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Development of the Addiction Research Center Inventory (ARCI): Selection of Items that are Sensitive to the Effects of Various Drugs

By

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If the present proliferation of compounds designed to favorably alter moods, feelings, anxieties, etc., is predictive of the future, the need for more systematic appraisal of verbal report may become imperative as one aspect of advance in pharmacology. When it is considered that man does so much of his living "subjectively," surprising indeed is the little effort that has been expended on systematic investigation of the subjective effects of drugs. One of the reasons for this inattention is the still rather widely held view that such "subjectivity" is an epiphenomenon, capricious to the point of making scientific study impossible. The main deterrent, however, is probably the relatively greater difficulty encountered in "subjective" as opposed to "objective" research in psychopharmacology. Although subjective data are, at times, more easily gathered than those obtained by instrumentation, they are often more refractory to quantitative analysis and meaningful interpretation.

The present studies are representative of one approach to evaluation of drug-induced alterations in subjective report. They were based in part on obtaining a format for the Addiction Research Center Inventory (ARCI)[1] which would be similar to that used in the Minnesota Multiphasic Personality Inventory (MMPI) (HATHAWAY and McKINLEY 1951). However, the content of most of the "true-false" questions was devised in preliminary work especially for investigation of drug effects. As a beginning, it is hoped that some specific as well as nonspecific effects of an array of drugs may be assessed by item and pattern analysis, and that the results may lend themselves to factor analytic techniques. The main purpose of the present report is to summarize the methods used in developing the 550-item ARCI and to indicate effectiveness of the inventory in preliminary studies.

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[1] The Addiction Research Center Inventory (unpublished).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

Judging by the literature, standard personality inventories are inadequate for the assessment of drug actions. Although the MMPI is a very versatile instrument and has been used to uncover some actions of LSD-25 and morphine, it is not sensitive to many psychologically active drugs (BELLEVILLE 1956; UHR and MILLER 1960; HAERTZEN and HILL 1959; LEBOVITS et al. 1960). It appears that although personality inventories may be excellent ancillary tests, uniform success should not be expected in areas for which they were not explicitly constructed. They seem fairly efficient when the actions being tested simulate serious behavioral abnormalities, e.g., the similarity of effects of LSD-25 to some aspects of schizophrenia, but they are inadequate in detecting effects which characterize many other drugs.

Among tests specifically devised for assessing subjective drug effects only a few are composed of questions presented as complete sentences. ABRAMSON et al. (1955), ISBELL et al. (1956), LINTON and LANGS (1962), FRASER et al. (1961), and BEECHER (1959) have used this type of item in short questionnaires for testing the effects of LSD, LSD and other psychotomimetics, and opiates respectively. BEECHER has also used check-lists composed of phrases and adjectives for studying the actions of amphetamine, pentobarbital, heroin, morphine and placebo in several different groups of subjects (1959). Apparently, however, the most extensive reported works on assessment of subjective effects of drugs have used "adjective check lists". Subjects are usually requested to "check", in graded form, the adjectives which apply to themselves before and after medication. Petrie's tests (1958) have generally emphasized "negative" mood such as feelings of inferiority or neurotic characteristics. Beecher's lists (1959) have a wider range and sample an area usually not found in other investigations, which for lack of more adequate terminology and space might be called "reportable physiological processes". The most extensive studies with adjective check lists, however, appear to have been done by NOWLIS and NOWLIS (1956). BEECHER has also used these selections. Since the subjects were college students, the range of drugs and dosages could not be great. These investigations are important, nevertheless, because they not only isolate effects of some commonly used drugs, but also because they demonstrate effective methodology for studying the interaction of drug effects and social influences. The Clyde Mood Scale (1960), an adjective check list developed from that of WENDT and NOWLIS (NOWLIS and NOWLIS 1956), has been used to isolate some of the effects of LSD and meprobamate and is being used by several investigators. Clyde also discussed potential utilities of self-ratings and the feasibility of their use as the main and ancillary sources of information of drug effects.

Construction of the present inventory entailed considerable preliminary work with standard personality inventories, mainly the MMPI, and tests that were "custom built" for assessing drug effects. In contrast with the content of personality tests, however, many items of the ARCI concern alterations in the "activity-sedation" continuum, and allied changes in motivation (readiness or disposition to respond), alterations in mood, such as in a "euphoria-dysphoria" continuum, or alterations in sensation and perception and in reportable physiological processes. In attempts to sharpen the delineation of drug-produced changes, attempts were also made to include items which would be relatively insensitive to drug effects. Thus the present paper will deal chiefly with methods used in selecting content of questions, but will describe vocabulary and format of the final inventory and the rationale for including items that may be useful in measuring certain personality characteristics.

