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The Addiction Research Center Inventory: Standardization of Scales which Evaluate Subjective Effects of Morphine, Amphetamine, Pentobarbital, Alcohol, LSD-25, Pyrahexyl and Chlorpromazine

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With 1 Figure in the Text

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A previous report discussed techniques used in the development of drug-sensitive items that comprise the Addiction Research Center Inventory (ARCI) and briefly discussed results of its use in preliminary tests[1]. The present paper describes the standardization of this 550-item inventory on a relatively large sample of former narcotic addicts. In cross-validity studies, "drug-scales" were developed which delineate, to some extent, the specific as well as non-specific effects of narcotics, alcohol and other drugs.

It was originally anticipated that item and profile analysis might, within the limits of the inventory content, make possible a standardized description of drug actions as differential patterns of subjective effects. Thus the general purposes of the investigations were to estimate such effects by 1. constructing scales of items that discriminate placebo from each drug condition separately, 2. differentiating specific patterns of drug actions through applying factor analytic and other correlational techniques to these items and scales, 3. comparing drug effects with some personality variables, and 4. comparing drug effects with behavior found in special groups, e.g., the actions of LSD-25 compared with behavior of schizophrenic patients. In addition it was hoped that the studies might produce hypotheses for experimental testing in further elucidation of mechanisms of drug-actions.

The present studies are concerned mainly with the first objective. Methods are described which were used in selecting items that discriminate significantly between a placebo and seven drug conditions, and in further testing of validity and reliability. Because report of subjective

[1] The Addiction Research Center Inventory (unpublished). HARRIS E. HILL, CHARLES A. HAERTZEN, and RICHARD E. BELLEVILLE. Sample copies and accompanying manual can be obtained from the authors.

drug effects is extremely sensitive to the instrument of measurement and the conditions of its use, much attention was given to controlling the testing situation. Thus procedures of gathering data and methods of analysis will be emphasized here, but examples will be given from the seven scales of both specific and general, non-specific effects.

Subjects, Materials and Methods

Subjects

Tests were given to 219 male postaddict prisoners who volunteered to serve as subjects. All were examined by members of the medical staff and none were used who were psychotic, neurotic, illiterate, or physically unfit. No subjects were used who showed signs of even a "cold", and rectal temperature was taken before each test to detect any who might be reluctant to admit illness. Some subjects were accepted for some drug tests but not for others, e.g., subjects who gave a history of peptic ulcer or of hostility or "blackouts" associated with alcohol were not given this drug, but may have been given other drugs.

Sixty-five subjects were white and 154 were negro (respective mean ages 30.2 and 28.8). Addicts are of average intelligence, mean $IQ=106$ on the Wechsler-Bellevue (BROWN and PARTINGTON 1942), and subjects in this study produced normal vocabulary scores as measured by the Shipley test which is described below (1940). Addicts are predominately psychopathic individuals (high psychopathic deviate score on the MMPI) who appear to vary mainly in the presence or absence of neurotic or schizoid characteristics. A classification of these social deviant characteristics has been attempted (HILL *et al.* 1960, 1962) as well as an appraisal of these characteristics as determinants of some drug effects (HAERTZEN and HILL 1959, FRASER *et al.* 1961), and as influencing the experimental modification of behavior (PAINTING 1961).

Medication Procedures

The drugs, dosages, modes and time of administration are given in Table 1. To disguise the nature of the drugs, except with alcohol, both oral and intramuscular agents were administered on all occasions. If the active agent was given intramuscularly, the accompanying placebo was administered orally; or if the drug was employed orally, the placebo was given by injection. The oral placebo was disguised for taste by layering the water with toluene. For the *placebo condition*, both oral and intramusular routes were employed. Only oral doses of alcohol were used and, with this exception, subjects were not told what drug they were receiving. However, since narcotic addicts are usually "drug-wise", they very frequently correctly guessed the administered drug.

