

COGNITIVE TEST PERFORMANCE UNDER LSD-25, PLACEBO AND ISOLATION

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This paper touches on two issues. The first concerns a hypothesis offered by several participants in the 1958 Harvard Symposium on Sensory Deprivation (10) about the similarity between the effects of perceptual 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 isolation on cognitive test performance.

The hypothesis that isolation is similar to, or at least parallels, some of the effects seen with drugs like LSD is largely traceable to the early, often dramatic reports of "hallucinations" and cognitive disruption in subjects participating in one or another form of experimental isolation. These reports would naturally give rise to the notion that yet another model psychosis-producing agent had been unearthed. Aside from the important, specific question of whether or not isolation in fact produces hallucinations, or simply facilitates a regressive, hypnogogic state in which imagery becomes heightened and sensory-like, the more general question concerning the similarities between LSD and isolation might be raised and put to an empirical test. Such a test would call for an administration of the same tests and questionnaires to different groups undergoing one or the

other experience, with a control group having neither experience. There is of course the intrinsic problem that inheres in comparing a concomitant effect (*i.e.*, LSD) with what strictly speaking constitutes an *after-effect* (*i.e.*, isolation); for the administration of any kind of test, by definition, interrupts the isolation condition. In the present study such interruption was kept to a minimum by administering the tests aurally *via* an intercom system with the subject still confined in the isolation chamber, in a recumbent position, wearing eye-cups, thus maintaining exactly the same impoverished surroundings that the subject had experienced prior to testing.

On the issue of cognitive deficits attributable to perceptual isolation one finds a rather confused picture in the relevant research literature. Some studies have yielded positive findings on some cognitive tests while not on others, with some authors reporting no positive findings at all (9). Aside from the many variations in isolation or deprivation techniques and conditions employed in different laboratories and the lack of comparability of the tests used from study to study, there is frequently also a serious defect in the research design (*e.g.*, lack of adequate control group, poor test reliability, statistical regression effects unaccounted for), allowing one or more uncontrolled variables free rein. It thus has become difficult, if not impossible, to interpret the findings unambiguously in this area. The present study attempted to exercise as much rigor, both experimental and statistical, as was feasible to determine the presence or absence of reliable decrements that could be attributed *solely* to perceptual isolation.

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METHOD

The exact procedures followed in the isolation and LSD studies are given in detail elsewhere (3-5, 7) but will be briefly summarized here. The subjects (Ss) for this study numbered 42 out of a larger subject pool of 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, Ss 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 S 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 during the peak effect of the drug. The placebo S was treated in every respect like the drug S.

Isolation condition: The S lay supine on a comfortable bed in a lit semi-soundproof room for eight hours. He wore translucent eyecups permitting only diffuse light and 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.

After eight hours they were tested aurally over the intercom system on an alternate form of the battery given under LSD or placebo.

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 (8) requiring S to hold several things in mind, yet calling for relatively overlearned material. One test deals with *numbers* (e.g., naming a number which doubled and added to 2 will give 6). The other test deals with *rhymes* (e.g., naming a color that rhymes with the word for writing fluid).

4) *Word-naming*, in which S was asked to name within a three-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 7s from a specified number (e.g., 103).

6) *Simple Rhyming*, in which S was asked to name within a three-minute period as many words as possible that rhymed with a given word (fist or rise).

The Ss were also given two cognitive tests designed primarily to tap Ss' ability to deal with a relatively unstructured cognitive task: one required S to make up two TAT stories from a verbal description of the cards, the other asked S to present a 10-minute monologue on a given topic, e.g., capitalism, racial segregation or monogamy.

In addition to the control group of placebo Ss, a baseline score was obtained for all Ss 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

TABLE 1
Results of the Analysis of Covariance of the Cognitive Tests

	Adjusted Means of Groups				t-Ratio between Groups		
	Placebo	LSD	Isolation	F-Ratio	Isolation vs. Placebo	Isolation vs. LSD	LSD vs. Placebo
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. request 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.

* $p = .05$.

† $p = .01$.

‡ $p = .001$.

basis of the baseline scores, while at the same time the significance of differences among these adjusted means was evaluated.² 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.

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 iso-

lation 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 was the only measure 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) are consistent with the findings in Table 1, namely: significant differences on the LSD *vs.* placebo comparison and

² Preliminary results, indicating the proportion of *Ss* who received impaired, improved or unchanged scores (evaluated by means of the Sign Test) relative to their baseline scores (but without a control group), were presented in a previous report (5), which also contained a detailed comparison of *Ss*' subjective experience, as measured by our so-called "LSD-Questionnaire," in the LSD, isolation and placebo situations.

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.³ But even here the quality and intensity differed strikingly: the loss of the time sense would be more profound in LSD, concentration difficulties more debilitating and pervasive. 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, five gamma of LSD might have been comparable to eight hours of isolation.⁴

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 *S* 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 sole positive finding pertaining to the Watson-Glaser Logical Deductions test was subsequently found to be an artifact due to Form inequivalence (6).)

Indeed, we now venture to hypothesize

³ These were also the only items on which isolation differed significantly in the placebo comparison.

⁴ This is not to imply a linear relationship, however.

that irrespective of the tests used, and with all the necessary experimental controls, 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 meager findings in a carefully designed study by Zubek, Sansom and Prysiazniuk (11), 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 still the positive findings of Bexton, Heron and Scott (1) to come to terms with. Zubek, Sansom and Prysiazniuk 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, prearrangement or by the experimenter in person—should be sufficient for the majority of Ss 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” (4); 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 re-

lationship is a general one; that is, 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 in a sense 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, based on our Ss’ 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 Ss 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 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 sus-

tenance 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 (3).

SUMMARY

Comparison between the effects of (100 gamma) LSD-25 and the effects of eight hours of perceptual isolation revealed in a group of normal Ss only a limited convergence in subjective experience as measured on a questionnaire. Comparing cognitive test performance, it was found that LSD produced significant impairment on eight out of nine tests, while isolation did not produce impairment on a single test, as compared with either the LSD or the placebo group. It is suggested that isola-

tion may produce a weakened ability to initiate and sustain internally-motivated tasks, but that efficient "secondary process" functioning is quickly reinstituted as soon as an externally-initiated task is presented.

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