THE EFFECTS OF PSILOCYBIN, DEXTRO-AMPHETAMINE AND PLACEBO ON PERFORMANCE OF THE TRAIL MAKING TEST

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PROBLEM

Psilocybin is similar in effect to Lysergic Acid Diethylamide (LSD)[5]. Psilocybin is not usually considered to produce a toxic psychosis or a state of organic intoxication because memory and orientation are spared and gross confusion is absent. Nevertheless, the clinical syndrome suggests intoxication sufficient to justify its study by a perceptual-cognitive-motor test. Some caution in test selection is necessary because psilocybin also produces some motor incoordination. Therefore, the Trail Making Test[3] involving the performance of a less complex test on Part A and a more complex test on Part B, both of which require the same motor response, was selected.

There is more data but equal controversy as to whether LSD causes any features of exogenous psychosis. Stoll's[6] initial observations of LSD described toxic features. Rinkel, DeShon, Hyde and Solomon[4] noted that LSD produced "concrete" results on a test of concrete vs. abstract thinking. They interpreted this as similar to schizophrenia. Organic change produces similar effects[2]. Abramson, Jarvik, Hirsch and Ewald[1] reported that LSD produces impairment in tests of spatial orientation. Nevertheless the general tendency is to differentiate between the LSD reaction and exogenous psychosis.

A simple double-blind study of psilocybin is of little value for control purposes as the presence or absence of the drug effect is obvious to experimenters and subjects. Thus, dextro-amphetamine was added with psylocybin and placebo in a double-blind procedure. Dextro-amphetamine produces some arousal and excitation[6] and thereby produces some uncertainty as to which drug, if any, is present. A secondary reason for the use of dextro-amphetamine was to discern its effects on performance of the Trail Making Test.

METHOD

The *S*s were 8 male university students who volunteered to participate in a drug study. Each *S* took all three "drugs" on separate days under the supervision of the second author. They were aware that the study involved psilocybin (Ps), dextro-amphetamine (DA), and placebo (PL), but they did not know on which day they were getting each. The "drugs" in black capsules were administered in the following order: two *S*s PL, DA, Ps; two *S*s Ps, DA, PL; two *S*s DA, PL, Ps; and two *S*s, Ps, PL, DA. The "drugs" were administered in the following dosage: Ps, 0.2 milligrams per kilogram body weight; DA, 30 milligrams; and PL, capsule full of sugar.

After a sufficient time interval each *S* was administered the Trail Making Test, Part A and Part B, in that order. Performance was measured in seconds required to complete each part of the test.

RESULTS

Inspection of data revealed a positively skewed distribution. Square root transformations were done to decrease the skewness. Table 1 presents the means and standard deviations in seconds for Part A and Part B of the Trail Making Test for each "drug" condition.

Analysis of variance revealed a significant main effect for both Part A and Part B and for the three "drug" conditions. Part B was consistently more difficult than Part A within each "drug" condition at the .005 level. In the "drug" comparisons, DA had a significantly greater effect on Part A and Part B than PL, and Ps

TABLE 1. MEANS AND STANDARD DEVIATIONS OF NUMBER OF SECONDS REQUIRED TO COMPLETE PART A AND PART B OF THE TRAIL MAKING TEST UNDER THREE "DRUG" CONDITIONS

	Placebo		Dextro-Amphetamine		Psilocybin	
Trail Making Test	Mean	SD	Mean	SD	Mean	SD
Part A	17.6	2.5	20.4	4.9	29.6	11.4
Part B	35.3	10.1	41.4	12.2	64.1	35.1

had a significantly greater effect on Part A and Part B than DA. Both of these comparisons were significant at the .05 level.

In addition, a significant Forms × Subjects interaction was found. Subanalyses indicated that this existed in the comparison between PL and DA. For some Ss, the forms (Part A and Part B) were more difficult than for other Ss. However, this did not nullify the findings for the main effects, i.e., significant form differences and significant drug differences between the groups.

DISCUSSION AND SUMMARY

This study shows clearly that both DA and Ps produce a deficit in performance as compared to placebo. Even though DA produces arousal and excitation, it does not increase performance (a characteristic sometimes attributed to it) as measured by the Trail Making Test. In addition, the demonstration that Ps significantly impairs performance of the complex task (Part B) as compared to the simple task (Part A) suggests that drug induced muscular incoordination is not responsible for decrements in performance.

The DA induced decrements are of interest. Data with other dosage levels is required for adequate interpretation. Thirty milligrams of DA is a large dose by clinical standards but less than that used in many experimental studies. The slower performance with DA demonstrates that physiological arousal and improvement in performance of some tasks are not correlated.

Though this study adds information about the effect of DA on the Trail Making Test with student volunteers, it still leaves unanswered the question of the effect of DA on the performance of depressed individuals who use it to help them over a difficult task, i.e., the depressed students who are taking an exam. Perhaps the improved subjective feeling is sufficient to improve their performance when they begin in a depressed state. The depressed state itself may cause sufficient difficulty to produce a deficit in performance as compared to the student who is not depressed initially.

The possibility also exists that these findings are a function of the test. For example, other tests which require skills of a different type may give different results. The answer to this question will be obtained when tests of a different nature are used in a similar situation.

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