Materials, Methods and Results

1. Methods used in developing drug-sensitive questions

a) Sentence completion. The first approximation to the ARCI was a list of 200 incomplete sentences which subjects finished by supplying one or several words. These stems, designed to elicit responses which might characterize various actions of drugs, were given to groups of 5 to 19 subjects under the conditions shown below. The responses are from different postaddict male subjects to the indicated stems under morphine sulfate (30 mg), d-lysergic acid diethylamide (LSD-25, 1.5 mcg/kg), d,l-amphetamine (20 mg), pentobarbital (250 mg), chlorpromazine (dosage increased from 150 to 300 mg/day over a four-day

Table 1

	"My head seems to be ..."	"I am very ..."
No-drug	"normal," "all right"	"sentimental," "undecided about my religion"
Morphine	"stimulated," "light," "tight," "normal"	"contented," "sorry about life," "much undecided about my religion," "relaxed now," "happy now," "nervous"
LSD-25	"in a cloud," "okay," "tight"	"upset," "healthy"
Amphetamine	"a little hot," "tightening slowly," "groggy and dull"	"disgusted with myself," "much upset"
Pentobarbital	"large but otherwise normal," "all right," "okay"	"very sorry I started," "friendly," "tired of this institution"
Chlorpromazine	"tight," "good," "clear"	"easy to wake up in the morning"
SKF-5390	"dizzy," "lighter," "thick"	"relaxed," "careful of what I say or do"

period), and a marihuana-like compound[1], SKF-5390 (1'-2'-dimethyl-heptyl-cannabinol, 0.021 mg/kg).

Many of the responses were as expected, but many were unintelligible when considered in isolation, and still others were found under more than one drug condition. The response "I am very nervous," found under the morphine condition in postaddict subjects, for instance, seems quite incomprehensible until it is considered that in the context of addict argot "nervous" often refers to the "drive" or "high" produced by opiates. As will be described in subsequent reports, correlational and factor analytic techniques were used later to select related classes of response.

Examples of final items developed from such completed sentences are: "My face feels tight," "I have a sentimental feeling," "I feel as if something pleasant had just happened to me," "I think this room is too small".

b) "Alternative stem" and "paired comparison" tests. From inspection of responses to incomplete sentences it appeared that indications of some drug actions might be obtained more readily if subjects chose between alternative effects, or ranked symptoms. Items in which symptoms were contrasted were developed by the alternative stem method, e.g., "I feel more ... than ..." Two other methods which accomplished essentially the same objective were paired comparisons, e.g., choosing between pleasant and unpleasant effects, ranking the intensity of symptoms (degrees of "confusion," "irritability," "happiness," "don't give a damn"), and reporting impressions of change in various parts of the body. Some examples of items that were developed in this way and used in the final form of the inventory are: "I seem to be thinking more about the bad things than the good things I have done," "I would rather listen to a conversation than take part in one," "I am more impulsive than poised," "My movements are free, relaxed and pleasurable," "I have spells of being confused," "I feel as if I have a lump in my throat," "My hands feel clumsy," "I have a pleasant feeling in my stomach," "My hands are changing color."

c) Word and drug associations. In one form of this method, subjects associated drug names and effects with words randomly chosen from the Thorndike Word List (THORNDIKE 1944) under both drug and no-drug conditions. Responses varied considerably and some similar associations

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[1] We are indebted to Smith Kline & French Laboratories for supplies of this compound. It corresponds to "RA-122" described by LOEWE [Archiv f. Exper. Path. u. Pharmakol. **211**, 175—193 (1950)] and to dimethyl heptyl pyran (DMHP) described by DAGIRMANJIAN and BOYD [J. Pharmacol. exp. Ther. **135**, 25—33 (1962)].

appeared irrespective of the condition. A few words and selected associations follow: *Apart:* "Cocaine. I feel more apart from other people"; *Attack:* "Alcohol. I am astonished at some of the things I do; *Fairy:* "A fairy doesn't bring you drugs"; *Custom:* "Reefer (marihuana) I have a custom of looking at mirrors"; *Disappoint:* "Heroin. I will disappoint anyone". In a similar but shorter test subjects associated drug names with words selected at random from Thorndike's list and with items from the MMPI.