Table 1. *Medication schedule*

	Dose	Route	Time of medication
No drug			
Placebo		IM + oral	8:00 a.m.
Morphine sulfate	10 mg	IM	8:10 a.m.
Morphine sulfate	20 mg	IM	8:10 a.m.
Pentobarbital	200 mg	IM	8:15 a.m.
Pentobarbital	250 mg	IM	8:15 a.m.
Chlorpromazine	*	Oral	
LSD-25	1.0 mcg/kg	Oral	7:30 a.m.
LSD-25	1.5 mcg/kg	Oral	7:30 a.m.
Pyrahexyl	60 mg	Oral	6:30 a.m.
Pyrahexyl	90 mg	Oral	6:30 a.m.
Amphetamine (d-1)	15 mg	IM	8:00 a.m.
Amphetamine	30 mg	IM	8:00 a.m.
Alcohol (30%)**	1.10 cm^3/kg	Oral	8:00 a.m.
Alcohol	2.12 cm^3/kg	Oral	8:00 a.m.
Alcohol	3.00 cm^3/kg	Oral	8:00 a.m.
Alcohol	4.43 cm^3/kg	Oral	8:00 a.m.
Testing time			9:00 a.m.

* Chlorpromazine: Day 1, 25 mg qid; Day 2, 50 mg qid; Day 3, 75 mg at 8 a.m. only.

** Alcohol: A maintaining dose of 0.239 cm^3/kg was given in addition every 20 minutes, starting at 8:30 a.m.

Materials

The Addiction Research Center Inventory (ARCI)[1] is a 550-item "true-false" questionnaire developed specifically to measure subjective effects of drugs which have diverse pharmacological actions. The construction of this inventory from preliminary testing and results on a validity index (Ca-scale) will be reported elsewhere[2]. Forty items were taken from the MMPI; most of the remaining items were independently developed on the basis of studies by the authors of the ARCI (HAERTZEN *et al.*, in press) although many similarities to items employed by other investigators will be found therein.

The Shipley Institute of Living Scale for the Measurement of Intellectual Impairment (SHIPLEY 1940) was used primarily to eliminate subjects who were illiterate. Thus, some illiterate subjects were given the ARCI but in the analysis of scales other than the Carelessness scale, subjects with Shipley scores of 12 (mental age = 9.9) or less were eliminated (approximately 2 percent).

Minnesota Multiphasic Personality Inventory (MMPI), California Personality Inventory (CPI), and Guilford-Zimmerman Temperament Survey (GZTS). The MMPI (HATHAWAY and MCKINLEY 1951), CPI

[1] See footnote p. 167.

[2] "Assessing subjective effects of drugs: An index of carelessness and confusion for use with the Addiction Research Center Inventory". (J. clin. Psychol., in press.)

(GOUGH 1957) and GZTS (1949) were given to all subjects under the no-drug condition. Data obtained from these correlative studies will be reported upon separately.

Testing Procedures

All tests were given at 9 a.m. Subjects had been given breakfast, but they were not allowed to have coffee until the test was completed. On alcohol test-days they were given no breakfast or coffee. Subjects were allowed to smoke after administration of drugs and during the test. As most drug effects are of a temporary nature, it was particularly emphasized to the subjects that they should answer all of the questions of the ARCI on the basis of how they "felt" during the test. "Answer as you feel today" is given in the ARCI booklet after each block of 50 items. An informal testing procedure was employed, since it appears that social interaction produces increased effectiveness of some drugs (NOWLIS and NOWLIS 1956). At the end of each half hour, subjects were requested to stand, move around, and take a five-minute break. If difficulty with words occurred or if explanations were necessary, a psychologist was always present to provide assistance.

On the first day of testing, subjects were given a written form which described the procedure to be followed and the incentive offered for serving as experimental subjects (recommendation to appropriate administrative authority that prison sentence be reduced by one day for each day of testing). The Shipley and GZTS were given on a "no-medication" day. On subsequent testing the MMPI and CPI were administered under no-drug conditions, and the ARCI under no-drug, placebo, and the various drug conditions shown below and in Table 1. Tests were given at weekly intervals to avoid residual drug effects (cf. ISBELL 1956). The gathering of data covered a number of years in roughly the following order:

1. Cross-validity studies. In randomized order 100 subjects were given the tests mentioned above but the drug dosages in use of the ARCI were restricted to morphine (20 mg), pentobarbital (200 mg), amphetamine (30 mg), LSD-25 (1.0 and 1.5 mcg/kg), pyrahexyl (60 and 90 mg) and the schedule of chlorpromazine shown.

2. Validity generalization studies. Thirty or more additional subjects were tested on each drug dosage shown in *1* above, and conditions were the same, except that some subjects did not have all the drug tests.

3. Retest studies. Thirty or more subjects from *1* and *2* above were re-tested on one or more of the following conditions: morphine (20 mg), pentobarbital (200 mg), chlorpromazine, LSD (1.5 mcg/kg), pyrahexyl (90 mg), amphetamine (30 mg), placebo, and no-drug.

