

STUDIES ON THE EFFECTS OF PERCEPTUAL ALTERATION

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FOREWORD

The studies reported here were carried out under Contract No. AF33(616)-6103, Project No. 7222, "Biophysics of Flight," and Task No. 71745, "Psychophysiology of Flight." The work was conducted at the Research Center for Mental Health, New York University (21 Washington Place, New York 3, New York) between October 1959 and February 1961, and involved the assistance of various members of the staff. We are particularly grateful to Dr. Walter Boernstein, who actively participated in the conduct of the vigilance experiment, and to Dr. I. H. Paul, Rita Ashmann, and Arthur Goldweber for their valuable aid in the analysis of the data. We also wish to acknowledge our thanks to Captain Victor H. Thaler, Biophysics Branch, Biomedical Laboratory, Aerospace Medical Laboratory, who served as the contract monitor.

ABSTRACT

This is a report of three separate studies which explored facets of sensory alteration (sensory deprivation). One study focussed on the role of a diffuse, homogeneous visual field (Ganzfeld) in promoting visual images; the second compared performance on a cognitive test battery immediately following eight hours of perceptual isolation with performances under a drug (100 gamma of LSD-25) and a placebo condition; the third study dealt with the effects upon cognitive functioning of an eight-hour isolation experience, during which constant auditory vigilance was required of the subjects.

PUBLICATION REVIEW

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HOMOGENEOUS VISUAL STIMULATION (GANZFELD) AND IMAGERY*

The experiment reported here was undertaken to see whether a limited form of "sensory deprivation"—namely the wearing of translucent eye-cups for a period up to 40 minutes—might not bring about vivid imagery similar to that found with multi-sensorial deprivation of much longer periods. The original observation linking imagery to homogeneous stimulation was made incidentally in a study on color adaptation under visual ganzfeld conditions by Hochberg, Triebel, and Seaman (6) and has subsequently been suggested by a number of other investigators in the sensory deprivation area (3, 4, 12).

Method

The procedure was the following: (a) The subject was seated, his head in a chin rest, in a totally dark room. (b) After a few minutes of dark-adaptation, the subject was informed that a flash would occur and that he was to report not only what he saw during the flash (a black cross, on a white translucent screen with a 150-watt light behind it, was the stimulus, which was flashed for approximately 5-10 seconds) but also after it had disappeared. This was done in order to get the subject to experience an after-image that could later be used as a form of "baseline" for evaluating spontaneous, subjective images in the ganzfeld situation proper. The flash frequently had to be repeated two or three times before the desired after-image was obtained. (c) The next step was to glue over the subject's eyes two eye-cups consisting of halved ping-pong balls (following Hochberg's method), bathe the room in light, and to ask the subject to report continually on anything that was happening in the visual field. The subject was not specifically told to report images, since we were interested in their spontaneous occurrence, without a directive set. The subject was left alone in the room, his reports being recorded on tape via an intercom system. (d) When and if the subject reported an image, during the average of 40 minutes in which he was in the situation, an inquiry was conducted to learn more about the nature of the image. A total of 16 subjects (drawn from the Research Center's pool of actors described earlier) took part in this experiment. The questionnaire used for all images follows:

1. (As soon as after-image reported) Describe it as fully as you can and let me know as soon as it goes away (time with stop-watch).
 - a. Were there any other details you noticed but haven't mentioned?
 - b. (If color not noted) Was it colorless or colored? What colors did you visualize? Any change in the colors?

* A slightly modified version of this part appears in Percept. mot. Skills, 1961 12, 91-93.

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- c. (If movement not noted) Did it stand still or move? How did it move? (How fast, how far, steady or jerky, etc.)
 - d. (If it was an image of something that exists in reality: It may be necessary to ask first: Have you ever seen anything that looked like it?) Did it look much like a real (blank)? In what respects was it different? (Or: Was it different from a real one in any other way than what you said about its [color; size; etc.]?)
 - e. Did it seem to be out in front of you, or was it in your head like an ordinary thought?
 - f. Were there any non-visual sensations or imagery along with it? Any special feelings?
 - g. (If not an after-image) Please try to compare this image with the after-image you just had--was it as vivid or bright as the after-image? (If yes) At what point of the after-image?
2. Was it something you decided to visualize, or did it come unexpectedly?
 - a. (If the second) Do you have any idea why you visualized just this?
 3. When you first noticed it (or at any other time), did you think it was something real, or were you always fully sure it was just an image?
 - a. (If any degree of acceptance or reality) Did you make any kind of gesture or movement towards or away from it, or not?
 - b. (However 3a was answered) Was there anything about the image that [could have] prevented you from accepting it as real?

