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EFFECTS OF PHYSICAL RESTRAINT AND OF REDUCTION OF ORDINARY LEVELS OF PHYSICAL  
STIMULI ON INTACT, HEALTHY PERSONS \*

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Introduction

We have been in pursuit of some answers to the question of what happens to a brain and its contained mind in the relative absence of physical stimulation. In neurophysiology, this is one form of the question: Freed of normal efferent and afferent activities, does the activity of the brain soon become that of coma or sleep, or is there some inherent mechanism which keeps it going, a pacemaker of the "awake" type of activity? In psychoanalysis, there is a similar, but not identical problem. If the healthy ego is freed of reality stimuli, does it maintain the secondary process, or does primary process take over, i.e., is the healthy ego independent of reality or dependent in some fashion, in some degree on exchanges with the surroundings to maintain its structure?

In seeking answers, we have found some pertinent autobiographical literature and reports of experiments by others, and have done some experiments ourselves. The experiments are a set on human subjects; truly neurophysiological experiments on animals are yet to be accomplished. Many psychological experiments in isolation have been done on animals, but are not recounted in detail here; parenthetically, the effect on very young animals can be an almost completely irreversible lack of development of whole systems such as those necessary for the use of

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vision in accomplishing tasks put to the animal.

### Autobiographical Accounts

The published autobiographical material has several drawbacks: in no case is there a true reduction of all possibilities of stimulation and action, and in most cases, other factors add complications to the phenomena observed. We have collected 18 autobiographical cases which are more frank and revealing than most. We have interviewed 2 cases who have not published any of their material. In this account, we proceed from rather complicated situations to the more simple ones, i.e., from a maximum number of factors to the most simple experimental situation.

From this literature we have found that isolation per se acts on most persons as a powerful stress. The effects observed are similar to those of any extreme stress, and other stressful factors add their effects to those of isolation to cause mental symptoms to appear more rapidly and more intensely. As is well-known, stresses other than isolation can cause the same symptoms to appear in groups. Some of our cases are found in the polar and sea-faring literature.

Taking our last point first, we have the account by Walter Gibson given in his book, The Boat. This is the case of the survival of 4 persons out of 135 in a lifeboat in the Indian Ocean in World War II. Gibson gives a vivid account of his experiences, and the symptoms resulting from loss of hope, dehydration, thirst, intense sunburn, and physical combat. Most of the group hallucinated aid, many despaired and committed suicide, others were murdered, and some were eaten by others. The whole structure of egos was shaken and recast in desperate efforts at survival.

I cite this case because it gives a clue as to what to expect in those who do survive isolation in other conditions: Gibson survived -- how? He says, (1) by previous out-of-doors training in the tropical sun for some years (2) by being able to become completely passive (3) by having and maintaining the conviction that he would come through the experience, and, we add, (4) by having a Chinese woman, Doris Lim, beside him, who shared his passivity and convictions.

In all cases of survivors of isolation, at sea or in the polar night, it was the first exposure which caused the greatest fears and hence the greatest danger of giving way to symptoms: previous experience is a powerful aid in going ahead, despite the symptoms. Physical passivity is necessary during starvation, but, in some people, may be contra-indicated in social isolation. In all survivors, we run across the inner conviction that he or she will survive, or else there are definite reassurances from others that each will be rescued. In those cases of a man and a woman together, or even the probability of such a union within a few days, there is apparently not only a real assurance of survival, but a love of the situation can appear. Of course, such couples are the complete psychological antithesis of our major thesis of complete isolation: many symptoms can be avoided by healthy persons with such an arrangement.

Solitary sailors are in a more complex situation than is the group of polar isolates. The sailing of a small boat across oceans requires a good deal of physical exertion, and the situation may be contaminated by a lack of sleep which can also cause symptoms. The solitary sailors, of which Joshua Slocum and Alain Bombard are outstanding examples, relate that the first days out of port are the dangerous ones: awe, humility,

fear in the face of the sea are most acute at this time. Bombard states that if the terror of the first week can be overcome, one can survive. Apparently, many do not survive this first period: there are several pairs of ocean-crossing sailors in which one of the couple became so terror-stricken, paranoid, and either bent on suicide and/or murder, that he had to be tied to his bunk.