4. Studies on alcohol. Thirty-six subjects who had been used in *1* and *2* above were given the ARCI under three dose levels of alcohol (2.12, 3.0 and 4.43 cm^3/kg) with maintaining doses as indicated in Table 1. Since about one third of these subjects had been unable to complete the test under the highest dose, it was later replaced by a 1.1 cm^3/kg dose. For the remaining subjects of the test and validity groups this dose was randomized with the other drug conditions.

5. Dose-effect studies. Subjects who had completed the series of tests were given morphine (10 mg), amphetamine (15 mg), pentobarbital (250 mg), and no-drug conditions in randomized order. Other subjects were given these conditions in randomized order with *4* above.

The cross-validity studies were the most highly controlled since all subjects completed all the test conditions shown. Although randomization was followed as closely as possible in the other studies, some subjects had all the tests of the series whereas others did not, since some were withdrawn from the study for being uncooperative or ineligible for medical or psychiatric reasons. However, attempts were made to administer a fairly constant number of tests in each of the various parts of the study to control partially for motivation and time and order of test administration.

Statistical Analysis

Selection and Cross Validation of Items Comprising the Drug Scales. To obtain initial scales, responses under all drug conditions were compared with responses under placebo for the first group of 50 men, using IBM-650 computer equipment and a program developed by CUMMINGS *et al.* (1961). MCNEMAR'S Chi-square technique for replicated measures (EDWARDS 1956) was employed to select all items that separately discriminated the various conditions from placebo at or less than the 0.05 level of significance. The same analyses were then applied to the answers of a second group of 50 men. Items which discriminated at the 0.05 level or less in both groups were retained as the significant scales (S-scale) for each drug condition. Since it was apparent that much rich material was being lost by conforming to these rigorous criteria for selection of items, a second scale (M-scale) was developed for each condition in the same manner as for the first scale, except that items were retained that discriminated between placebo and each drug at the 0.05 level or less for the total sample of 100 subjects, excluding of course the items of the first scale (see Table 2). Since it was later found that these scales did not differ significantly in discriminative power (see Footnote 1, p. 178), they were combined to produce one scale for each drug condition. Results will be presented on both, but the present paper is chiefly concerned with the combinations. As indicated by LORD (1959), reliability increases as a function of the number of items.

To obtain a standard reference level, all drug scales were scored on the placebo and no-drug conditions of the original test, validity generalization, and retest groups. Only non-significant differences were found between these two conditions for each scale across the groups. Thus, by combining the results on placebo and no-drug conditions, *control* base levels were obtained for standardizing the inventory. Because the distributions of scores were skewed under the control conditions and because variances of these conditions were less than those of all drugs, it was helpful to use a transformation. For this purpose cumulative proportions were calculated, using a table of normal deviates (GUILFORD 1936) on scores of 195 subjects (504 observations). T-scores were then derived, using a mean of 50 and an SD of 10. From these scores transformation tables were developed from which the T-score of any individual for any drug could be obtained.

Only valid tests were used in scale development. For this purpose, validity was defined by an index (Ca-scale) which measures some aspects of carelessness, confusion and illiteracy. This scale consists of 23 items repeated exactly or in semantically opposite form; the score is the number of inconsistent responses (see Footnote 2, p. 169). Subjects were eliminated for present purposes if their scores on this scale were 8 or greater (T-score of 70 or greater).

Validity of the scales was also tested in the following ways: 1. The significant or S-scales were developed as mentioned previously by using a method of cross-validation on two groups, each composed of 50 subjects, 2. for the combined scales, analysis of variance for replicated measurements (EDWARDS 1956) was applied to the scores obtained under control and each drug condition ($N = 100$), 3. differences between the initial group, the "validity generalization" group and the retest group on each drug scale were also studied by analysis of variance for independent measures (EDWARDS 1956), and 4. analysis of variance for independent measurements was applied to dose-effect data since not all subjects received all the doses of each drug.

Reliability was inferred from product moment correlation coefficients between scale scores for placebo and no-drug conditions in the initial groups, between placebo and the various drug conditions, and between drug conditions.

Results

Table 2 presents results of the development of empirical scales which were obtained by comparing placebo with all other conditions separately and, finally, placebo with the no-drug condition. Although the main interpretations of the present paper are based on items of the combined scales, the number of items in the S- and M-scales, as described in Table 2, are given here as complementary data. These scales were

combined to obtain more precise differentiation of subjects, and to provide sufficiently extensive scales for a later application of factor analysis.

