THE EFFECTS OF MATERIAL REWARD ON PERFORMANCE IN DRUG DEPENDENT SUBJECTS

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CHAPTER I

RESEARCH PROBLEM

Several investigators have shown that reward, when introduced into children's discrimination learning and other simple tasks, hinders rather than facilitates performance (Terrell, Durkin, & Weisley, 1959; McCullers & Martin, 1971; Spence & Segner, 1967). Subsequently, the detrimental effects of material rewards have been demonstrated across a wide range of tasks and developmental levels. Contrary to expected facilitation, rewards have been shown to undermine subsequent interest in an activity (Csikszentmihalyi, 1975; Deci, 1975; Lepper, Greene & Nisbett, 1973), and to have detrimental effects on immediate task performance (McGraw, 1978; Kruglanski, Friedman, & Zeevi, 1971).

Recently, investigators have suggested another interpretation, that of developmental regression (Fabes, Moran, & McCullers, 1981; Moran, McCullers, & Fabes, 1984). According to this view, based upon results obtained through research with university students using the Weschler Adult Intelligence Scale, rewards may have an adverse effect by producing a temporary regression in cognitive and psychological functioning. Extending the regression inquiry to children, Moran et al. (1984) replicated Fabes et al. (1981) findings with adults. However, based on findings with

children, it was suggested that there may be a minimal level below which regression effects do not occur or are not detectable.

Fabes, McCullers, & Moran, (in press) utilitzed ten developmental variables of the Holtzman Inkblot Technique (HIT) with university students to extend the inquiry from higher (cognitive) functions, to more primitive, perceptual tasks. Results again supported the regression hypothesis. Based on these results, it seemed resonable to conclude that rewards can produce a regression in higher cognitive functioning and lead to less mature perceptual organization and functioning as well. Although as Fabes et al. (in press) point out, a further search for the mechanisms by which rewards produce these effects is needed.

Few would disagree that from an evolutionary perspective, rewards are essential to individual and species survival. For this reason, rewards may be related to behaviors and brain centers that could be described as primitive (MacLean, 1973). From a biochemical perspective, brain mechanisms for reward have recently received new attention as a result of the discovery of endogenous neuropeptides, the endorphins and enkephalins, present in the brain tissue of humans (Goldstein, 1976). Stein and Belluzzi (1979) have strongly suggested that brain endorphins are involved in the reward function. Concurrent with the study of the biochemical processes involved in the reward system, recent research has also shown a relationship between the process of addiction or dependence on opiate substances and

below which regression effects do not occur or are not detectable.

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the functioning of the endorphin/enkephalin system Goldstein, 1983).

Based upon the physiology of other hormone systems, Goldstein (1983) suggests that the endorphin/enkephalin system operates on a negative feedback cycle which provides the body with natural opiates as needed. When an outside source of opiates is present in the system, as happens when opiates are ingested by a drug abusing person, the body's internal endorphin/enkephalin system ceases to function. Sudden removal of the outside source is believed to result in painful withdrawal symptoms because the natrual opiate mechanism has lost the capacity to function properly.

Logically, one might deduce that the addiction process and the reward system share a common ground. Likewise, the phenomenon of regression under reward may be related to these same subcortical centers of the brain that are involved in the biochemical reward system and the process of drug addiction or dependency. It is this potential interrelationship between the reward system, regression and the process of addiction that provided impetus for the present research.

The specific purposes of the present study were to further investigate the regression hypothesis, expanding the inquiry to adult subjects under the influence of an exogenous opiate substance. The study also attempted to replicate earlier findings (Fabes et al., 1981; Moran et al., 1984; Fabes et al., in press), and increase the body of knowledge about the reward system and the process of drug dependence.

The experiment attempted to answer the following questions: (a) Does the offer of reward to a normal subject produce responses that resemble those of a nonrewarded drug-dependent subject or a drug-free subject with a history of drug dependence?, and (b) What effect do rewards have on the performance of the drug-dependent subject?

It was hypothesized the performance of normal and drug-free subjects under reward would resemble the performance of drug subjects not under reward on instruments sensitive to reward effects and changes in developmental level. That is, a regression effect would occur in normals and drug-free subjects as a result of rewards, and in drug-dependent subjects as a result of drugs. The performance of drug subjects under reward might be further regressed or show no change if these subjects were maximally regressed already as a result of the daily chemical ingestion of Methadone. It was also hypothesized that reward subjects, relative to nonreward subjects, in the drug-free and normal groups, would perform at a developmentally less mature level.

CHAPTER II

METHOD

Logic

A sample of persons undergoing treatment for dependency on exogenous opiates was thought to yield the best opportunity for detecting a relationship between such dependency and a reward-system disruption. If endorphins are responsible for the "reward" or "pleasure" effect, which is essentially duplicated daily in the drug group from an external source (Methadone), then the subject's internal reward system should be disrupted which behaviorally would be demonstrated in the performance of these subjects under reward and nonreward conditions.

Subjects

All subjects in the experiment were adult male volunteers who ranged in age from 26 to 54 years. The mean ages for the Drug group and the Drug-free group were 38.8 and 35.9 years respectively. Mean age for the normal group was 33.4 years. Subjects in the Drug and Drug-free were undergoing treatment for drug dependency in Oklahoma. The potential maximum sample available for participation in the Drug and Drug-free groups was 45 subjects. Of this number, 37 participated initially, with 28 completing both sessions. Each of the three groups consisted of 14 subjects, or a total of 42.

Occupationally and educationally, the subjects varied widely, but equally within and between groups, with members of each group having educational preparation ranging from high school to graduate school and occupations ranging from skilled workman to professional.

Drug Group

The 14 subjects in the Drug group, ranged in age from 28 to 54 years. Each was involved in an outpatient treatment for drug dependence. The treatment generally consisted of several visits per week to the clinic for group or individual counseling or psychotherapy and daily oral maintenance doses of Methadone Hydrochloride in amounts ranging from 30 to 55mg per day. The dosage varied individually depending on need, and medical history. Additionally, to remain in the program and be eligible for receipt of Methadone maintanence, each patient was required to maintain some type of paid employment and avoid all other drugs. Subjects in this group had been enrolled in the treatment program for various periods of time ranging from one to five years.