Once this first period is past, other symptoms develop, either from isolation itself or from isolation plus other stresses. In the South Atlantic, Joshua Slocum had a severe gastro-intestinal upset just before a gale hit his boat; he had reefed his sails, but should have taken them down. Under the circumstances, he was unable to move from the cabin. At this point he saw a man take over the tiller -- at first he thought it was a pirate, but the man reassured him and said that he was the pilot of the Pinta and that he would take his boat safely through the storm. Slocum asked him to take down sail but the man said, no, they must catch the Pinta ahead. The next morning Slocum recovered and found his boat had covered 93 miles on true course, sailing itself.

This type of hallucination - delusion seems to be characteristic of the strong egos who survive: a "savior" type of hallucination rather than a "destroyer" type. Their inner conviction of survival is projected thoroughly.

Other symptoms that appear are superstitiousness: (Slocum thought a reef named M Reef was lucky because M is the 13th letter of the alphabet and 13 was his lucky number; Bombard thought the number of matches necessary to light a cigarette represented the number of days until the end of the voyage); intense love of any living things (Slocum was revolted

at the thought of killing food-animals, especially a goat given to him at one port; Ellam and Mudie became quite upset after catching and eating a fish that had followed the boat all day, and swore off further fish-eating); conversations with inanimate objects (Bombard had bilateral conversation with a doll mascot); and a feeling that when one lands, one had best be careful to listen before speaking to avoid being considered insane (Bernicot refused an invitation to dinner on another yacht after crossing the Atlantic alone, until he could recapture the proper things to talk about). The inner life becomes so vivid and intense that it takes time to re-adjust to the life among other persons and to re-establish one's inner criteria of sanity (when placed with fellow prisoners, after 18 months in solitary confinement, Christopher Burney was afraid to speak for fear that he would show himself to be insane).

Life alone in the polar night, snowed-in, with the confining surroundings of a small hut is a more simple situation. However, there are other complicating factors: extreme cold, possibilities of carbon monoxide poisoning, collapse of the roof, etc. Richard Byrd, in his book Alone, recounts in great detail his changes in mental functioning -- and talks of a long period of CO poisoning resulting in a state close to catatonia in himself. I refer you to his book for details. He experienced, as did Slocum and many others, the oceanic feeling, the being "of the universe", at one with it.

Christiane Ritter (A Woman in the Polar Night) was exposed to isolation for periods up to 16 days at a time. She saw a monster, hallucinated her past as if in bright sunshine, and became "at one" with the

moon, and developed a monomania to go out over the snow -- she was saved by an experienced Norwegian who put her to bed and fed her lavishly. She developed a love for the situation and stayed out the next year with her husband. For a thorough and sensitive account of symptoms, I recommend her book to you.

From these examples and several more (bibliography) we conclude the following:

- (1) Published autobiographies are of necessity incomplete: social taboos, discretion to one's self, suppression and repression of painful or uncomfortable material, and rationalization severely limit the scope of the material available. (Interviews with two Norwegians, each of whom lived alone in the polar night, confirm this impression).
- (2) Despite these limitations, we find that persons in isolation experience many, if not all, of the symptoms of the mentally ill.
- (3) In those who survive, the symptoms can be reversible. How easily reversible, we do not know. Most survivors report a new inner security and a new integration of themselves on a deep and basic level.
- (4) The underlying mechanisms are obscure:

It is obvious that inner factors in the mind tend to be projected outward, that some of the activity which is usually reality-bound now becomes free to turn to phantasy and ultimately to hallucination and delusion; it's as if the laws of thought had become projected into the realm of the laws of inanimate matter and of the universe: the primary process tends to absorb more and more of the time and energy usually taken by the secondary process.

Experiments to clarify the necessary conditions for some of these effects have been done. One of the advantages of the experimental material is that simpler conditions can be setup and tested, and additional stresses can be eliminated.

#### Experimental Isolation

The longest exposures to isolation on the largest number of subjects has been done in Dr. Donald Hebb's Department of Psychology at McGill University by a group of graduate students. We started a similar project independently with different techniques at Bethesda. In the Canadian experiments, the aim is to reduce the patterning of stimuli to the lowest level; in ours, the objective is to reduce the absolute intensity of all physical stimuli to the lowest possible level.