With regard to the comparisons of no-drug and placebo conditions shown in Table 2, it will be observed that one item maintained discrimination between placebo and no-drug conditions under cross-validation

Table 2. *Number of items in scales developed by comparing all other conditions with placebo*

	S-scale*	M-scale**	Combined scale
No-drug	1	23	24
Morphine (20 mg)	44	85	129
Pentobarbital (200 mg) . . .	15	61	76
Chlorpromazine (25 qid)*** .	14	38	52
LSD-25 (1.5 mcg/kg)	67	107	174
Amphetamine (30 mg) . . .	36	84	120
Pyrahexyl (90 mg)	5	45	50
Alcohol (3.0 cm^3)	—	—	64

* Consisting of cross-validated, significant items, $P \leqq 0.05$ in two groups of 50 subjects.

** Marginally significant items, $P \leqq 0.05$ in total test group of 100 subjects.

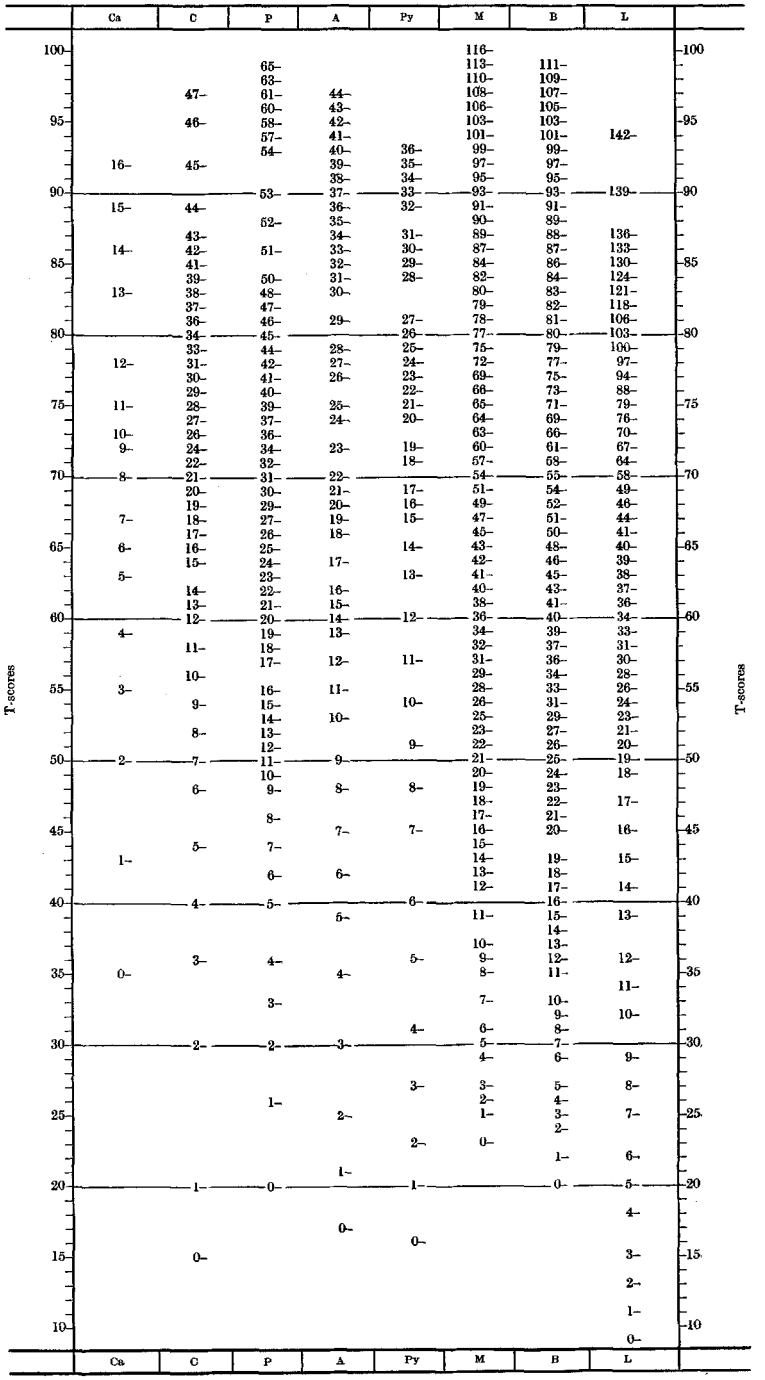
*** See text for schedule of medication.

using two groups of 50 subjects each (S-scale), and that 23 items distinguished between these conditions for these groups with a combined N of 100 (M-scale). The 24 items shown for the no-drug condition may then be considered a placebo scale.

