual perception when the visors were removed.

Prolonged exposure to a monotonous environment, then, has definitely deleterious effects. The individual's thinking is impaired; he shows childish emotional responses; his visual perception becomes disturbed; he suffers from hallucinations; his brain-wave pattern changes. These findings are in line with recent studies of the brain, especially of the reticular formation in the midbrain [see "Pleasure Centers in the Brain," by James Olds; *SCIENTIFIC AMERICAN*, October, 1956]. In some way the reticular formation regulates the brain's activity. The recent studies indicate that normal functioning of the brain depends on a continuing arousal reaction generated in the reticular formation, which in turn depends on constant sensory bombardment. It appears that, aside from their specific functions, sensory stimuli have the general function of maintaining this arousal, and they rapidly lose their power to do so if they are restricted to the monotonously repeated stimulation of an unchanging environment. Under these circumstances the activity of the cortex may be impaired so that the brain behaves abnormally.

The results of our experiments seem to throw light on a number of practical problems. For instance, studies in France and at Harvard University have indicated that hallucinations are fairly common among long-distance truck drivers. After many hours on the road they may begin to see apparitions such as giant red spiders on the windshield and non-existent animals running across the road, which frequently cause accidents. Similar phenomena have been reported by aviators on long flights: Charles Lindbergh described some in his autobiography. It is not improbable that some unexplained airplane and railroad accidents have been occasioned by effects of prolonged monotonous stimulation.

A changing sensory environment seems essential for human beings. Without it, the brain ceases to function in an adequate way, and abnormalities of behavior develop. In fact, as Christopher Burney observed in his remarkable account of his stay in solitary confinement: "Variety is not the spice of life; it is the very stuff of it."

HALLUCINATIONS of isolated subjects are depicted. The drawings are based on descriptions by the subjects during the experiment and on sketches made after isolation period.

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