In the McGill experiments, a subject is placed on a bed in an air-conditioned box with arms and hands restrained with cardboard sleeves, and eyes covered completely with translucent ski goggles. The subjects are college students motivated by \$20/day for as long as they will stay in the box. An observer is present, watching through a window, and tests the subject in various ways verbally through a communication set.

In our experiments, the subject is suspended in a tank containing slowly flowing water at 34.5°C., wears a blacked-out headmask for breathing and wears nothing else. The water temperature is such that the subject feels neither hot nor cold: the experience is such that one tactually feels the supports and the mask, but not much else. The sound level is low -- one hears only one's own breathing and some faint water sounds from the piping. It is one of the most even and monotonous environments I have experienced. After the initial training period, no



observer is present. Immediately after exposure, the subject writes personal notes on his experience.

At McGill, the subjects varied considerably in the details of their experiences. However, a few general phenomena appeared. After several hours, each subject found that it was difficult to carry on organized, directed thinking for any sustained period. Suggestibility was very much increased. An extreme desire for stimuli and action developed; there were periods of thrashing around in the box in attempts to satisfy this need. The borderline between sleep and awakedness became diffuse and confused. Somewhere between 24 and 72 hours most subjects couldn't stand it any longer and left. Hallucinations and delusions of various sorts developed, mostly in those who could stay longer than 2 days.

The development of hallucinations in the visual sphere followed the stages seen with mescaline intoxication; when full-blown, the visual phenomena were complete projections maintaining the 3-dimensions of space in relation to the rest of the body and could be scanned by eye and head movements. The contents were surprising to the ego, and consisted of material like that of dreams, connected stories sharing past memories and recent real events. The subjects' reactions to these phenomena were generally amusement and a sense of relief from the pressing boredom; they could describe them vocally without abolishing the sequences. A small number of subjects experienced doubling of their body images. A few developed transient paranoid delusions, and one had a seizure-like episode after 5 days in the box with no positive EEG findings for epilepsy.

Our experiments have been more limited both in numbers of subjects and duration of exposures. There have been 2 subjects, and the longest

exposure has been 3 hours. We have much preliminary data, and have gained enough experience to begin to guess at some of the mechanisms involved in the symptoms produced.

In these experiments, the subject always has a full night's rest before entering the tank. Instructions are to inhibit all movements as far as possible. An initial set of training exposures overcomes the fears of the situation itself.

In the tank, the following stages have been experienced:

(1) For about the first 3/4 of an hour, the day's residues are predominant: one is aware of the surroundings, recent problems, etc.

(2) Gradually, one begins to relax and more or less enjoy the experience: the feeling of being isolated in space and having nothing to do is restful and relaxing at this stage.

(3) But slowly, during the next hour, a tension develops which can be called a "stimulus-action" hunger ("lust" might be a better term because of the high intensity it can reach): hidden methods of self-stimulation develop: twitching muscles, slow swimming movements (which cause sensations as the water flows by the skin), stroking one finger with another, etc.

If one can inhibit such maneuvers long enough, intense satisfaction is derived from later self-stimulations.

(4) If inhibition can win out, the tension may ultimately develop to the point of forcing the subject to leave the tank.

(5) Meanwhile, the attention is drawn powerfully to any residual stimulus: the mask, the suspension, each come in for their share of concentration -- such residual stimuli become the whole content of

consciousness to an almost unbearable degree.

(6) If this stage is passed without leaving the tank, one notices that one's thoughts have shifted from a directed type of thinking about problems to reveries and fantasies of a highly personal and emotionally charged nature. These are too personal to relate publicly, and probably vary greatly from subject to subject. The individual reactions to such fantasy material also probably varies considerably, from complete suppression to relaxing and enjoying them.

(7) If the tension and the fantasies are withstood, one may experience the furthest stage which we have yet explored: projection of visual imagery. I have seen this once, after a 2 1/2 hour period. The black curtain in front of the eyes (such as one "sees" in a dark room with eyes closed) gradually opens out into a 3-dimensional dark, empty space in front of the body. This phenomenon captures one's interest immediately, and one waits to find out what comes next. Gradually forms of the type sometimes seen in hypnogogic states appear. In this case, they were small, strangely shaped objects with self-luminous borders. A tunnel whose inside "space" seemed to be emitting a blue light then appeared straight ahead. About this time, this experiment was terminated by a leakage of water into the mask.