Results and Conclusion

The results may be outlined briefly as follows:

- a. All subjects experienced a fairly vivid after-image. The after-image was seen "out there," although all subjects knew that it was a subjective phenomenon.
- b. The majority of subjects reported what appeared to be idio-retinal phenomena (phosphenes, luminous dust, pulsations of light, shadow, color) during all phases of the ganzfeld experience. About half of the subjects reported the phenomena described by Hochberg et al. (6), namely, that the visual field gradually turned gray. In some instances, however, the field quickly resumed its former brightness.

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- c. Five subjects (as compared to 17 out of our total of 30 eight-hour isolation subjects) reported phenomena classifiable as imagery. In only two of these cases were the images comparable in impressiveness to those characteristically reported in our eight-hour isolation subjects.* Excerpts from the protocols of these two subjects follow:

- S1. "All I see is milky white... molecules, little spirals [interpreted as reflecting idio-retinal phenomena]... seems darker in the right side... Occasionally the light itself takes on forms into smaller areas... Now I see a pair of lips with mouth open—no teeth—it's imaginary (after 4')... The pattern now suggests a back of a lobster, an ear, a face (7')... makes me nauseous... an eye (8')... an airplane (15')" This subject saw several more such discrete images during the remainder of the session. Of note in the inquiry with this subject was his response that they [the images] might well have been slides which he had somehow suspected the experimenter would introduce.
- S2. "The only thing is light—dark around the edges—now it's like a microscopic slide, you know, little things swimming around, they must be on my eyeball because they move with it, I can see them more clearly if I focus directly on them... again all these little things... I'm looking straight ahead and I can again see one of these curly figures, I have a tendency to follow it with my eyes. Really, there are thousands of them, I have been aware of these before but I was never aware—that there were so many. There are suggestions of color—light green, pink, but mostly grayish or chalk-white... Now it seems like I can look down a long spiral whirlpool (8') The light seems to be more intense now, there is no space—like looking into infinity... Still looks like a network of very fine lines... Sort of the outline of a shovel or spade or something like that... I keep getting those fine lines—like a thatch of grass... Looks like it keeps changing into birds and things, lines change into feathers (10')... Now, like a peacock or something... Some sort of animal's head, I can't figure out what it is, a dog or a deer (15')... Now I get nothing but shapes and colors, light pastel colors, nothings (25')" The subject continued getting "nothing" for the rest of the experimental session. In the inquiry with this subject, it came out that he felt the images less intensely than the after-image experience; that the shapes and forms reported were experienced as being out there and came about

*See 4 and L. Goldberger and R.R. Holt, A comparison of isolation effects and their personality correlates in two divergent samples. ASD Technical Report 61-417, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio, August 1961.

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involuntarily; that they at times had vague colors; that they did not seem real because of their subtleness and frequently abstract-design quality, and their "fine, indistinct forms"; that movement was present when the subject's eyes moved and that he attributed the images to a retinal phenomenon "that is part of me."

From an evaluation of all the data from inquiry it was learned that these images were generally experienced as being less vivid than the after-images. Only one subject felt that they were of equal intensity. All five subjects reported that they knew that the images were subjective phenomena because: 1) they were wearing eye-cups and thus the experimenter could not possibly present them with patterned stimuli, and 2) the images consisted generally of very fine, soft lines lacking in definiteness and clear-cut figure-ground relations.

The only conclusion that one can draw from this experiment is that a brief ganzfeld procedure is not a particularly potent method for promoting the kind of imagery obtained with eight hours of isolation (during which the subjects also wore translucent eye-cups). Whether or not a prolonged homogeneous visual field alone could account for the emergence of hallucination-like images in isolation experiments and what effect, if any, the prior experience with a strong after-image may have had, is still an open question. It would be difficult to answer the former question experimentally without confounding the variable of visual homogeneity with such factors as immobility, confinement and boredom which are inherent in a prolonged ganzfeld procedure. On the basis of our other data,* primarily correlational, we would suggest that prolonged immobility, combined with a group of personality variables having to do with passivity, intellectual flexibility, and emotional freedom, participate with the factor of visual homogeneity in facilitating imagery in isolation experiments. Finally, we would suggest that the need to please—to be a "good" subject and hence to anticipate the experimenter's demand—must also be considered a relevant parameter in view of the generally unstructured situation in which the subject finds himself.

*See 7 and L. Goldberger and R. R. Holt, A comparison of isolation effects and their personality correlates in two divergent samples. ASD Technical Report 61-417, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio, August 1961.