Results of standardization are presented in Table 3. The raw scores for each drug scale are given with the equivalent T-scores. A T-score transformation equalizes the intervals between raw scores. Each T-score represents a probability that a subject's score is greater or less than that of the standardization group. Thus 50 percent of subjects under no-drug or placebo obtain a T-score of 50 or greater, 16 percent obtain a T-score of 60 or greater, and 2.5 percent obtain a T-score of 70 or greater. It will be noted, for example, that the alcohol or A-scale scored on the *control conditions* produced a median of 9 "true" responses, or a T-score of 50. If, however, a raw score of 22 were obtained under some other condition on this scale, the T-score would be 70. The skewing of the raw scores is indicated by their greater separation at the low than at the high T-scores.

After standardization was accomplished on control conditions, each drug scale was scored (for the drug condition on which it was developed; for example, the chlorpromazine scale was scored for subjects under chlorpromazine) on the test, validity generalization and retest groups.

Table 3. *T-score transformations for various scales of the ARCI*



Ca = "Carelessness"; C = Chlorpromazine; P = Pentobarbital; A = Alcohol; Py = Pyrahexyl; M = Morphine; B = Amphetamine; L = LSD-25.

For purposes of partially showing the validity and reliability of the instrument results are presented in Fig. 1 for the test and validity generalization groups. The "no-drug" condition on these groups produced small variations around a T-score of 50, none of the differences reached statistical significance. The T-scores obtained on drug conditions were all very significantly different from control. Except for the alcohol conditions mentioned below, differences between the test and validity generalization groups were non-significant, and Fig. 1 shows that as many were increased in the validity generalization group as were attenuated. Strikingly, however, the placebo scale showed great attenuation, leaving a very small, non-significant difference between the nodrug and placebo condition on the validity generalization group.

Fig. 1. Comparison of "test" and validity generalization groups. (Points for each drug scale were obtained by scoring it on the no-drug and the specific drug conditions for the two groups.) *C* Chlorpromazine, *P* Pentobarbital, *A* Alcohol, *Py* Pyrahexyl, *M* Morphine, *B* Amphetamine, *L* LSD-25, *Pl* Placebo. Drug conditions: ▵———▵ test group, ○———○ validity generalization group. No-drug conditions: ▲———▲ test group, ●———● validity generalization group

Since, with one exception the scale scores did not differ significantly across the test, validity generalization and retest groups, they were combined to produce the final score for each drug condition. The exception was the alcohol condition; the score on the test group was significantly greater than that on the validity generalization group. However, since the lesser of these mean scores was differentiated from control at <0.001 level, combining groups seemed a valid procedure.

The mean T-scores of the scales and the drugs and doses on which they were developed are contained in Table 4. Presentation of the F-ratios for the differences from control values is belaboring the obvious, but these ratios and probability levels are added for completeness.

The results of "dose-effect" studies are shown in Table 5. The F-ratio for the two doses of pentobarbital is non-significant. This outcome apparently occurred because both doses of this drug that were used (200 and 250 mg) were quite "high" in terms of their effects; a dose-effect relationship might have been found if a substantially lower dose had been included. Both morphine and amphetamine produced significant effects but only at the 0.05 level in the doses employed. The other dose-effects were well beyond the 0.01 percent, with pyrahexyl showing

Table 4. *Mean T-scores for drug and dose on which scales were developed*

	C	P	A	Py	M	B	L
Dose	*	200 mg	3.0 cm³	90 mg	20 mg	30 mg	1.5 mcg/kg
N (test group) .	100	100	50	100	80	100	100
N (validity generalization)	39	43	40	36	30	49	35
N (retest group)	34	47		34	38	41	37
N (combined) .	173	190	90	170	148	190	172
T-score	61.9	60.1	71.2	65.5	64.7	62.3	66.3
SD	12.6	12.2	10.5	12.5	12.2	12.8	11.3
F-ratio of diff. .	151.3	119.1	337.2	295.4	227.7	190.5	326.0
P	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

* See Table 1.

C = Chlorpromazine; P = Pentobarbital; A = Alcohol; Py = Pyrahexyl; M = Morphine; B = Amphetamine; L = LSD-25.