d) Summary of results. While the number of subjects used in the above pilot work was not large for any one drug, the value of sentence completion and similar association techniques for developing drug-sensitive items was clearly demonstrated. Taken in conjunction, the data indicated that addicts associated alcohol with aggressive tentencies, emotional lability, creating excitement, difficulty with the law, and religious preoccupation. Thus 18 out of 19 associated the statement, "At times I feel like picking a fight with someone," with alcohol. The men associated good judgement, energy or lack of tiredness, active interest in intellectual pursuits, worry over sex, and difficulty with sex organs with amphetamine. Cocaine was associated with a variety of hallucinatory and morbid experiences, racing thoughts, urge to do something harmful, paranoid ideas such as the belief of being plotted against, restlessness, fearfulness, frightening experiences, and dreams of a sexual nature. Barbiturates were associated with the word "can't". Subjects associated it with difficulties in concentration, difficulties in memory, lack of energy or feeling of tiredness, and difficulty in starting to do things. The "marihuana-resembling" compound seems to be the "social" drug since it was associated with fun, social groups, social adequacy, joking, energetic activities, happiness, not being easily provoked, care about personal appearance and dress, and interest in intellectual and aesthetic pursuits. Thus, they associate marihuana with dramatics, being a journalist, drawing pictures and the like. With respect to intellectual interests generated it resembles amphetamine. It is different, however, since marihuana associations also include being facetious and silly.

In those who have misused it, morphine produces euphoria and a number of reported somatic changes, but is also associated with a variety of attitudes, chiefly those which involve a distrust of other people. The drug reminds the postaddict of being secretive, "keeping his mouth shut" or being reticent if people are overly friendly or ask many questions, telling only part of the truth, or just not being in on the gossip or part of a general conversation. He is reminded of times when he has been irritable, angered, or "difficult," worried about sex, disappointed in love, concerned about money.

LSD-25 appears to combine the effects of several drugs. Some subjects report the hallucinatory experiences common in the cocaine user, as well as his paranoid ideas. The subject may believe that someone else is controlling his actions, or that he will become insane or lose complete control of his behavior. In common with the barbiturates, he reports being less able to concentrate, being fearful, sensitive, restless, worried, and concerned about dreams. In common with morphine and amphetamine, euphoria is frequently reported after the administration of lower doses of LSD, but may alternate with dysphoria and anxiety on higher doses (1.5 mcg/kg).

It cannot be assumed that the above types of statements will always be reported if subjects are tested by questionnaire methods. This is most obvious with a drug such as LSD. The subjects may experience all sorts of hallucinations, but the test itself introduces external stimulation at the time a question is answered, and this may interfere with hallucinatory experiences. Thus, almost 100 percent of the subjects who had previous experience with LSD associated hallucinations with it, whereas only a small percentage agreed that they were having hallucinations while taking the test. In this respect, also, addicts associate lying and cheating with morphine at a highly significant level, but are less likely to agree that the statement applies to them while they are under this drug.

This kind of discrepancy also occurs when the results of interviews and those of structured personality tests are compared. Under drug conditions hallucinatory experiences occur much more frequently in interview situations, especially if the experimenter makes suggestions. Some subjects state that the testing procedure enables them to detach themselves from some of the drug effects. For this reason a great deal of emphasis in the present work was centered on the development of questions that would focus the subject's attention on experiences ocurring during the test or in reaction to taking the test.

2. Criteria of drug-sensitive questions

As suggested above, although other characteristics of items are influential, content is by far the most important characteristic in determining whether a drug will produce a change in response. In an attempt to evaluate the relation of various types of content for relative sensitivity to drug effects, all items of the MMPI and, later, the ARCI were classified under the five headings shown in Table 2. Items on sensation, perception, anxiety and mood, bodily symptoms and activity level were changed much more often than those concerning personality characteristics, occupational interests, general attitudes or philosophy of life.

One modifying aspect of item content, and one which is difficult to control, is degree of social desirability (or undesirability). Although social undesirability is positively correlated with high probability of a drug-induced change, change is not likely to occur on extremely morbid items. Therefore, most preliminary items of this nature were eliminated or rewritten to make the experience more acceptable. Endorsement, under drugs, of items having morbid content is also influenced by tense; use of the present tense increases the probability of endorsement under drugs. For example, more "true" responses were given under the no-drug condition for the question "I have had peculiar and strange experiences," than for "I am having a peculiar experience". However, as might be expected, drugs produced much greater change on the latter form of question. Thus, since drug-produced changes are strongly related to the present, most of the items in the final inventory (ARCI) were written in this tense. Closely associated with endorsement of socially undesirable or morbid content is the manner in which such content is phrased. It was found that the "as if," "seems to be," or "similar to" construction was much more conducive to change than categorical phraseology.