Drug-Free Group

The 14 subjects in the Drug-free group ranged, in age from 26 to 44 years. These subjects also were involved in treatment for drug dependence, with 12 undergoing treatment for dependence upon exogenous opiates and 2 undergoing treatment for dependence upon a variety of drugs including narcotics. The treatment consisted of weekly individual and group psychotherapy, but did not include receiving Methadone Hydrocholride. Members of this group were also required to

maintain paid employment and avoid all drugs. Therefore, this group was was referred to as the Drug-free group. Subjects in this group had been drug-free at the time of participation for periods of time ranging from a few months to several years.

Normal Group

The 14 subjects in the Normal group ranged in age from 26 to 36 years, and were currently employed as firefighters. As part of the criteria for employment, these men were required to pass physical and psychological screening batteries designed to eliminate persons having any of several problems, including drug dependence. Holtzman et al.(1961) utilized Austin, Texas, firefighters to obtain adult normative data for the HIT. In matching this group to the other two, the same rationale applied. This group varied educationally in the same ways as the other two groups.

Interviews were held with each man prior to participation and each subject was asked to exclude himself if he was using any prescription medication now, or if he had ever been involved in treatment for drug dependence. The administration of the department was also asked to identify those persons whom they thought might now, or previously have had a drug abuse problem.

Matching Procedure

All three groups were matched as closely as possible on age, sex and initial intellectual ability. The Vocabulary and the Block Design subscales of the WAIS were used to estimate IQ. Research on short forms of the WAIS (Tipton, & Stroud,

1973; Silverstein, 1967; 1970) has shown this pair of subscales to be one of the best duads for predicting Full Scale IQ (r=.90). The average IQ estimations for the groups ranged from 95 to 119. The results of the matching procedure and the data on the matching variables are presented in the Results section.

Selection Procedure

A presentation was made by the investigator inviting the total population of patients to participate in a study aimed at helping to increase information about drug dependence and treatment. No mention of reward was made at any point in the presentation. The patients were told that participation was not required by either the treatment program or the counselors. Volunteers we asked to contact the secretary at the clinic for an appointment. Confidentiality was stressed concerning identities of the participants. A letter, restating the oral presentation was placed on the program bulletin board and patients told of its location. Several meetings were held with the staff and administration to explain the study and enlist cooperation. The staff was asked not to discuss the project with the patients but to refer questions to the investigator.

Essentially the same procedure was followed with the normal group, with emphasis placed on confidentiality and on voluntary participation. Finally, letters were provided to those not present at the oral presentation inviting participation. All sessions were scheduled at the subjects' convenience.

Materials

Background and pretest.

In deciding upon the appropriate instruments for the study, the following criteria the effects of developmental change in a normal population. (b) The instrument should be sensitive to the effects of reward. (c) Ideally, the instruments should be well-known, published devices with established reliability, validity, and standardized normative data available.

The instruments selected for use in the present study were four subscales of the Wechsler Adult Intelligence Scale (WAIS), i.e., Picture Arrangement (PA), Object Assembly (OA), Block Design (BD), and Vocabulary (V), (Wechsler, 1955); and Form A of the Holtzman Inkblot Technique (HIT), (Holtzman et al., 1961). These instruments have been used with drug dependent populations, including methadone patients. Also, these instruments meet the selection criteria of the present study (Moran et al., 1984; Fabes et al., 1981; Fabes et al., in press; Lombardo,Lombardo, & Goldstein, 1976; Culver & King, 1974; Appel & Gordon, 1976).

The Holtzman Inkblot Technique

The Holtzman Inkblot Technique was developed by Holtzman, Thorpe, Swartz and Herron (1961) in an attempt to produce an inkblot series for use in research, free from limitations of the Rorschach Inkblots. Of the possible 21 variables scored on the HIT, 10 have appeared sensitive to developmental change in previous studies (Fabes, et al., 1981; Fabes, et al., in press; Clark, Veldman & Thorpe,

1965). These variables are Form Appropriateness (FA), Form Definiteness (FD), Location (L), Shading (Sh), Human (H), Movement (M), Color (C), Integration (I), Reaction Time (RT), and Pathonogmic Verbalization (PV) and are scored individually for each inkblot.

A total score is obtained for each subject's performance by totalling all individual inkblot scores on each variable. Higher scores in FA, FD, Sh, C, H, M, and I with lower scores in L, and PV, with slower RT, are associated with a more mature level of perceptual development in previous studies. Conversly, a more immature level of development would be demonstrated in lower FA, FD, Sh, C, H, M, I scores, higher L, and PV, and a faster RT.

Holtzman et al.(1961) reports consistently high reliability for the instrument, on several factors. Reported measures of interscorer reliability, regardless of the scorer's degree of training and experience with the HIT, were generally .90 or higher (p. 104). Likewise,a split-half reliability study on college age males, using Form A, reveal reliability coefficients for each variable ranging from .84 to .99.

Only a portion of the HIT was used due to the time required for administration of the total 45 blots , (usually 70 minutes), and the length of time the subjects typically were available for each session. Initially, the total 45 blots were to be administered to each subject. However, in two pilot sessions the subjects failed to complete the blots due to fatigue and time available. Interviews held with

program staff and several patients, revealed that the optimal period for maximum participation of subjects in the Drug and Drug-free groups would be about one hour per session. The HIT literature indicated that a 30 item short form of Form A was available for group administration. However, the group format could have resulted in a loss of sensitivity to several developmental variables of interest (Herron, 1963; Holtzman et al., 1961).

Based upon these considerations, the first 30 blots of Form A, individual form, were chosen for use in the study. These were divided into two sets of 15 blots each. Set one consisted of the even numbered blots (2-30), and Set two consisted of the odd numbered blots (1-29). Holtzman et al. (1961) reported that in a study of 92 college aged males, the even numbered blots were compared to the odd numbered blots, and yielded split-half reliability coefficients for each variable that ranged from .84 to .99.

The Wechsler Adult Intelligence Scale

The Wechsler Adult Intelligence Scale is a standardized psychological instrument used commonly for assessment of intelliqence in adults. Three subscales, Block Design, Picture Arrangement, and Object Assembly from the nonverbal intelligence portion of the WAIS, were chosen for use in the study. Validity and reliability values are available in the WAIS manual (Wechsler, 1955).

Experimental Procedure

In order to insure that the subjects in the Drug-free group remained drug free, and that those in the Drug group

ingested only their prescribed daily Methadone, random urine samples were taken weekly from the Drug and Drug-free throughout the project. None of the subjects was in need of detoxification at the time of their participation. Subjects suspected, either by the experimenter or the staff, of taking drugs other than the prescribed Methadone, or subjects having a positive urine screening test were excluded from the study. Subjects behaving in an intoxicated manner during testing or during their regular clinic psychotherapy sessions were given a urine test. A total of eight subjects from the Drug group were excluded based upon positive urine tests following the first session of testing. Urine screening tests were not conducted with the normal group. None of the normals was suspected of taking drugs and none was excluded from the study.