COGNITIVE TEST PERFORMANCE UNDER LSD, PLACEBO, AND ISOLATION*

This report touches on two issues: the first concerns a proposition made by several participants in the 1958 Harvard Symposium on Sensory Deprivation (11)—notably Gray Walter—about the similarity between the effects of isolation and the effects of psychotomimetic drugs like LSD and mescaline. The second issue, and the primary focus here, concerns the effects of eight hours of perceptual isolation on cognitive test performance.*

Method

The exact procedures followed in the isolation and LSD studies are given in detail elsewhere (4, 8) but will be briefly summarized here. The subjects totalling 50 in all were unemployed actors recruited through Actors Equity on a paid, hourly basis. We chose unemployed actors because they constituted a ready source of subjects who had the time, motivation and articulateness for participating in the rather extensive research program in which we involved them. After first being screened for gross pathology they were told in general terms about the research. They were told that one experiment would involve taking a harmless, unnamed drug, that had "interesting psychological effects." With respect to the isolation study they were told only that there would be an all-day experiment in which they would be asked to do nothing. In a double-blind procedure, subjects were assigned to the LSD or placebo condition. Subjects were seen individually in all conditions. The LSD dose was 100 gamma; it was administered orally early in the morning, following which the subject was seated in a comfortable easy-chair in a semi-soundproof, dimly-lit room. He spent an entire day in this room, being occupied by one experimenter after another with tests, interviews and experimental procedures. The cognitive battery was administered around 11 am, during the peak effect of the drug. The placebo subject was treated in every respect like the drug subject.

Isolation condition: The subject lay supine on a comfortable bed in a lit semi-soundproof room for eight hours. He wore translucent eyecups, permitting only diffuse light, and wore an air force helmet containing earphones through which he was fed a constant white "masking" noise. Subjects were instructed to lie as still as possible, to talk freely about their thoughts and feelings, and to try to stick it out, if at all possible. At the termination of eight hours they were tested aurally over the intercom system on the same (or alternate form) of the battery given under LSD or placebo.

* A briefer version of this paper was presented at the Eastern Psychological Association meetings, Philadelphia, April 7, 1961.

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The battery was composed of the following tests:

1. Digit Span from the Wechsler-Bellevue Intelligence Scale.
2. Comprehension of long and short passages, adapted from the Iowa Silent Reading Test.
3. Two tests devised by Mary Frances Robinson (10) requiring a subject to hold several things in mind, yet calling for relatively overlearned material—one dealing with NUMBERS (e. g. , Name a number which doubled and added to 2 will give 6).

The other dealing with RHYMES (e. g. , Name a color that rhymes with the word for writing fluid).

4. Word-naming, in which the subject was asked to name within a 3-minute period as many words as possible having a certain number of letters (3 or 4).
5. Serial Sevens, that is, counting backwards by intervals of 7's from a specified number (e. g. , 103).
6. Simple Rhyming, in which the subject was asked to name within a 3-minute period as many words as possible that rhymed with a given word (fist or rise).

The subjects were also given two cognitive tests designed primarily to tap the subjects' ability to deal with a relatively unstructured cognitive task: one required the subject to make up two TAT stories from a verbal description of the cards, the other asked the subject to present a 10-minute monologue on a given topic.

In addition to the control group of placebo subjects, a baseline score was obtained for all subjects either before or, in some cases, subsequent to the experimental schedule.

The test data were analyzed by means of the analysis of covariance. That is to say, the group means were adjusted on the basis of the baseline scores, while at the same time the significance of differences among these adjusted means was evaluated. * It should be noted that for this analysis only the subjects are represented in the LSD or placebo condition who are not also included in the isolation group. The need for independent groups reduced the original sample size somewhat for all conditions.

*Preliminary results, indicating the proportion of subjects who received impaired, improved or unchanged scores (evaluated by means of the Sign Test) relative to their baseline scores, were presented in a previous report (8), which also contained a detailed comparison of subjects' subjective experience, as measured by our so-called "LSD-Questionnaire," in the LSD, isolation, and placebo situations.

Results

Table 1 presents a summary of the results. It will be noted that a significant F-ratio was found on all but the Short Paragraph Comprehension measure. T-tests between the groups reveal the LSD group to be significantly different from both the isolation and placebo groups on all tests, with the exception of Digit Span, on which it differed significantly only with the isolation group (although the placebo comparison came close to significance as well). The difference on all measures is in the direction of greater impairment for the LSD group. The table further indicates the absence of significant differences between isolation and placebo on any of the measures, a finding that washes out the earlier preliminary finding of impairment on Robinson's Rhymes under isolation. Indeed, this last was the only score on which isolation subjects did not obtain a better mean than did placebo subjects.