Table 5. *Dose effect data on the specific drug for which each scale was developed*

Drug	Dose	N	T-score	Drug	Dose	N	T-score
Pentobarbital	200 mg	190	60.1	Morphine .	10 mg	15	57.8
	250 mg	30	63.5		20 mg	148	64.7
F-ratio . . .			1.94	F-ratio . . .			4.34*
Alcohol . . .	1.10 cm³	66	61.8	Amphetamine	15 mg	30	56.7
	2.12 cm³	75	66.1		30 mg	190	62.3
	3.00 cm³	90	71.2	F-ratio . . .			4.84*
	4.43 cm³	32	73.5	LSD-25 . .	1.0 mcg/kg	150	62.0
F-ratio . . .			12.80**		1.5 mcg/kg	172	66.3
Pyrahexyl .	60 mg	144	58.0				
	90 mg	170	65.5	F-ratio . . .			11.76**
F-ratio . . .			27.56**				

* <0.05. ** <0.01.

Table 6. *Correlation coefficients showing reliability of the scales under various conditions**

Drug	No-drug vs drug	No-drug vs placebo	Drug vs drug
C Chlorpromazine	0.37	0.47	0.61
P Pentobarbital .	0.56	0.68	0.70
A Alcohol. . . .	0.35	0.36	0.65
Py Pyrahexyl . .	0.25	0.32	0.55
M Morphine . . .	0.62	0.72	0.72
B Amphetamine .	0.65	0.77	0.69
L LSD-25 . . .	0.49	0.56	0.69

* All coefficients significant at less than the 0.01 level.

the strongest effect even though the S-scale of this condition (Table 2) contained the fewest items.

Validity of the scales is shown by many of the above comparisons, including those of "dose-effect". Retest reliability is partly demonstrated in Table 6. The first column shows the mean product moment correlation coefficients between scores obtained by comparing no-drug with each drug separately on the drug scale indicated. The second column presents the retest coefficients produced by comparing the scorings of the respective scales on the no-drug and placebo conditions. The third column shows the mean intercorrelations of four pairs of drug conditions scored on the indicated scales. The four pairs were: amphetamine-LSD (1.5 mcg/kg); placebo-pentobarbital; chlorpromazine-LSD (1.0 mcg/kg); pyrahexyl (60 mg)-pyrahexyl (90 mg). When non-significant coefficients occurred they were found only when comparing no-drug or placebo with some other condition. Such reliability coefficients progressively increase in magnitude over the comparisons of 1. no-drug, drug; 2. no-drug, placebo; 3. drug, drug. In addition, a further increase is found when the communalities are obtained on no-drug and the drug conditions. As the complete data are not contained in the present paper for these calculations, communalities are not shown in Table 6. Use of a standard measure of reliability of items, KR 20 (KUDER and RICHARDSON 1937, WEBSTER 1962), agrees very well with communality obtained for the LSD scale scored on the LSD condition.

It should be noted with regard to the drug scales discussed above that, with two exceptions, results are presented only for the scoring of each scale on the drug condition for which it was developed. These are basic data in the use of the ARCI, but they provide little information on the "common" or overlapping effects of drugs as would be obtained by scoring all scales on *all* conditions.

Discussion

Considerable attenuation was expected between the test group ($N = 100$) and the validity generalization groups. Little was found except on the placebo and alcohol scales. The placebo scale differentiated the no-drug and placebo conditions on the test group at the 0.05 level, but lost discrimination almost entirely on the validity generalization group. This is a rather striking demonstration of the need for using independent groups in validating subjective effects of drugs. In considering drug scales, only that for alcohol showed a significant decrease in mean score, and this may be due to the use of a smaller test group. This scale, however, has proved to be as effective as other scales in the present series. If dosages are appropriate, dose-effect relations provide further tests of one form of validity. Using the present scales

three drugs in different doses produced very significant F-ratios. The differences between the morphine doses, and between the amphetamine doses were significant, but at lower probability levels. This reduction in significance of dose-effects appears to be associated with a smaller number of subjects. It would seem however that the lack of significance between the two doses of pentobarbital was due to the selection of inappropriate dose levels; if 100 mg had been included, the range might have been more effective.

No significant differences were found between the test-retest conditions, demonstrating a high degree of reliability. Reliability correlation coefficients between test conditions also produced evidence of marked consistency; correlation coefficients generally increased progressively over the comparisons (no-drug)-drug, (no-drug)-placebo, to drug-drug conditions.