3. Personality disorders and drug effects

As gathering of items continued, it became apparent that a considerable number suggested behavioral abnormalities. The foregoing discussion of the degree of morbidity of questions indicates some of the difficulties encountered in using this type of content even without considering the possible interaction of specific personality characteristics and drug actions. Direct attempts, however, were made to devise and select some items which would be indicative of the main disorders or dimensions of personality, even though some of these might not be altered by drugs. Findings of present investigators, BELLEVILLE (1956), HAERTZEN and HILL (1959), ISBELL's studies of tolerance (1956), WIKLER's review (1957), and preliminary work in the present study on LSD-25 were helpful in constructing items that are suggestive of schizophrenic reactions. A larger number of questions were also developed that appear to be related to psychopathic characteristics which in turn appear to be related to some forms of alcoholism and especially to narcotic addiction in the United States. Some items were also chosen that might indicate hostility and aggression, and their alteration, because of the presumed relation of these to the effects of pentobarbital and alcohol (HILL 1962). Although relatively few items with obviously classic neurotic content are included, many items sample differences in mood and cognition which may be more subtle indications of neurosis.

Also, attempts were made to include items representing extroversion and introversion, partly because of the importance EYSENCK (1957) attaches to this postulated continuum.

4. Secondary characteristics

A number of secondary characteristics of items were used which may make a test effective. The instrument was planned so that it might be used with practically any literate English-speaking population. Items in which drug names or argot equivalents are used are often very effective with drug addict populations (FRASER et al. 1961), but dependence on these words would limit the use of the ARCI to subjects who had considerable drug-related experience. Since it would be difficult to compare different groups on such items, drugs that are used by addicts such as morphine or marihuana are not mentioned in any item, and "alcohol" appears very infrequently.

To make the test usable with the widest variety of groups, vocabulary must be "easy," print must be large (so that a test can be given to subjects with some degree of visual blurring), and the test should be easily scored (use of IBM answer sheets). "Difficulty" was operationally defined as the word count for the most infrequent word in each item according to Thorndike's method (1944). The average for the ARCI was 45.8 occurrence/million words. The comparable average for the MMPI, California Personality Inventory (CPI, GOUGH 1957), GUILFORD-ZIMMERMAN (first 100 items, 1949) and Sixteen Factor Personality Questionnaire (16 P. F., CATTELL 1957) respectively are 49.4, 45.2, 38.9 and 11.8. Thus, the average ARCI question is just above the third-grade level in difficulty. The preponderance of items is below the 6th grade. Cattell's P. F., in contrast, is about the 8th grade in difficulty and contains many words at the college level. On the basis of the word-count it would appear that the ARCI, MMPI, and CPI would be usable with subjects who have a narrower range of reading ability than either the Guilford-Zimmerman or especially the 16 P. F. Originally it seemed desirable to key all items below the 6th grade level in difficulty, but this is impossible since many "symptom" words would have been eliminated. The present subjects complain of only a very few words in the ARCI, e.g., "shirk" and "remorse". Print and spacing between letters and items is larger than for the tests listed above, and the print appears adequate for drugs employed to date[1].

5. Final form of the ARCI

The pool from which the final questions were selected consisted of 3300 items. As discussed above, most of these were compiled from

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[1] Results of preliminary studies were presented at meeting of Midwestern Psychological Association in Chicago, 1961.

suggestions gained by testing subjects under both drug and no-drug conditions, but others were derived from experience of the staff with narcotic addicts and experimental use of drugs. All items were classified according to the rather arbitrary headings shown in Table 2. By isolating items in this way the original pool was reduced to about 1,000 by eliminating similar questions and those which appeared to be least suitable. Successive selections by three psychologists finally reduced the number of items to 550 while maintaining as wide a grouping as possible[1]. In making the final selection emphasis was placed upon obtaining fairly representative content for each category. While the main effort was to select items which would be sensitive to effects of drugs, items thought to be insensitive were included for the purpose of showing contrasts. Thus each judge sorted all items with regard to representativeness of content (Table 2), probable sensitivity to drug effects (both specific and non-specific), and content which might simulate some of the more common behavioral abnormalities. When concensus did not occur, choice was determined by further discussion. Included in the final selection are 30 items which are either repeated exactly or in negative form. These were later used as a validity (Ca) scale for determining consistency and validity of response[2]. The ARCI in its final form contains 40 items from the MMPI and, as far as can be ascertained, 510 original items. A considerable number of the latter, however, will be found to resemble some items used by ABRAMSON (1955), ISBELL (1956), FRASER (1961), BEECHER (1959), and others.