Of the two relatively unstructured tasks in our battery, only the Aural TAT has so far been fully analyzed. The stories were evaluated by means of a specifically designed manual that, either by counting or rating, attempted to assess such variables as degree of compliance with the story instructions, affective tone, story length, amount of non-contributory verbiage, and manifestations of formal primary process elements (e.g., condensation). The results of this analysis (treated by analysis of variance) follow right along with the findings in Table 1, namely: significant differences on the LSD vs. placebo comparison and LSD vs. isolation comparison, but not one significant difference on the isolation vs. placebo comparison. More specifically, a significant F ratio was found on three variables: compliance with instructions, length, and verbiage. The LSD condition produced less adherence to the instructions, shorter stories and greater amount of non-contributory verbiage as compared to both placebo and isolation. It might be pointed out that a preliminary analysis of the 10-minute monologue task indicates a similar pattern of findings.

Discussion

On the first issue, namely that of the presumed similarity in isolation and LSD effects, these findings indicate that, at least on a quantitative basis and with respect to cognitive test performance, no similarity exists. On a questionnaire designed to elicit reports of the main symptoms of LSD, administered under all three conditions, there was hardly any overlap between LSD and isolation either (see 8 for details). On 35 of the total 47 questions a significantly greater proportion of LSD as compared to isolation subjects indicated the presence of a symptom. What little overlap there was between the two conditions occurred on the items having to do with loss of the time sense, difficulties in concentration, experiencing blank periods, and imagery.* But even here the quality and intensity

*These were also the only items on which isolation differed significantly in the placebo comparison.

Table 1

Results of the Analysis of Covariance of the Cognitive Tests

	Adjusted Means of Groups			t-Ratio Between Groups				
	Placebo	LSD	Isolation	Isolation vs. Placebo		Isolation vs. LSD		LSD vs. Placebo
				F-Ratio	t-Ratio	F-Ratio	t-Ratio	
Digit Span	14.01	12.59	14.61	4.14*	.85	2.86*	2.01	
Short Passage Comprehension	7.53	6.61	7.55	2.00				
Word-naming	40.78	21.42	43.58	10.67**	.53	4.24**	3.71**	
Serial Seven (error)	.97	3.52	.51	4.91*	.45	2.92*	2.48*	
Serial Seven (time)	1.68	2.13	1.66	19.72***	.24	5.66***	5.42***	
Rhyming	18.61	12.98	19.05	4.96*	.21	2.89*	2.68*	
Robinson's Rhymes (error)	2.01	4.43	2.28	12.10***	.49	3.94**	4.43***	
Robinson's Numbers (error)	2.16	4.90	2.01	13.41***	.24	4.60***	4.36***	
Robinson's Numbers (No. requests for repetition)	5.58	8.92	3.78	12.05***	1.75	4.99***	3.24**	
Long Passage Comprehension	7.30	5.05	8.81	12.77***	2.03	5.05***	3.02**	

Note: N = 14 except for Long and Short Passage Comprehension where N is 13.

* p = .05; ** p = .01; *** p = .001

differed strikingly: the loss of the time sense would be more profound in LSD, concentration difficulties more debilitating and pervasive, etc. It might also be added that it did not require much in the way of sensitivity for the experimenter to tell a drug subject apart from an isolation subject.

Of course, in concluding that LSD and isolation produce quite different patterns of effects, we would have to qualify this by making reference to the variables of dosage and length of isolation: it is conceivable that weeks of drastic isolation might produce effects similar to that of 100 gamma of LSD, or, conversely, 5 gamma of LSD might have been comparable to eight hours of isolation.*

Turning now to the finding that eight hours of isolation does not produce any significant impairment as compared to the placebo group, it may be argued that we stacked the cards against finding isolation impairment by using the placebo group for our control. It is a rather stringent control since upon close inspection it turns out that the placebo and isolation conditions were in some respects quite similar: the placebo subject sat in a dimly-lit room, usually with an interviewer, but occasionally alone, for approximately eight hours; they were frequently as bored as subjects in isolation, certainly more frustrated and angry, because they expected the "drug" to show the promised "interesting" effects. However, this kind of comparison may have been uniquely suited to tease out the specific effects (of which there apparently were none) of the presumably unique components in the isolation situation: namely, the drastic curtailment of meaningful external sensory input.