For obvious reasons the items or questions and the respective item numbers comprising the scales cannot be presented here. These are contained in a manual which accompanies the ARC Inventory[1]. In general, items of the S-scales and M-scales are respectively suggestive of primary and secondary effects of drugs. The primary changes appear to be those which are more obviously due to alteration in physiological functioning. Interestingly, it was shown in using correlational methods on data from part of the inventory under LSD-25 conditions that drug-produced changes on the S-scale account for most of the variation found on the M-scale (HAERTZEN 1961). Also, as might be expected, the S-scales appear to be responsible for most of the overlapping effects of different drugs.

Although there can be no firm operational distinction made between verbal report of simple sensory changes and verbal report of reactions which are due to more extensive learning and conditioning, it is possible to interpret variations in item content along this dimension. "Primary" drug effects include more of the following: report of general and specific muscular weakness, slower movements, clumsy hands, dryness of mouth, difficulty in swallowing, bitter, metallic or peculiar taste, changes in voice, specific hungers for sweet or salty foods, heaviness in head, dizziness, etc. So-called secondary effects may include report of being generally changed or different over a wide range of reactions, including desire or lack of desire for certain activities, alterations in perceptions, interests, mood, and in sympathy and empathy in interpersonal relations.

[1] For complete list of items including those used in the empirical scales, see H. E. HILL, C. A. HAERTZEN, A. B. WOLBACH, jr., and E. J. MINER: Appendix. The Addiction Research Center Inventory: I. Items Comprising Empirical scales for Seven Drugs; II. Items which Do Not Differentiate Placebo from Any Drug Condition. This issue p. 184.

Specificity of action appears to be quite relative since some general or common, non-specific effects are found to a significant degree for all the drugs tested. In an attempt to show some of the more specific effects, examples will be given from each drug scale. The items are shown together with the ARCI number, the direction of scoring, and the Chi square for differentiation from the placebo condition ($10.8 = 0.001$).

Table 7. *Morphine*

Number	Item	Scoring	Chi square
2	I have a pleasant feeling in my stomach	T	36
3	I feel as if I would be more popular with people today	T	29
345	I feel so good that I know other people can tell it	T	32
457	My nose itches	T	33
541	My speech is not as loud as usual	T	31

These items illustrate some of the more marked changes produced by morphine but some degree of change was found on these items for several other drugs. In the addict population, morphine also produces some specificity of reported somatic change, decrease in sexual interests but increased report of sexual satisfactions, and increased concern about past failures and inadequacies. However, results as presently analyzed do not show evidence of a specific morphine euphoria. Euphoric effects were extremely prominent for both morphine and amphetamine. This comparable effect, extending often to the degree of differentiation of items of this class from control conditions, was quite unexpected, both because of the pharmacological dissimilarity of the two drugs and in the absence of any grossly observable behavioral effect of amphetamine in the doses used in this study. The first and second items, of the following selection from the amphetamine scale, are those shown for morphine; the remainder, however, are more specific for amphetamine.

Table 8. *Amphetamine*

Number	Item	Scoring	Chi square
2	I have a pleasant feeling in my stomach	T	36
3	I feel as if I would be more popular with people today	T	37
59	My thoughts come more easily than usual	T	19
152	My memory seems sharper to me than usual	T	26
279	I feel a very pleasant emptiness	T	33

Amphetamine seems unique in the present series in several ways. In addition to the above, subjects generally report increased energy, alertness, intellectual efficiency, "patience", and cooperation.

The specific effects of the pyrahexyl compound used in these studies were relatively weak, but included a mixture of psychomotor retardation, a silly type of euphoria, and increase in appetite and loquacity.

Table 9. *Pyrahexyl*

Number	Item	Scoring	Chi square
18	Very frequently, things that seem humorous or comical to others do not seem so to me	F	13
190	I feel more clear-headed than dreamy	F	10
425	My throat feels sticky	T	13
476	The happiness I feel is normal	F	23
540	I have a floating feeling	T	11

Although pentobarbital produces profound effects, thus far evidence for specificity of action is not striking because of its similarity to alcohol. The most common reactions to pentobarbital were reports of tiredness, weakness, general "slowness", and drowsiness, accompanied by some degree of euphoria.

