

# Reports

## Influence of Suggestion and Subjects' Prior Knowledge in Research on Sensory Deprivation

*Abstract.* Several investigators have reported that normal human subjects placed in a dark, quiet room for several hours undergo a variety of hallucinatory experiences; these are typically attributed to extended periods of reduced sensory input. In the present experiment, similarly dramatic subjective experiences occurred within 1 hour when subjects were told of the possibility and appropriateness of such phenomena.

Normal experimental subjects have been found to experience peculiar images—"hallucinations," "delusions," and so on—during periods of sensory deprivation (1-3). Typically, a subject lies on a bed in a room by himself for periods ranging from 8 hours to a week or more. He wears translucent eye goggles which permit him to perceive diffused light but not forms, earphones into which is played "white noise" (static) of sufficient intensity to mask out other sounds, and gloves and cardboard cuffs to reduce tactual stimulation. The subject is instructed to describe his experiences from time to time, and his reports are usually tape recorded.

Although research on sensory deprivation is still exploratory, most investigators have emphasized one or another apparent dimension of the deprivation situation: for example, patterning of

stimuli (1), intensity of stimuli (4), meaningfulness of stimuli (5), "imposed structuring of stimuli" (2), restricted bodily movement (3), and social isolation (6). The unusual and sometimes dramatic experiences which are typically reported have been considered relevant to the understanding of brainwashing, solitary confinement, hallucinogenic drugs, and schizophrenia.

Based on their previous reading, their observations of the experimental equipment, and the nature of the instructions, subjects in experiments on sensory deprivation typically have some knowledge and some expectations of the "anticipated" peculiar effects. The influence of such prior knowledge and expectations about anticipated effects was investigated in the experiments reported here.

Fourteen male, college students were paid \$5 each to undergo pretesting, 1 hour of sensory deprivation under the aforementioned typical conditions, post-testing (7), and an interview. Before deprivation all subjects were given prepared information regarding the "anticipated" results. They were told that previous subjects had reported peculiar cognitive and perceptual experiences—unusual images, perceptions, ideas, feelings, and so on. However, no specific contents were suggested. (Subjects in many previous experiments have possessed similar information.) Since the period of deprivation was so short, and in order to make these expectations seem more plausible, the subjects were told that they would also take a hallucinogenic drug which facilitated the effects of sensory deprivation. They were, in fact, given placebo pills. In addition, they were told that unusual experiences under these circumstances were entirely normal.

During the 1 hour of sensory deprivation under the aforementioned typical conditions (that is, lying on a couch alone in a dimly lighted room and

wearing translucent goggles, gloves, arm cuffs, and earphones), subjects were instructed to report "from time to time, about your mental processes, your thoughts, images, daydreams, feelings, and any unusual perceptions."

During the experimental hour, all subjects reported a wide variety of unusual experiences. On the basis of the tape recordings, supplemented by inquiry during the interview, these experiences were classified as indicated below. Although a subject often reported more than one experience in a category (for example, seeing colors four or five times), all his experiences in one category were counted but once in the tabulation of that category. The number of categories of experiences reported by each subject varied from 10 to 25 with a median of 21. The number in parentheses after each category gives the number of subjects reporting that experience.

*Visual.* All but two of the 14 subjects reported visual experiences: complex sequences (6), people (5), colors (5), moving spots (4), geometrical shapes (4), unusual objects (4), and changes in illumination (2).

*Auditory.* All 14 subjects reported auditory experiences: airplanes, trains, and so on (10); water or wind (9); ringing in ears (9); complex sequences (6); birds, insects, or animals (5); sounds of people (other than talking) (5); people talking (4); and music (4).

*Taste and smell.* Only two subjects reported such experiences.

*Somesthetic.* All 14 subjects reported one or more unusual somesthetic experiences: peculiar bodily sensations (14); unusually warm or cold (10); body floating, tumbling, and so on (9); "depersonalization" (8); sleepy or eyelids heavy (7); dizziness (5); movement of goggles or earphones (5); muscle spasms or tics (3); and extreme pain (1).

*Emotional.* All but two of the 14 subjects reported experiences classified as: reluctance to or difficulty in talking (10), anxious or afraid (8), peculiar emotional tone (6), and lonely or abandoned (3).

*Cognitive.* All 14 subjects complained of some difficulty in thinking: hard to concentrate (8), hard to tell if awake or asleep (7), peculiar thoughts (8), fantasy of disease or physical malfunctioning (7), time discrepancy (4), sexual thoughts (3), and concern about deleterious effects of experiment (3).

Most of these categories are self-

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Type manuscripts double-spaced and submit one ribbon copy and one carbon copy.

Limit the report proper to the equivalent of 1200 words. This space includes that occupied by illustrative material as well as by the references and notes.

Limit illustrative material to one 2-column figure (that is, a figure whose width equals two columns of text) or to one 2-column table or to two 1-column illustrations, which may consist of two figures or two tables or one of each.