Use of the ARCI with 100 postaddict subjects under seven different compounds in addition to no-drug and placebo conditions indicates that the test is effective in differentiating various subjective effects of drugs. Of the 550 items only about 200 failed to distinguish significantly between placebo and some drug condition. Separate item analyses using morphine, pentobarbital, and LSD-25 on the ARCI and on the MMPI showed that approximately 25 percent of the items were changed by each drug on the former, in contrast with 10 percent on the MMPI. Although these studies were not entirely comparable because a considerably greater N was used on the ARCI, the results indicate the marked superiority of the "custom built" inventory which is constructed from sentence completion and allied techniques. In addition, preliminary comparison by means of the ARCI of postaddict subjects under placebo and LSD-25 with the responses of schizophrenic patients suggests that the inventory may delineate some of the similarities and differences between naturally occurring and experimentally induced behavioral abnormalities (HAERTZEN 1961). Preliminary testing also suggests that

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[1] See Footnote, p. 155.

[2] Questions were edited by GEORGIA HILL, Department of Literature and Languages, Eastern State College, Richmond, Ky.

Table 2. *Classification of ARCI items* ($N =$ number of items)

	N		N
1. General Information		4. specific skills	3
a) family	16	5. maturity	5
b) law	3	6. social expression	15
2. Interests and Drives		b) reactions toward the test .	11
a) interests in activity now . .	20	c) attitudes toward people . .	45
b) energy	15	d) attitudes toward institutions	4
c) general interests (occupatio-		e) content of thought	7
nal interests)	20	f) character traits	
d) appetite	10	1. empathy, sympathy . .	7
e) sex	23	2. control, patience, hostility	44
f) sleep	7	3. personal appearance . .	5
3. Sensation and Perception		4. impulsiveness vs planning	19
a) hearing	6	g) schizophrenia	
b) internal sensations	10	1. affect	10
c) kinesthetic sensations . . .	7	2. loss of interest	5
d) pain	7	3. idea of things being	
e) smell	2	changed	4
f) taste	6	4. ideas of reference, mind	
g) time	4	reading	5
h) touch	4	5. hallucinations	6
i) vision	17	6. supernatural powers . .	2
j) temperature	5	7. feeling of being abused .	20
4. Bodily Symptoms and Processes		8. suspicion	3
a) head	7	9. "weird" experiences . .	15
b) nose and lungs	4	10. general characteristics . .	15
c) body image	2	h) expression	7
d) coordination (muscle) . . .	10	i) fears	
e) mouth, throat, stomach . .	10	1. fears	11
f) heart	2	2. anxiety	6
g) nerves	4	3. nervousness	13
h) skin	2	4. "bothered by..."	6
i) speech	5	5. pain	3
j) extremities	6	j) guilt	
k) neck	1	1. guilt	8
l) excretion and genitals . . .	5	2. worry	15
m) eyes	7	3. depression	10
n) ears	6	k) mood	
5. Feelings and Mood		1. state of feeling	12
a) ability		2. euphoria	14
1. general discouragement or		3. depression	7
confidence	18	4. excitement	12
2. concentration	15	l) interpersonal relations . . .	20
3. memory	2	m) orientation	8
		n) philosophy of life	10
		Total	550

the effects of morphine and alcohol may simulate to some extent the lack of concern or disregard of social conventions found in many psychopathic individuals. Subsequent reports will deal with testing procedures, development of serveral "drug" scales, various applications of factor analysis, and some relations of personality and drug actions.

Summary

A "custom-built" inventory for assessing subjective effects of drugs, the Addiction Research Center Inventory (ARCI), was developed from the use of "sentence completion" and other association techniques on male subjects under drug and no-drug conditions. In addition to demonstrated "drug-sentitive" questions, the final form of the inventory (550 "true-false" items) also contains items which may delineate to some extent schizoid and "psychopathic" characteristics. The format is similar to that of the MMPI and the content has a fairly wide range. Initial use indicates that the inventory is effective in differentiating various subjective effects of drugs and in discriminating some similarities and differences of naturally occurring and experimentally induced behavioral abnormalities. Results also indicate that the effectiveness of specially designed tests, whether in the form of complete sentences or adjective check lists, chiefly depends upon assessment of the "activity-sedation" continuum and allied changes in motivation, alterations in mood such as in a "euphoria-dysphoric" continuum, alterations in sensation and perception, and in reportable physiological processes.

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