On the basis of the present negative findings—and in view of the negative findings with another battery of cognitive tests in our first very similar eight-hour isolation study, using college students (4), we must conclude that eight hours of isolation does not produce significant group effects of either impairment or improvement, at least not with the kinds of tests so far employed. (Parenthetically, it should be noted that our earlier reported positive finding pertaining to the Watson-Glaser Logical Deductions test was subsequently found in some recent research at the University of Michigan to be an artifact due to Form inequivalence.)**

Indeed, we now venture to hypothesize that, irrespective of the tests used, no decrement in cognitive performance will be produced, for a group as a whole, as a direct consequence of a day of experimental isolation. The recent very meagre findings in a carefully designed study by Zubek, Sansom, and Prysiazniuk (13), after as much as seven days of rather drastic isolation, seems to make it hardly necessary to qualify this hypothesis as to length of time. But there are

*This is not to imply a linear relationship, however.

** Personal communication from Dr. E. L. Kelly, University of Michigan.

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still the positive findings of Bexton, Heron, and Scott (1) to come to terms with. Zubek, Sansom, and Pryslazniuk have suggested that perhaps the fact that they, unlike Bexton, Heron, and Scott, used relatively short tests administered visually rather than aurally, and the fact that they used dark conditions rather than diffuse light, might account for the apparent discrepancy. To this list of possible variables should be added the deleterious motivational effects of repeated testing on rather lengthy batteries.

On theoretical grounds there is really no reason for expecting decline in performance—since it could readily be argued that the very presence of an external task—whether administered via intercom, pre-arrangement, or by the examiner in person—should be sufficient for the majority of subjects to reinstitute contact with reality and hence adequate, adaptive functioning, at least for the duration of the task. In other words, we are suggesting that there is a very close temporal correspondence between the absence of an externally-initiated demand for thought or action of some kind, on the one hand, and the facilitation of the kinds of phenomena that we have referred to as "primary process" or "regressive secondary process thinking"; and conversely, that an externally-initiated demand causes these phenomena to quickly recede in favor of the adaptive, secondary process mode of thought. We suggest further that this relationship is a general one; i. e., it is not limited to the isolation situation, but operates in any situation lacking demand characteristics. To call the kind of thought produced in such situations "impaired" is quite meaningless, unless we are prepared to state with respect to what it is impaired. Following through with this theoretical formulation, it would also be folly to try to measure this so-called "impairment," since that inevitably requires the introduction of a demand in the form of a test, which promptly removes the "impairment." But, then, does the isolation situation produce no cognitive effects beyond those experienced in the absence of an externally-initiated demand in ordinary situations? It is on this critical point that systematic information is lacking. All we have to go on are the subjective reports of subjects, based on their own (frequently tacit) conceptions of how and what they ordinarily think and feel when they have "nothing in particular to do" for a prolonged period of time. However, the subjective data from subjects in isolation, in their agreement, strongly suggest that the isolation situation does produce a specific cognitive effect, namely, a weakened ability to initiate and sustain attention on internally-motivated tasks, as witness the characteristic reports of subjects who came prepared with plans, ideas, or problems to think about only subsequently to admit that they were unable to concentrate on them for very long. Wherein lies the uniqueness in the isolation situation that might account for this weakening? In answering this question we seem to have come a full circle, for we can only say that the isolation situation is unique in that it furnishes a most impoverished supply of the usual external and kinesthetic sensations, which despite their lack of relevance to the internally-motivated task and their lack of inherent "meaning," appear to furnish, in a very fundamental sense, the necessary nutriment of or "backdrop" for the initiation and sustenance

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of secondary process thought. It would, indeed, be difficult to think of any "ordinary" situation in which a person ever finds himself so deprived. The closest analogue is going to bed at night; here sleepiness confuses the picture, but surely most people are unable to think connectedly or constructively as they lie in a quiet, dark room.

It clearly follows from the above discussion that the search for cognitive tests on which to demonstrate impairment as a consequence of perceptual isolation is rather futile. Nevertheless, despite the absence of significant group changes, the individual differences in performance (at least on some of the tests) seem lawfully related to other aspects of the isolation reaction and personality, as, for example, our finding that the subjects with the most impairment showed a general maladaptive reaction to the isolation situation, as judged by independent ratings. *

*See L. Goldberger and R.R. Holt, A comparison of isolation effects and their personality correlates in two divergent samples. ASD Technical Report 61-417, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio, August 1961.