All subjects performed individually in two separate sessions, each lasting approximately one hour. Informed consent was obtained from each subject prior to participation in the first session. In the first session, all subjects were administered Set One of the HIT (even numbered blots, 2-30) and subscales of BD, V, PA, OA, of the WAIS, according to the standard (nonreward) procedures contained in the manuals of the two instruments (Wechsler, 1955; Holtzman et al., 1961). Following Session One, subjects in each group were randomly assigned to either a reward or a nonreward condition, with the restriction on randomization that there be equal numbers of subjects in each condition. Session Two was scheduled an average of ten days after

Session One. Prior to administration of the instruments in Session two, subjects in the reward condition were told:

> This research is being funded by a grant and as a result we have been authorized to give money to some of the participants in this experiment. Therefore, you will receive five dollars for your participation. I have the money with me and after the session is completed, I'll fill out a receipt and I will give you five dollars.

In Session two, all subjects again received the same instruments used in Session One, except that Set Two of the HIT (odd numbered blots, 1-29) was used in place of Set One and the Vocabulary subscale was omitted. The Vocabulary subscale had been used in Session One only for estimating IQ. Following completion of the instruments, in both Sessions One and Two, all subjects were interviewed concerning whether and how much they enjoyed the experiment, and were debriefed and asked not to discuss the experiment with their peers.

Design

The final design was a multi-factor mixed design with repeated measures. Three groups of subjects were matched on initial ability, age and sex: (a) a Drug group, (b) a Drug-free group, and (c) a Normal group. In the first session, all subjects performed under standard, nonreward

conditions. In the second session, within each group, subjects were assigned randomly to either a reward or a nonreward condition.

CHAPTER III

RESULTS

Matching Variables

The matching procedure yielded average estimates of IQ that ranged from 96 to 119 across groups. The mean IQ estimates for the Drug group were lower than the other two groups, on analysis the Drug group, mean IQ was 96 and 105 for reward and nonreward conditions respectively. For the Drug-free group, the reward and nonreward mean IQ scores were 112 and 119, repectively. For the Normal group, the reward and nonreward IQ means were 119 and 115 respectively.

Analysis of the Vocabulary and Block Design score revealed that mean Vocabulary score for the Normal group was 14.2, and mean Block Design score was 12.5. For the Drug-free group, mean Vocabulary and Block Design scores were 14.2 and 11.2 respectively. Mean scores for Vocabulary and Block Design for the Drug group were 13 and 9.6 respectively. The majority of the subjects in the Drug group responded to the Block Design tasks at a much slower rate than in the other groups, resulting in a lower scale score on Block Design and an overall lower IQ estimate. Drug group subjects also had an overall slower Reaction Time on the Holtzman Inkblot Technique. These results appear to be due to the effect of the ingestion of Methadone daily and could reflect

an underestimate of true IQ in the Drug group.

Quantitative Findings

Initially, a 3 (Drug, Drug-free, Normal) X 2 (Reward, Nonreward) analysis of variance with repeated measures on the 10 targeted HIT variables and the 3 WAIS variables revealed significant main effects for group on 4 of the HIT variables and on all 3 WAIS variables, as well as significant group x treatment x pre and post measures interactions. Individual comparisons for each of these significant variables were computed using F tests for repeated measures. The results of these analysis indicated that reward subjects in the Drug group scored significantly lower on Location, $F(1,36) = 10.19$, $p < .05$, higher on Movement, $F(1,36) = 4.33$, $p < .05$, and lower on Human $F(1,36) = 4.20$, $p < .05$, and Pathognomic Verbalization $F(1,36) = 8.06$, $p < .05$, than nonreward Drug subjects. All other values in the Drug group failed to reach statistical significance. Table 1 summarizes these results.

Insert Table 1 about here

Analysis of reward and nonreward pretest/posttest scores revealed nonsignificant trends in the Drug group toward faster Reaction Time, higher scores on Form Appropriateness, Shading, Form Definiteness, and lower scores on Integration under reward compared to nonreward Drug subjects. Table 1 summarizes the Session One and Session

Two results. In both the Normal and Drug-free groups no significant effect of reward was found.

Analysis for the Normal and Drug-free groups revealed no significant reward effects. Although there were trends in predicted directions in several variables, these failed to reach statistical significance. The mean HIT scores for each group tend to be somewhat misleading unless pretest/posttest scores for each group by condition are considered as well. Tables 2 and 3 summarize these results.

Insert Tables 2 and 3 about here

Analysis of pretest/posttest raw score differences for the Normal group revealed trends toward lower scores on Integration, Movement, Form Appropriateness, higher scores on Location and Form Definiteness, and faster Reaction Time under reward conditions. Analysis of the pre/posttest raw scores of subjects in the Drug-free group revealed trends toward lower scores in Integration, Color and higher scores in Location, and Human and a slower Reaction Time under reward conditions. While not statistically significant, comparison of these pretest/posttest raw scores assist to clarify relationships between the variables.

Significant group differences occurred between the Drug-free and the Normal groups in Human variable scores, with the Drug-free group scoring significantly higher than

the Normal group. $F(1,24) = 8.08$, $p < .05$. All other group main effect differences occurred between the Drug and the Normal group, with the Drug group scoring significantly lower on Form Appropriateness $F(1,24) = 8.97$, $p < .05$, Block Design $F(1,24) = 12.97$, $p < .001$, and Object Assembly $F(1,24) = 16.85$, $p < .001$, Picture Arrangement $F(1,24) = 6.75$, $p < .05$, and significantly higher on Movement $F(1,24) = 7.82$, $p < .05$, and Integration $F(1,24) = 6.58$, $p < .05$, than the Normal group.

There were no significant effects on the WAIS subscales of Picture Arrangement, Block Design, and Object Assembly in reward or nonreward conditions, however, reward subjects did have a higher error rate on the WAIS variables than the subjects in nonreward conditions and a shorter solution time measure. The exception to this was the drug subjects, where the time measure slowed under reward.

Qualitative Findings

Subjects questioned following the sessions concerning their enjoyment of the tasks overwhelmingly stated they enjoyed the tasks and frequently described the experience as "fun" or "interesting". The majority of the subjects perceived the inkblots to be the most difficult of the tasks presented. With regard to reward, several interesting responses occurred to the offering of reward during the second session.