Table 10. *Pentobarbital*

Number	Item	Scoring	Chi square
66	I feel drowsy	T	27
76	My head feels heavy	T	16
153	It would be hard for me to concentrate on arithmetic problems right now	T	12
452	I feel dizzy	T	16
462	I have a "high" feeling which is similar to that produced by alcohol	T	20

The predominant effects of alcohol consisted of an awareness of impairment in both physical and intellectual functioning as well as in self-control, coupled with some euphoria. Alcohol also induced an increase in report of negativism, impatience, aggressive tendencies, and a decrease in social concern.

Table 11. *Alcohol*

Number	Item	Scoring	Chi square
66	I feel drowsy	T	7
153	It would be hard for me to concentrate on arithmetic problems right now	T	13
354	I feel like joking with someone	T	10
434	My appetite is increased	T	13
462	I have a "high" feeling which is similar to that produced by alcohol	T	41
476	The happiness I feel is normal	F	19

Chlorpromazine, pentobarbital and alcohol produce many similar effects, especially reports of fatigue and a general "slowing" of psychomotor activities. After administration of chlorpromazine, however, mood and feeling tone is dysphoric and there is a general avoidance of social interaction.

Table 12. *Chlorpromazine*

Number	Item	Scoring	Chi square
9	I feel weak	T	10
66	I feel drowsy	T	34
70	I am more tired than usual	T	29
86	It seems harder than usual to move around	T	14
536	I am as active as usual	F	16

LSD-25 induced the most specific effects of the present series of drugs which may be subsumed under the categories of depersonalization paranoid reactions and distortion of "bodily image". With respect to euphoria, the actions of LSD are complex. Some items that presumably characterize euphoria (e.g., "free, relaxed and pleasurable") were generally scored negatively, whereas others (e.g., "pleasant feeling in stomach", "thrills going through the body") were often scored positively, together with items of a definitely dysphoric nature—"anxiety", "restlessness", "agitation", "nervous habits". Euphoria, however, is strongly related to dose, being more evident at the lower dose employed here.

Table 13. *LSD-25*

Number	Item	Scoring	Chi square
96	I notice my hand shakes when I try to write	T	36
201	I feel anxious and upset	T	40
267	I have a weird feeling	T	44
476	The happiness I feel is normal	F	36
499	I feel an increasing awareness of bodily sensations	T	41

All drugs produce some change on all the scales discussed here. This is not surprising for some items, e.g., any effective drug should induce a subject to report that he feels different than normally, but many of the "common" effects are not this obvious. Most such non-specific effects, however, are sampled by the S-scales and appear to be more clearly dependent upon physiological alteration than are the specificities. The non-specific effects are generally in the direction of impaired functioning and morbidity. A few examples which differentiate between placebo and all drug conditions, but which do not differentiate between the latter except at different levels of significance are:

Table 14. *Examples of non-specific drug effects*

Number	Item	Scoring
9	I feel weak	T
209	My hands feel clumsy	T
267	I have a weird feeling	T
476	The happiness I feel is normal	F
524	My breathing has become deeper	T
545	My movements seem slower than usual	T

Judging from the results obtained to date with the ARC Inventory, it is quite apparent that considered *individually* very few of the subjective changes measured are unique for any of the drugs studied. On the other hand, it is quite clear that viewed as a spectrum of concurrent changes, subjective effects of drugs do exhibit a high degree of "pattern specificity". Further possibilities of meaningful interpretation of these alterations in patterns of response tendencies may lie in the application of factor analytic techniques. Such methods may also provide a means of relating drug-induced subjective changes to patterns of personality organization and to individual differences in physiology.

Summary

The ARCI, a 550-item inventory for assessing subjective drug effects and personality characteristics, was standardized using former addict subjects on a number of drug conditions. The inventory was administered under "no-drug" and placebo, and various doses of morphine, pentobarbital, chlorpromazine, LSD-25, amphetamine, pyrahexyl, and alcohol. By means of item analysis, cross-validity and other initial comparisons, items were chosen to comprise each drug scale that discriminated the particular drug from placebo; the (no-drug)-placebo comparison also produced a tentative placebo scale. Since non-significant differences were found when scoring each of the drug scales separately on the no-drug and placebo conditions, these data were combined for standardizing all scales. Validity generalization, dose-effect, and retest studies showed that the drug scales possessed a high degree of validity and reliability. In contrast, the placebo scale lost discrimination entirely in the validity generalization group. Because of the very considerable number of item comprising the scales, only examples were presented. Subjective effects of the various drugs were discussed in terms of specific and general, non-specific actions and patterns of these alterations.

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