THE EFFECTS OF EIGHT HOURS OF ISOLATION AND AUDITORY VIGILANCE: PRELIMINARY FINDINGS

We shall present some preliminary findings of a study dealing with eight hours of auditory vigilance in an isolation setting. It may be recalled that on page 10 we hypothesized a general relationship between the presence of a task in the isolation situation (i. e., the cognitive tests), and the fairly immediate reinstatement of reality contact and efficient secondary-process functioning. But, what would happen if we introduced a monotonous, repetitive, prolonged task requiring constant vigilance (such as pressing a transmission key in response to randomly generated and randomly occurring signals)? Our study was primarily aimed at exploring this question.

The study was initially stimulated by the reports of Hauty and his associates (2, 5) of finding striking perceptual aberrations, including bona fide hallucinations (i. e., vivid images accompanied by loss of adequate reality testing), with their subjects sitting in the USAF School of Aviation Medicine Space Cabin Simulator and required to attend intensively to a small perceptual field of work for hours on end—thirty-six to be exact. Hauty's findings suggested the hypothesis that prolonged vigilance, requiring the steady focussing of attention on a monotonous task monopolizes the supply of available attention cathexis to the extent that its usual function of facilitating secondary-process thinking and aiding reality testing is hampered. Two subsidiary hypotheses were also proposed:

a) Prolonged focussing of a sensory-perceptual apparatus of a particular modality will tend to create anticipations of stimulation in that modality, anticipations which will foster the production of imagery of hallucinatory vividness.

b) The effects just specified require auditory vigilance, and are not a function of the stimulus conditions as such.

To test these two hypotheses we planned to have a control group of subjects exposed to the auditory signals without being required to respond to the signals. This phase of the study has yet to be carried out.

Part of our aim in this study, then, was to explore the potency of a vigilance task in producing or facilitating the emergence of vivid imagery—in the auditory rather than the visual modality used by Hauty—and other primary-process manifestations within the relatively brief, eight-hour period of isolation. (It should be noted that in Hauty's study no particular attempt was made to remove the subject from "reality contact.")

Method

The task. The input to the subject was a pre-recorded tape, recorded on both sides so that it took at least an hour to get through the pattern; thereafter, the same tape was repeated again and again. We generated a random pattern of intervals, ranging from 1 to 99 seconds; these being the periods of silence between bursts of information. The information inputs were beeps from an oscillator, the signal from which was piped directly onto the tape. The table of random numbers was also used to generate a random sequence of signals, from 3 to 9. Each signal was either a dot or a dash, depending on the sequence of odd and even numbers adjacent in the table. Therefore, some signals were quite easy (e.g., dash, dot, dash; etc.), while others consisted of a complex pattern of 9 dots and dashes intermingled, presumably quite difficult to pick up and reproduce exactly.

The subject was seated in an easy chair inside a lighted sound-proof room* which was equipped with a one-way mirror, a refrigerator containing the subject's chosen food, a chemical toilet and silent air-conditioning. The transmission key (a simple telegraph key arrangement) was fastened to a narrow table at arm's height and adjacent to the chair. He was instructed to remain alert so that he would not be remiss in signalling back the exact pattern of dots and dashes (likened to micrometeorites in the specifically alluded to space flight simile) at all times, except for momentary pauses (indicated by the subject verbally) for food and toilet needs. He was asked to speak his mind freely, indicating from time to time what his thoughts and feelings were. He was also asked to give transit reports every 1 1/2 hours (subjectively judged). He was told that there would be someone in attendance at all times, but that no communication would come from the experimenter after the door was closed. All subjects' remarks were recorded on tape as was the interview, patterned after the isolation interview guide (see Appendix), administered at the end of the experiment.

The subjects were tested the day before and again immediately after the eight hour experimental session on alternate forms of Moran's Repetitive Psychometric Measures (9), designed (each with a 2-3 minute time limit) to tap seven factorially derived primary mental abilities: number facility, aiming, flexibility of closure, visualization, speed of closure, perceptual speed, and social memory. Moran's 20-word Word Association test was also administered.**

*The room was an Audiometric Testing Room Model 1203 (Industrial Acoustics Company, New York City) with the inside dimensions of 88" width and 84" length. The sound attenuation is in the range of 50-72 db for the middle and the high frequencies, between 26-30 db for the lower octave bands.

**L. J. Moran. Repetitive psychodiagnostic measures: Word association. Unpublished manuscript. Subjects were also given the Figure Drawing test, the Szondi and the Rhythm part of the Seashore test, but the results of these procedures will not be included here.

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Up to the time that this report was being prepared we had seen a total of six subjects: three Air Force pilots studying meteorology at New York University, one actor from our basic subject pool, and two psychologists (who actually served as initial trial subjects). With such a small group of subjects we shall do no more than outline some very tentative impressions.