In the Drug group, all but one of the subjects were delighted to receive payment, with the one simply not commenting. The Drug-free group likewise, happily accepted

the reward without hesitation. However, in the Normal group, which was chosen from volunteers of local firefighters, the first four subjects offered the reward, abruptly declined stating they did not wish to participate for payment, because they were "doing this to help". When reminded that the money came from a grant for the project and not from the personal funds of the investigator, these four subjects again replied consistently that they were participating to "help". At this point, the investigator discontinued the discussion and re-assigned these subjects to the nonreward condition, retesting them without reward. All remaining Normal subjects except one accepted the reward in a manner similar to the subjects in the Drug-free and Drug groups. The additional Normal subject who refused reward was also re-assigned to the nonreward condition.

In attempting to explain the refusal of reward by five subjects in the Normal group, a study by Upton (1974) where blood donors were payed for giving blood and compared to donors who were enlisted to help by voluntarily giving blood may be of relevance. The offer of monetary reward to potential donors was found to undermine their motivation for giving blood. Perhaps in this instance, an added variable of altruistic concern or a specific characteristic of the subjects was responsible for their response. Additional research in these areas is needed to clarify these issues.

CHAPTER IV

DISCUSSION

Initially, one sees from the results that reward does affect performance on certain HIT variables in all three groups, however, reward affects performance differently in each group. This is not a surprising idea, for as group differences are compared, results seem to indicate that all three groups are different to some degree, with the Drug group and the Normal group differing significantly ($p < .05$) on several HIT and variables. The Drug group had significantly lower scores than the Normals on FA of the HIT, and BD, PA, OA of the WAIS, and significantly higher scores on the HIT variables of M and I. In addition, the Drug group tends to score higher, though not significantly so, on H and PV than the Normals under nonreward conditions. Essentially, these differences indicate the Drug group is developmentally less mature relative to the Normal group prior to the administration of reward. This conclusion was further clarified by comparing the Drug group scores to the HIT norms for five year olds, elementary school children, and 7th graders, by multiplying the score obtained on the fifteen HIT blots by three, to get full form estimates. The Drug group scores resembled the normative scores for children more than the adult norms supplied by Holtzman et al,(1961).

Although the Drug group's HIT profile does not match any one particular group profile, the score values are more in the average ranges for the younger normative groups than the older, normative groups. In fact, only scores on two of the ten variables, M (66%) and L (57%), in the Drug group approaches the 50th percentile for the adult norms. All others fall in extreme (below 35% or above 85%) percentages of the adult norms. Higher M, H, and I for the Drug group seem not to be in a developmentally less mature direction, however, Hill (1972) reports higher H and M scores in persons with labile emotions. In one of the few studies using the HIT with Drug users, Hartzung & Skorka (1980) report higher H and M scores for psychedelic drug users compared to nondrug users. Thorpe & Swartz (1965) found a regular increase of I scores with increasing age from five to twenty years, with late adolescents scoring higher than older adults. This finding supports the idea that the Drug group may be developmentally younger than the Normal group on I, considering mean chronological age and comparison to HIT adult norms.

Differences on H and M variables may be consistent with profiles of populations with labile emotions, or with Drug abuse histories. These findings and comparisons, along with the present data suggest the scores of the Drug group prior to reward, are at a developmentally less mature level relative to the Normal group. This is consistent with the hypothesis predicting the Drug group would be developmentally less mature than the other groups.

In comparing the Drug-free to the Normal group, no differences existed between the Drug-free and the Normals except on the H and M variables, which were higher for the Drug-free group and consistent with the direction of the same variables in the Drug group and in the study of Drug users. On other variables, the Drug-free group was more like the Normal group developmentally. When compared to the HIT norms, these two groups appear most like the adult and college-age norms, which is more consistent with their chronological age, under nonreward conditions. Thus, the hypothesis that these two groups would differ developmentally from the Drug group, but not from each other, was supported by the results.

The idea that the performance of the Drug-free and Normal groups under reward would be at a developmentally less mature level under nonreward, was not supported statistically . However, the performance of Drug-free and Normal groups under reward, while not reaching statistical significance, did modify in the predicted directions, suggesting that the idea of performance und reward resembling performance under Drug effect is a viable one. As a comparison of Drug group responses is made to those of the Normal group, an opposite effect is observed. The Normal group reacts to reward in a way very similar to previous studies (Fabes, 1981; Fabes et al., in press), that is, scores on FA, Sh, RT, M, I, and H decrease, with a raising of L and PV scores, with reward. In the present study, this response makes the Normal group under reward

resemble the Drug group's performance. Only in the M and H variables do the Drug group and the Normal group under reward differ widely, most probably related to the inherent differences in the two populations, also seen in previous studies of Drug users (Hartzung & Skorka, 1980).

The Drug group, on the other hand, unpredictably, did respond to reward, but in a way unlike the other groups. The Drug group's scores elevate significantly on L and M, while decreasing on H and PV under reward. On FA, Sh,and FD, there is a trend toward elevation and a decrease in I with reward. This seems to suggest that the Drug subjects under reward move towards a higher developmental level, while the Normals move in an opposite direction. An explanation of these findings seems to be found in the Moran et al.(1984) study where nursery school children's performance was facilitated on heuristic tasks when reward was offered. In the same study, college-age subjects' performance was disrupted by reward on heuristic tasks. Perhaps because the Drug subjects were at a developmentally less mature level than the Normals, their performance was facilitated in the same ways as the nursery school children. Perhaps, for both young children and drug patients, further regression can not occur or can not be measured. On the other hand, the performance of the Normal group under reward tends to look more like that of the Drug subjects, though not statistically significant, these directions provide rationale for exploring these questions more fully.

As stated previously, performance on the subscales of

the WAIS was not significantly different for reward or nonreward conditions in any group. The Drug group did score significantly lower than the Normal group on all three WAIS variables, probably related to their lack of ability to respond as quickly as the Normals due to the Drug effects of Methadone. The Drug-free group did not score significantly differently than the Normal group, suggesting the slowness of the Drug group may be related again to Drug ingestion versus long term neurological deficits from a history of Drug use.

An increase in errors with a shorter response time, did occur in the Normal and Drug-free reward groups, consistent with previous findings of reward disrupting performance on these tasks (Fabes et al., 1981). On the contrary, there was a tendency toward slowing of response times and an increase in errors in the Drug groups suggesting that reward may have enhanced the effects of the drug with the Drug subjects, although no significant conclusions can be drawn at this point.