For further details see "Suggestions to contributors" [*Science* 125, 16 (1957)].

explanatory. "Complex sequences" refer to seeing or hearing a series of related scenes or sounds—for example, "I saw an expressway and heard cars going across. A few minutes later I saw a whole city from an airplane. It just lasted a second." "Sound of people other than talking" refers to hearing crowds applauding or booing, people scraping their chairs across the floor, and so on.

An example of "unusually warm or cold" is "the little finger of my left hand feels like it is burning." "Depersonalization" refers to feeling dead, parts of the body feeling detached, peculiar loss of bodily sensation, and the like. "Concern about deleterious effects . . ." refers to the report of several subjects that they were getting gangrene or becoming paralyzed in the course of the experiment.

The subjective experiences reported in this experiment appear very similar to, and fully as extreme as, those reported in many of the previously cited studies. Several subjects were convinced of the reality of their hallucinations, and one found the experimental situation so stressful that he was unable to continue the experiment. Since 1 hour is so much shorter than commonly used deprivation periods, the effects reported by our subjects are considered to be due primarily to the subjects' prior knowledge of the anticipated results and to the creation of the attitude "it is appropriate to experience hallucinations in this situation." This interpretation is supported by the findings of Kandel *et al.* (8) whose subjects reported unusual visual experiences following "loaded" instructions. It is also of interest to note that the subjects of Hochberg *et al.* (9), in a "ganzfeld experiment" carried out before the first studies on sensory deprivation, reported hallucinatory experiences in the visual field but not in other categories of experience. They had been instructed to report continuously on perceived shapes, distances, color, and texture.

Our findings, supported by those of Kandel and Hochberg *et al.*, raise serious doubt concerning the current practice of attributing unusual experiences to one or another dimension of the sensory-deprivation situation. While it is conceivable that 1 hour of sensory deprivation produced the dramatic experiences reported by our subjects, it seems more likely that these experiences resulted primarily from a combination

of suggestion and the creation of an attitude concerning the appropriateness of hallucinatory experiences. If so, it is essential that the possible influence of suggestion be allowed for in the design of, and in interpreting the results of, future studies of sensory deprivation (10).

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#### References and Notes

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### All-Female Species of the Lizard

#### Genus *Cnemidophorus*, Teiidae

**Abstract.** Six species of lizards in the genus *Cnemidophorus*, Teiidae, have been found to be all-female or virtually all-female. The species are *C. costatus exsanguis* Lowe, *C. deppei cozumelus* Gadow, *C. inornatus* Baird (western population), *C. perplexus* Baird and Girard, *C. tessellatus* (Say), and *C. velox* Springer. It is hypothesized that the explanation of these virtually all-female populations is genetic.

During the summer of 1959 an expedition, under the auspices of the Thorne Ecological Institute and the University of Colorado Museum, was made to the Yucatan Peninsula and Cozumel Island. The primary purpose of the expedition was to collect adequate series of endemic teiid lizards for osteological studies. The party of four, Mr. and Mrs. Herbert Beargie, Christopher Smith, a National Science Foundation participating undergraduate scholar, and I, arrived at Cozumel Island on 26 June and left on 1 July. Because of inclement weather, effective collecting was possible only on 28, 29, and 30 June. During this period, a series consisting of 72 adults and 4 juveniles of *C. deppei cozumelus* was collected. Subsequent internal examination

of each individual for testes, hemipenes, oviducts, or ovaries with developing follicles revealed the astounding fact that all 76 specimens were females.

Two possible explanations of this phenomenon can be made. First, it may be assumed that males do exist, that collecting was biased, and that the apparent lack of males has an ecological explanation. Or, second, it may be assumed that, during the breeding season at least, males do not exist, that females reproduce by some parthenogenetic mechanism, and that the explanation of the phenomenon is genetic.

The genus *Cnemidophorus* is notorious for its erratic periods of activity, both diurnal and seasonal. There is some evidence of sexual disparity in this respect as well. Duellman (1) reports that during the dry season from November through May adult males of *Cnemidophorus costatus zweifeli* apparently aestivate. Inasmuch as our entire series of *C. deppei cozumelus* was collected during a 3-day period at the end of June, the possibility that in this species too, only females were active at that time of the year, was considered. A series of 35 specimens was borrowed, four from the region of Lake Peten, Guatemala, 30 from Cozumel, and one from Mujeres Island to the north. These specimens, collected at different times of the year, also proved to be females.

An examination of the remaining species in the genus was initiated to determine whether separate seasonal cycles of activity of the two sexes of a species existed elsewhere, and also to check on the sex ratios of the 74 currently recognized forms. It became immediately apparent that the condition found in *C. deppei cozumelus* is not unique.

Five additional species, subspecies, or populations were found which resemble *C. deppei cozumelus* in being predominately or entirely female in structure. These are *C. costatus exsanguis*, *inornatus* ssp. (western populations), *C. perplexus*, *C. tessellatus*, and *C. velox*. One male *C. tessellatus* was found in a series of 223 specimens examined, and two juvenile males, questionably allocated to *C. velox*, were found in a series of 104 specimens of that species. The specimens examined constitute large series, collected by various institutions over a long period of time and at all seasons of lizard activity. There seems to be little doubt that in these species some other ex-