Results

In many ways the phenomena we observed were similar to those found in our previous isolation studies: Subjects were quite bored, slightly restless, and relieved when it was all over. Although the dominant affective tone was obviously in the negative direction, in none of the six subjects did it reach anywhere near the proportion of quitting—although in a couple of subjects the thought did occur. There was the same kind of obsessive preoccupation with time, together with an expressed feeling of having a disrupted time sense; the same fear of being abandoned by the experimenter. Similar, too, was the drowsiness that all subjects experienced rather quickly, accompanied by the strong urge to sleep—a few took catnaps for periods of a few minutes—but the incessant demandingness of the auditory beeps kept them from succumbing to the urge.

The demandingness of the task—as repetitive, monotonous and relatively unchallenging as it was experienced as being—was referred to over and over by all subjects. Notably by the Air Force subjects, it was held responsible for their not allowing themselves to "slip into" an unrealistic state of daydreaming and fantasizing, a state they frequently would slip into as co-pilots or when flying on automatic pilot, or, as one pilot recalled, when he would sit in the back end of a B-66 for hours without a thing to do but to think. In other subjects there was a slight suggestion of an increase in daydreaming, as if they may have been less guilty about such an idle activity since they were after all doing something, performing a task, albeit a routinized one. In any event, there was on the whole less of the kind of thought referred to by us as "primary process" or "regressed secondary process," while there was a noticeable increase in stimulus-bound thinking—a kind of narrowing of the cognitive field to the immediate situation, suggestive of hypnotic induction. The task was also blamed for interfering with talking and with extended serious thinking; as one subject put it: "I no sooner got started on a train of thought when the signals came at me..."

The picture conjured up by subjects' subjective reports was that the task quickly became like a millstone around the neck, but when asked in the interview following the experiment whether they would have preferred that there be no task, the four subjects queried answered with a vehement, "No," explaining that the signals were their only "contact with reality," "contact with the outside world." It would appear that to have a monotonous, repetitive, inherently meaningless task to perform was the lesser of two evils. Was it because the stimuli were piped in from "outside" rather than being perceived as part of the "inside" with its stimulus-impoverishment—the four walls, the chair, refrigerator, etc.—or

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was it the demand for a response that carried the feeling of being in contact with reality? Our proposed control group in which subjects would not be required to respond to the signals might clarify this question. It might be incidentally noted that one subject suggested that, for him at any rate, the demand to stay awake was sufficient a task to keep him harnessed to reality.

We did not produce the kinds of perceptual aberrations reported by Hauty, but then we did not keep our subjects in the situation long enough to make a valid comparison. There were some ambiguous hints that were we to extend the experimental session beyond the eight hours, we might have replicated Hauty's results in the auditory modality. These hints stem from the reports of three subjects to the effect that they heard voices, slamming of doors, "rumbling of the subway" (actually two city blocks away). It is difficult to check the validity of some of these perceptions since even with the good sound attenuation of our audiometric testing room, low frequency sounds may seep in, very faintly, at any rate. It may be that subjects' auditory thresholds were slightly lowered (an interesting thing to check in the future). Be this as it may, there certainly was a great deal of attention given to the residual stimuli confronting the subjects: Several subjects were obsessively intrigued by the literally thousands of small holes in the perforated metal shields covering the walls, and even attempted a full count; one subject noticed and reported on a cigarette butt, a tiny pin and other generally ignored refuse on the floor; still another subject reported some olfactory stimuli which he claimed, despite the air-filter in the air-conditioning unit, came from the outside. The combination of a possibly lowered auditory threshold, and the increased focus on residual stimuli in a situation in which both anticipation of external stimuli and a need for stimulus nutriment operate, may indeed produce hallucinations, particularly in response to faint, non-specific external noises.

In the visual modality there was a notable absence of phenomena. There was only one report of a vivid image, a piano, preceded by thoughts about music. Another subject reported the room to have increased in phenomenal size; he attributed this to an increased familiarity with the room. In this connection it might be noted that feelings of being confined, being in a small room, thoughts pertaining to claustrophobia, were more prevalent in this situation as contrasted with the isolation situation in which, it may be recalled, subjects wore translucent goggles, and thus in a sense faced infinite space. The fact that these subjects could see may have had something to do with the uneasiness voiced (when questioned) with regard to being watched (a fact that they were told about at the outset, and were constantly reminded of by the one-way mirror confronting them).