Conclusions and Implications

The present study produced much information for thought on the issues initially raised. The findings provide some support for the idea that reward may produce regression effects in normals that resemble performance of subjects under the influence of a drug. Certainly, from these results, the effects of reward seem most duplicated by the people receiving an actual drug substance, than by those with only a history of drug taking. The normal group under reward tends to regress developmentally to perform like the drug group,

with the drug-free group looking more like the normal subjects than the drug subjects. The tendency for normals under reward to perform like drug subjects under nonreward may mean the effect of reward resembles that of an opiate in this case, Methadone. However, the effects of reward in these populations is far from clear at this point.

The present study was limited to a small sample and partial measures on the Holtzman Inkblot Technique. The effects of these limitations are difficult to predict. So, replication with a larger sample, and all 45 HIT blots would be useful. Likewise, comparison of a drug population to a population previously shown to have a highly significant reward effect would also be useful in gaining a more accurate understanding of the concept of regression, reward and the reward system.

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Table 1

HIT Performance of Drug Group Under Reward and Nonreward Conditions

HIT Variable	Nonreward				Reward			
	Session 1		Session 2		Session 1		Session 2	
	M	SD	M	SD	M	SD	M	SD
RT	16.8	6.1	16.2	7.0	30.7	15.2	27.7	12.9
L	10.0	2.1	12.1	3.4	11.7*	4.9	9.8	2.9
FD	23.0	4.2	23.1	3.2	21.0	4.5	22.8	2.6
FA	14.0	3.3	15.4	1.5	13.0	3.7	16.8	3.5
C	14.2	5.2	10.7	5.6	11.5	4.8	11.8	2.9
Sh	8.4	2.4	9.1	2.4	5.8	2.2	7.8	2.1
M	17.8	10.1	16.5	7.2	9.1*	7.2	13.1	5.4
H	8.0	5.6	8.4	3.3	8.4*	3.7	6.1	4.4
PV	3.0	2.5	2.5	2.7	0.5*	1.1	0.4	0.7
I	5.0	2.9	4.1	2.9	4.5	2.7	2.7	1.8

* $p < .05$

Table 2

HIT Performance of Drug Free Group Under Reward and Nonreward Conditions

HIT Variable	Nonreward				Reward			
	Session 1		Session 2		Session 1		Session 2	
	M	SD	M	SD	M	SD	M	SD
RT	21.5	8.4	20.5	7.0	19.8	3.7	22.8	10.2
L	11.5	4.7	10.8	4.4	9.4	2.6	14.4	4.1
FD	24.4	3.9	24.1	4.0	22.1	3.8	24.7	6.1
FA	16.5	3.2	16.2	2.7	16.8	1.3	16.5	4.0
C	9.5	2.8	10.0	2.8	12.0	1.9	9.4	4.0
Sh	7.7	4.0	8.7	3.7	8.8	2.2	6.7	2.7
M	15.8	3.8	14.0	6.8	12.0	5.1	11.1	5.6
H	9.1	3.5	8.5	3.9	8.1	3.0	9.4	4.0
PV	0.4	0.7	0.8	0.8	1.4	1.5	1.1	1.9
I	4.0	1.7	3.4	2.2	3.4	2.2	2.7	2.3

Table 3

HIT Performance of Normal Group Under Reward and Nonreward Conditions

HIT Variable	Nonreward				Reward			
	Session 1		Session 2		Session 1		Session 2	
	M	SD	M	SD	M	SD	M	SD
RT	25.2	6.1	24.7	8.3	24.5	5.8	23.1	9.6
L	8.7	1.2	10.2	2.9	9.5	2.0	13.4	4.7
FD	22.0	1.1	22.4	3.0	21.1	3.7	24.4	4.1
FA	17.7	1.9	16.2	3.1	18.2	2.3	17.0	1.7
C	12.4	4.0	9.4	3.9	12.0	4.4	10.8	4.0
Sh	8.4	2.3	5.8	3.4	7.7	2.0	6.0	2.1
M	7.1	4.3	7.4	5.2	10.1	6.3	6.7	3.8
H	7.2	1.6	4.4	2.4	6.4	1.6	5.4	2.5
PV	0.2	0.7	0.8	1.2	1.5	1.8	1.0	1.4
I	2.4	1.8	2.1	2.4	2.7	0.7	2.0	1.4

APPENDIX A

REVIEW OF LITERATURE

REVIEW OF THE LITERATURE

A review of the literature was conducted focusing on the main concepts providing the background and foundation for the present study. These concepts included reward and performance; endorphin/enkephalin compounds; the reward system; drug dependency, specifically opiate dependency; and the relationships between these concepts which are pertinent to the present research. A review of literature concerning the instruments used in the present study is also included.

Reward, Performance and the Concept of Regression

As previously stated, several researchers have shown that reward, when introduced into children's discrimination learning and other simple tasks, hinders rather than facilitates performance (Terrell, Durkin, & Weisley, 1959; Spence & Segner, 1967; McCullers & Martin, 1971). Subsequently, the detrimental effects of material rewards have been demonstrated across a wide range of tasks and developmental levels. Contrary to an expected facilitation, rewards have been shown to undermine subsequent interest in an activity (Csikszentmihalyi, 1975; Deci, 1975; Lepper, Greene & Nisbett, 1973), and to have detrimental effects on immediate task performance (McGraw, 1978; Kruglanski, Friedman, & Zeevi, 1971).

In an effort to explain and understand the seemingly

illogical finding of material reward having a detrimental effect on performance, McGraw (1978) proposed an empirical prediction model consisting of an algorithmic--heuristic dimension and an attractive--aversive dimension. Simply, the model predicts material rewards will facilitate aversive and algorithmic tasks, but prove detrimental to performance on tasks that are both heuristic and attractive. An empirical test of this model (Fabes, Moran, & McCullers, 1981) revealed that subjects under reward performed heuristic--attractive tasks with a greater error rate than did subjects under nonreward conditions. Reward and nonreward subjects in the Fabes et al.(1981) study, however, did not perform significantly different on the algorithmic tasks suggesting that reward may not facilitate algorithmic task performance, as McGraw (1978) would have predicated. If nonreward subjects had preformed more poorly on both algorithmic and heuristic tasks one might argue that reward disrupts performance in general. Nonetheless, reward--nonreward differences were confined to heuristic tasks, which typically require a higher level of cognitive functioning. These findings led McCullers and colleagues to suggest that a regression of higher level, cognitive functioning may occur under reward. That is, subjects under reward may function at a lower level developmentally than they would if reward were not present.