It turns out that exposures to such conditions train one to be more tolerant of many internal activities -- fear lessens with experience and personal integration can be speeded up. But, of course there are pitfalls here to be avoided -- the opposite effects may also be accelerated in certain cases.

In both the McGill experiments and in ours, certain after-effects are

noted: the McGill subjects had difficulty in orienting their perceptual mechanisms; various illusions persisted for several hours. In our experiments, we notice that after immersion, the day apparently is started over, i.e., the subject feels as if he has just arisen from bed afresh; this effect persists, and the subject finds he is out of step with the clock for the rest of that day. He also has to re-adjust to social intercourse in subtle ways.

Experiments such as these demonstrate results similar to that given above for solitary polar living and sailing alone: if one is alone, long enough, and at levels of physical and human stimulation low enough, the mind turns inward and projects outward its own contents and processes; the brain not only stays active despite the lowered levels of inputs and outputs, but accumulates surplus energy to extreme degrees.

Apparently even healthy minds act this way in isolation. What this means to psychiatric research is obvious -- we have yet to obtain a full, documented picture of the range available to the healthy human adult mind; some of the etiological factors in mental illness may be clarified and sharpened by such research. Of course, this is a limited region of investigation -- we have not gone into details about loss of sleep, starvation and other factors which have great power in changing healthy minds to sick ones. I think that you can see the parallels between these results and phenomena found in normal children and in psychotics -- and if we could give you a more detailed account, possible applications to "brainwashing" and its opposite, psychotherapy, would be more evident.

## REFERENCES

SMALL, Maurice H., On some psychical relations of society and solitude,  
Pedagogical Seminary, VII, No. 2, April 1900.

### SOLITARY SAILORS

SLOCUM, Captain Joshua, Sailing Alone Around the World, Rupert Hart-Davis,  
London, 1948.

ELLAM, Patrick and Colin Mudie, Sopranino, W. W. Norton and Co., Inc.,  
New York, 1953.

BOMBARD, Dr. Alain, The Voyage of the Héretique, Simon and Schuster,  
New York, 1953.

MERRIEN, Jean, Lonely Voyagers, G. P. Putnam's Sons, New York, 1954.

MERRIEN, Jean, Les Navigateurs Solitaires, Editions Denoël, 1954.

BERNICOT, Louis, The Voyage of Anahita - Single-Handed Round the World -  
Rupert Hart-Davis, Soho Square, London, 1953.

### DRASTIC DECREES OF STRESS

GIBSON, Walter, The Boat, Houghton Mifflin Company (The Riverside Press),  
Boston, 1953.

### LIVING IN THE POLAR NIGHT

SCOTT, J. M., Portrait of an Ice Cap with Human Figures, Chatto and  
Windus, London, 1953.

COURTAULD, A., Living alone under polar conditions, the Polar Record,  
No. 4: University Press, Cambridge, July 1932.

BYRD, Richard E., Alone, G. P. Putnam's Sons, New York, 1938.

RITTER, Christiane, A Woman in the Polar Night, E. P. Dutton and Co., Inc.,  
New York, 1954.

FORCED ISOLATION AND CONFINEMENT

BURNEY, Christopher, Solitary Confinement, Coward-McCann, Inc., New York, 1952.

STYPULKOWSKI, Z., Invitation to Moscow, Thames and Hudson, London, 1951.

THE DEAF AND THE BLIND

COLLINGSWOOD, Herbert W., Adventures in Silence, The Rural New Yorker, New York, 1923.

ORMOND, Arthur W., C.B.E., F.R.C.S., Visual hallucinations in sane people, British Medical Journal, Vol. 2, 1925.

BARTLET, J. E. A., A case of organized visual hallucinations in an old man with cataract, and their relation to the phenomena of the phantom limb, Brain, a Journal of Neurology, Vol. 74, Part III, 1951, pg. 363-373.

EXPERIMENTAL ISOLATION

HERON, W., W. H. Bexton, and D. O. Hebb, Cognitive effects of a decreased variation to the sensory environment, The American Psychologist, Vol. 8, No. 8, August 1953, pg. 366.