Turning to the results on the Moran test battery, they would appear to go along with the proposition that the mere introduction of a test dispels whatever "cognitive impairment" may have been operative. There was, in other words,

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no general pattern of impairment on any of these tests of primary abilities. An interesting finding did turn up in the Word Association test, however: all six subjects showed a lowering of scores on conceptual distance, the dimension on which subjects' responses were scored according to the following system developed by and quoted from Moran:*

Conceptual Distance

<u>Score</u>	<u>Response</u>
5	Coordination: synonym, antonym, or common "opposites," e.g., <u>circle</u> , "square."
4	Superordination: a category, e.g., <u>car</u> , "vehicle." Subordination: an example, e.g., <u>car</u> , "Ford." Function: a use, e.g., <u>car</u> , "ride." Attribute: e.g., <u>car</u> , "wheels."
3	Loose relationship: not classifiable as above, but still a clear and understandable relationship, e.g.: Realm, e.g., <u>desk</u> , "chair." Completion, e.g., <u>horse</u> , "sense." Species, e.g., <u>foot</u> , "yard." Word Extension, e.g., <u>mere</u> , "merely."
2	Unrelated word: a <u>single</u> word with no understandable relationship to the stimulus word. Also, words of "personalized" or subjective reactions (if not tied closely to the stimulus word) e.g., pretty, bad, rude, sweet, etc.
1	No association produced. A multi-word response of any kind. Repetition of the stimulus word.

Qualitatively we may note that the lowering of scores stems to a large extent to the giving of more 'completion' and 'realm' (i. e., physical, perceptual realm rather than conceptual) responses. This would suggest that the general narrowing of the cognitive field by the stimulus-boundness of subjects' thoughts during the eight hours may not have been completely dispelled by the introduction of tests. It should also be noted that the instructions to the Word Associations only ask the subject to give the first word that comes to mind and do not ask for the most abstract, or the most conceptually related word—hence, the issue

* L. J. Moran. Repetitive psychodiagnostic measures: Word association. Unpublished manuscript.

of impairment in the adaptive sense does not enter in, for one would first have to see how the subject would perform if such instructions were given. In any event, we interpret the decrease in conceptually related responses as reflecting a general tendency in the direction of stimulus-bound thought as was noted for all subjects.

Conclusion

Our initial hypotheses, relating monopolization of attention cathexis to decreased reality testing (i. e., the occurrence of hallucinations), cannot be said to have been put to a test here, since we would obviously need to prolong the vigilance task beyond eight hours.* Part of the hypothesis did seem to find support, namely that secondary process would be hampered by the constant expenditure of attention cathexis. But rather than finding an increase in primary-process manifestations, we found a state of stimulus-slavery to exist: The subject's consciousness appeared dominated and narrowed by the external, monotonous task. To phrase these findings in Rapaport's terms, rather than finding much evidence for a decrease in the ego's autonomy from the drives (as would be the general model for the effects of isolation), we found evidence for a decrease in the ego's autonomy from the environment.

*That length of time is not the only relevant variable, but that the degree of attention absorbed by the task, a function of the subjects' level of motivation, is suggested by Dr. Hauty's comments on our findings: "...unless the subject attends completely to the task for 12, 15, and even up to 20 consecutive hours, he will not experience aberrant behavior. This requires that the entire situation be structured so as to elicit and maintain the utmost in motivation. This means from the subject's point of view that he is driven like he has never been driven before, judging from his manifested hostility. Furthermore, we have been able to get only two subjects out of a total of forty or so to repeat such an experience." (personal communication)

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APPENDIX

Interview Questions

How in general did you pass the time ?

What was the most disturbing aspect of the whole experience ?

Have you been bored ?

Have you had any bodily pains ?

Have you been tense ? restless ? uneasy or ill at ease ? dreamy ?

Have you felt suspicious ? (about what ?)

Did you feel abandoned ?

Did the steady signals bother you ? Would you have preferred not to have them ?
Why is that ?

Did you ever think about terminating the experiment ?

Have you enjoyed any of it ?

What was the most pleasant aspect of the experience ?

Did you sleep or doze off ? How much ?

Any trouble telling if asleep or awake ?

Have you thought about interesting things ?

Have you found any difficulty in thinking, or concentrating on your own thoughts ?

Did you lose sense of time ?

Did you find it difficult to talk ? How come ?

Any daydreaming ?

Any sexy thoughts ?

Have you had any 'crazy' or bizarre thoughts ? What were they ? (If so) How
did you feel about them ?

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Did you have any images? What kind? How did you feel about them?

Did you wander about the room? Explore it any?

How much moving have you done?

Did you play any games?

Did you hear any outside sounds?