Investigation of the concept of regression in cognitive functioning under reward conditions has continued in several subsequent studies. To examine the effects of reward on the drawings of preschool children under conditions that would

allow for a developmental assessment of performance, McCullers, Moran, & Fabes, (in press) utilized Goodenough's Draw-A-Man (DAM) and the Peabody Picture Vocabulary (PPVT) with boys and girls from 42 to 68 months of age. The children under reward conditions demonstrated consistently poorer performance on both the drawing tasks of the DAM and the intelligence measure of the PPVT whether measured between or within subjects. In addition, when given opportunity to perform in the first session under reward conditions, then in the second session under nonreward conditions, the children's performance improved dramatically in the second, nonreward condition, a finding that would be difficult to explain by means of cognitive motivational theory. In support of the regression hypothesis, consistently poorer (developmentally less mature) performance, was obtained under reward on both measures in the study. The finding, that the offer of reward to subjects often led to less mature performance was in general agreement with the results of previous studies by these researchers using selected subscales of the Wechsler Adult Intelligence Scale (Wechsler, 1955) and developmental variables on the Holtzman Inkblot Technique (Holtzman et al., 1961) with adults and children (Fabes et al. 1981; Moran, McCullers, & Fabes, 1984; Fabes, McCullers, & Moran, in press).

In one such study, Moran et al. (1984) attempted to replicate earlier findings (Fabes et al. 1981) and extend the inquiry to children, utilizing subscales of the Wechsler tests (ie. The Wechsler Adult Intelligence Scale [WAIS] for

university students; the Wechsler Intelligence Scale for Children--Revised [WISC-R] for fourth graders; and the Wechsler Preschool and Primary Scale of Intelligence [WPPSI] for nursery school children). Results in reward and nonreward conditions revealed reward again significantly hindered performance on those subscales defined as heuristic (Similarities [S]; Block Design [BD]; Object Assembly [OA];) for college students, while also revealing the subjects made significantly more errors than nonrewarded adults on the heuristic tasks. Surprisingly for the nursery school children, the effect of reward on the algorithmic and heuristic tasks was reversed. That is, reward facilitated heuristic performance and hampered algorithmic performance. While for elementary school subjects, there was no significant effect with reward on either set of subscales. These results provided further evidence that reward can have adverse effects on performance on heuristic tasks, consistent with McGraw's (1978) model and Fabes et al.(1981) findings. The results for the nursery school children suggest, according to Moran et al. (1984), that while reward produces regression in performance, there is a minimum level of development below which regression effects do not occur or are not detectable.

The developmental impact of reward is further clarified and expanded by Fabes, McCullers, & Moran (in press) utilizing variables of the Holtzman Inkblot Technique (HIT) sensitive to developmental change. Focusing on detecting reward-induced regression by extending inquiry from higher

(cognitive) function to more primitive, perceptual tasks requiring heuristic processes, Fabes et al.(in press) explored the effect of reward on the inkblot responses of male and female university students. Results revealed a highly significant main effect of reward. That is, reward subjects performed at a significantly lower level across the developmental variables, than nonreward subjects. Males performed relatively lower under reward than females. In general, these results again supported McGraw's (1978) model which predicts the detrimental effects or rewards in tasks that are attractive and require heuristic solutions. To further illustrate the regression effect, comparisons of the median HIT scores of the reward and nonreward groups to the normative data presented by Holtzman et al. (1961) indicate the scores of the nonreward group resembled the normative information for college students. Whereas, the same comparison to norms with the reward group data, indicate reward subjects' scores resemble the normative scores for fifth-grade elementary children. The results reviewed in the literature have led to the conclusions that rewards produce a regression in higher level (cognitive) functioning and lead to less mature perceptual organization and functioning, as well. Although, as Fabes et al.(in press) point out, a further search for the mechnisms by which rewards produce these effects is needed.

The Holtzman Inkblot Technique

The Holtzman Inkblot Technique was developed by Holtzman, Thorpe, and Herron (1961) in an attempt to produce an

inkblot series for use in research free from limitations of the Rorschach Inkblots. By permitting a subject only on response per card, increasing the number of blots used, and employing more objective standardized, yet simplified scoring procedures, Holtzman et al.(1961) attempted to preserve the rich perceptual, projective material of the Rorschach, while enhancing the psychometric value (Holtzman et al., 1961).

As evidence of achievement of enhancing the psychometric value, Holtzman et al. (1961) reports consistently high reliability for the instrument, on several factors. Reported measures of interscorer reliability, regardless of the scorer's degree of training and experience with the HIT, were generally .90 or higher (p. 104). Likewise, a split-half reliability study on college age males, using Form A, reveal reliability coefficients for each variable ranging from .84 to .99.

Furthermore, the HIT has been used to investigate developmental cognitive functioning. Thorpe and Swartz (1965, 1966) administered the HIT to several different levels (6.7, 9.7, 12.7 years of age). Results revealed significant increases in variables of Integration (I), Form appropriateness (FA), Form Definiteness (FD), Movement (M), Human (H), and Shading (Sh) with increasing age. Decreases were seen with increasing age in Pathognomic Verbalization (PV). Other studies utilizing the HIT to assess developmental, as well as heuristic processes, reveal the above developmental changes, in addition to increases in Color (C) and

Response Time (RT) and decreases in Location (L). These variables were found to be related to flexible, creative or divergent thinking (Clark, Veldman, & Thorpe, 1965; Richter & Winter, 1966).

Fabes et al.(in press), utilized ten developmental variables on the HIT, under reward and nonreward, with college students. Reward subjects had lower scores on the variables of FA, FD, Sh, I, M, H, C; and higher scores on PV and L; with faster RT. Generally, these findings were again consistent with a lower developmental level in problem solving, creativity and perceptual maturity. Evidence from previous research actively supports the selection of the HIT as an instrument for measuring developmental change of perceptual or heuristic stimuli.

The Wechsler Adult Intelligence Scale

The study also employed selected subscales of the WAIS. Subscales previously defined as heuristic attractive, by Fabes et al. (1981) were chosen in an attempt to replicate those findings and others (Moran et al., 1984). The subscales utilized in the present study are the Block Design (BD), Picture Arrangement (PA), Object Assembly (OA), and Vocabulary (V). V and BD were combined to yield a scaled score IQ equivalent for matching each group on initial ability. Reliability an validity scores for the WAIS are available in the WAIS manual (Wechsler, 1955; p. 12).

Brain Reward Mechanisms

Few would disagree that from an evolutionary

perspective, rewards are essential to individual and species survival. For this reason, rewards may be related to behaviors and brain centers that could be described as primitive (MacLean, 1973). From a biochemical perspective, brain mechanisms for reward have recently received new attention as a result of the discovery of endogenous neuropeptides present in brain tissue of humans, named endorphins and enkephalins (Goldstein, 1976). In examining the function of endorphins and enkephalins in the brain, Stein and Belluzzi (1979) have strongly suggested a reward, and the release of endorphins into the body. Concurrent with the study of biochemical processes in the reward system, recent research has also shown a relationship between the process of addiction or dependence on opiate substances and the endorphin/enkephalin system (Goldstein, 1983). A review of these areas of study follows.

Endorphins/Enkephalins

The endorphins are a group of chemical compounds known as neuropeptides, containing as principle members Leu-enkephalin and Met-enkephalin. For the purposes of the present study, these will be referred to collectively as endorphins. The search for endocrine substances which interact with the brain began as a result of research aimed at understanding mental illness and drug action on the brain. Studies conducted by Avram Goldstein (1971) revealed the presence of specialized receptors for endogenous opiate substances located in the brain. Almost simultaneously, Snyder and Pert (1973)

discovered specific opiate receptor pathways. An uneven regional distribution of these receptore in the limbic area suggested specific neuropharmacologic functions such as pain modulation for the endogenous substances, and Pert's (1973) discovery of the presence of these receptors as far down the developmental ladder as the hagfish, further suggested some specific functional role. These discoveries stimulated several investigators to pursue the search for a morphinelike substance. In 1974, John Hughes identified two such pentapeptides, methionine enkephalin and leucine enkephalin (Hughes, 1975). Likewise, high concentrations of biologically active peptides or beta-endorphins, were discovered in the pituitary and brain (Goldstein, 1976).

Following discovery of endogenous opiates, questions concerning the function of these substances centered around the recognition that the location of the endorphin and enkephalin receptors were placed strategically along those nerve pathways within the brain dominated by the monoamine neurotransmitters, positioned to control communication from one nerve cell to the other (Synder, 1977). The position of these receptors along primary pathways of perception, emotion, and pain, the enkephalins, at least appeared situated to modulate sensory sensations and emotional reactions. The suggestion of a relationship of these substances to the control of emotional processes led to further differentiation and identification of other active compounds (beta endorphins) capable of either

enhancing or inhibiting the awareness of pain and stress (Bloom, 1978). This finding led to speculation that with the brain, beta endorphin might control an opiate system which might dominate the opiate network or pathways identified by Pert (1973). Until this time though, studies revealing these findings were limited to animal studies only.

Finally, Li (1977) began synthesizing a replica of human endorphin for administration to humans with pain. Studies followed in five drug dependent subjects who volunteered to withdraw from exogenous opiates and receive the synthetic endorphin and as a result, suffered no withdrawal sickness (Li, Yamashiro, Tseng & Loh, 1977). Watson et al. (1978) investigated the relationship between endorphin administration and mental illness in several studies with psychiatric patients revealing dramatic reversals of symptoms in some of the patients receiving the synthetic compound. As a consequence of these beginning investigations, hypotheses resulted describing various roles for endogenous opioids in sensations of pain, emotional disorders, drug dependence, pleasure mediation, and reinforcement systems.

Endorphins, The Reward System, and Drug Dependence

For the past thirty years, interest has focused on the study of the physiological basis of motivation. Much of the research has attempted to identify reward centers or pathways in the brain using animals. Olds and Milner (1954), using rats, found that when given a brief electrical stimulus to their brains, animals learned as well as when rewarded by food. This finding led to the belief that a specialized

system was present in the brain, which when activated, yielded behaviors similar to those seen in behaviors motivated by biological needs. This heralded the beginning of research on the reward system in the brain, using direct intracranial stimulation. Other studies continued following Olds (1954) footsteps, eventually leading to a fairly consistent model of the anatomical and physiological reward system. A portion of the brain known as the median forebrain bundle emerged as the location for a majority of the "reward system" neurons (Olds, 1960; Routtenberg, 1971). Interestingly, this portion of the brain cooresponds closely to the primitive or reptilian centers of the triune brain as described by MacLean (1973). This same area is also densely concentrated in endorphin and enkephalin receptors (Belluzzi & Stein, 1977).

Further research with the endorphin receptors using narcotic antagonists, or synthetic drugs which compete for the natural opiate binding sites, demonstrated an ability to reverse self-administration behavior (M. Olds, 1979) and an ability to reverse reward effects (Stein, 1978; Akil, Mayer, & Libeskind, 1975). These findings suggest the physiological reward system may be biochemically mediated by the endorphin/enkephalin compounds. Based upon this idea, investigations further clarifying the relationship between the reward system, endorphins and drug dependency, centered around the phenomenon of self administration. Logically, if endorphins serve as "reward transmitters", behavior should be reinforced not only by administration of exogenous opiates

but also by direct release of endogenous opiate following electrical stimulation of the probable opiate sites. As stated previously, animal self-administration studies reveal when the reward section of the brain is stimulated, or when endorphins are self-administered, the animals will self-administer the compounds at intense rates even when hunger or survival are threatened (Belluzzi & Stein, 1977).

Adams et al.(1972) supported this idea by finding that morphine facilitated self-administration behavior, suggesting yet another link between endorphins and drug dependency. In addition, Marcus and Kornetsky (1974) implicated the reward system in opiate abuse based on the outcomes of their experiments showing that morphine lowered the threshold for rewarding brain stimulation. Subsequently, the hypothesis that the euphoric effects, or "high" of morphine are due to activation of the reward system has been advanced by these, and other investigators (Farber & Reid, 1976). The link between the reward system, endorphins and drug dependency is most predicated on the self-administration behavioral studies mentioned above.

Regardless of the effects bound in chemical or physical dependency and regardless of the activation of the reward system itself, the key question seems to be, what mechanisms are activated to mediate self-administration ? As discussed, numerous investigations support the ideas that, (a) The facilitation of self-administration by exogenous and endogenous opiates. (b) The reversal of this facilitation

using narcotic antagonists, (c) Location of endorphin/enkephalin receptor sites indirect proximity to "reward pathways" identified through intracranial stimulation, and (d) An abstinence or withdrawal syndrome is present which is practically identical to the withdrawal syndrome seen in opiate addiction, initiated by administration of a narcotic antagonist and reversed by administration of exogenous opiates (Collier, 1983).

Originating in the behavioral, social and biochemical sciences, these studies provide the foundation for the theory of drug dependence offered by Goldstein (1976, 1978) and others (Collier, 1983).

In relating the logic of his ideas, Goldstein (1978) suggests that most pharmacological substances, or drugs, function by mimicking endogenous substances in the body. That is, they interact with specific receptors on each cell, to bring about a biochemical alteration of cell function, ultimately producing a pharmacologic action. However, the body is not endowed, evolutionarily, with specific receptors for man made chemical substances. Logically then, the receptors with which many drugs interact are actually receptors for endogenous substances which are necessary or have a normal role in organism physiology. Goldstein (1978) proposes that the endorphin system is analogous to other endocrine and neuroendocrine systems, that is to say, the administration of an exogenous hormone will activate a homeostatic negative feedback mechanism in the body that turns off endogenous production of the similar hormone.

Sudden removal of the exogenous hormone substance following institution of this negative feedback cycle results in a deficiency in endogenous synthesis. The deficiency induces an abstinence crisis until endogenous production can begin again.

Goldstein (1976) compares the above cycle to the drug dependence abstinence syndrome or drug withdrawal people. The presence of such a withdrawal syndrome to further validates his hypothesis that, given the presence of a naturally occurring opiate (endorphins), adminstration of an exogenous opiate substance (opiate drugs) produces binding of the substance with receptors usually occupied by natural endogenous substances. Subsequently, a "supply and demand" negative feedback cycle is initiated as occupation of the cell sites by the exogenous opiate signals the body's biochemical system to stop making the endogenous substance. Following interruption of the exogenous "supply" of opiates, the receptor sites are no longer bound and the "demand" for opiates ensues. Unfortunately, because the internal mechanism for production of the compounds has previously been turned off, the person experiences withdrawal, with the accompanying physiological and psychological properties. This abstinence syndrome or withdrawal is rapidly reversed by administration of exogenous opiates when once again, the body's demand is met (Goldstein, 1976; Goldstein, 1983; Stein, 1978).

Opiate Dependency and Methadone Maintenance

Opiates were developed in the nineteenth century, from

extracts of the opium poppy plant. In the early 1800's, the chemist Frederich Serturner isloated the active ingredient of the poppy and named it morphine after Morpheus, the Greed god of dreams. The other natural occurring opiate is codeine, which is present in the poppy at about 1/20th the natural concentration of morphine. The subjective effects of opium were known to several ancient civilizations, while the addictive properties of the drug were recognized by Greek physicians at the time of Hippocrates. Opium smoking became popular only in the eighteenth century in the orient. The oral use of opium extracts produced a mild form of addiction which did not represent a serious public health problem.

Widespread concern about severe opiate addiction originated in the second half of the nineteenth century with the invention of the hypodermic needle and the ready availability of pure morphine. Intravenous morphine to relieve severe pain rapidly was a medical breakthrough that had wide application in the Civil War, but came to be known as "soldiers disease" due to the resulting addiction which occurred commonly in Civil War veterans (Musto, 1974; Synder, 1980).

In the late nineteenth century, many drug companies searched actively for an alternative opiate which would have the good effects of morphine without the addictive properties. In 1898, a Bayer Drug Company chemist added two acetyl groups to morphine, thereby creating heroin. The acetyl groups facilitated the passage of heroin from the blood to the brain, assisting it to produce more euphoria,

more analgesia and a more rapid action than morphine. Apparantly, physicians mistakenly adopted heroin as a cure for morphine addiction, using the drug to wean addicts from morphine to heroin, taking five to ten years to recognize heroin addiction. By 1915, heroin had fully replaced morphine as the drug of choice for opiate addicts (Snyder, 1980).

The Boylan Act of 1914, passed by the New York state legislature, controlled prescribing of most opiates and established guidelines regulating the maintainence administration of opiates to addicts. Numerous opiate maintainence clinics were established to contain the problem of heroin addiction. In the atmosphere of World War I, however, all drugs and alcohol were banned from army training camps, a movement to rid the United States of degenerate people, and a rationale was shared by society that if drugs were controlled, then most of crime would be eliminated (Musto, 1974). Consequently, all drug maintenance clinics were closed, spawning a widespread illicit drug market (Synder, 1980).

In the mid 1960's a major heroin "epidemic" spread throughout the United States for various reasons, including the fact that available, potent heroin was used by U. S. servicemen in Viet Nam. Methadone maintenance, as a modality in the treatment of narcotic addiction, was developed during the 1960's by Drs. Vincient Dole and Maris Nyswander, in response to the heroin "epidemic" (Inciardi, 1977).

Methadone Maintenance

Methadone is a synthetic narcotic drug with analgesic, euphorigenic, and dependency producing qualities. The pharmacological basis of its use in treatment rests on the notion that methadone intervention can restrain the phenomonally untoward effects of morphine-like drugs by substitution. According to Inciardi (1977), methadone reflects many of the characteristics of morphine, including: (a) cross tolerance, that is a person tolerant to one morphine-like drug is also tolerant to equally potent doses of another. (b) Methadone, when administered to an opiate dependent person, will either prevent or eliminate the withdrawal symptoms caused by abstinence, including "drug hunger", that is the feeling of person freedom from administration of heroin three to four times a day; (d) High doses of methadone will prevent withdrawal and block the eurphoric effect from an injection of heroin; (e) Methadone is administered orally and unlike heroin, medically controlled, having minimal side effects (Incardi, 1977). Under various trade names, the pharmacological actions of methadone are qualitatively identical to morphine.

Substitution of dependency on other opiates with dependency on methadone was accepted based upon the criteria discussed above, with the general aim of the methadone maintenance movement focusing on rehabilitation from criminal activity secondary to drug dependency, and eventual withdrawal from methadone which produces a relative low intensity, slow onset abstinence syndrome compared to

other narcotic dependencies (Incardi, 1977).

Opiates

The group of drugs known as opiates or sometimes as narcotics comprises the various naturally occurring alkaloids of the opium poppy, of which, morphine is the principle example. Various other synthetic compounds mimic the chemical structure and actions of morphine and include many commonly prescribed pain relieving medications. Opiates readily support the development of drug tolerance, that is, following repeated administrations of opiate compounds, the person receiving the drug becomes less responsive to the effects of the drug and requires a greater dosage to achieve responsiveness. Drug tolerance, with opiates, is also accompanied by physical dependence.

Iverson and Iverson (1981) define physical dependence as a condition where the organism requires an outside substance for normal functioning. Such a state is revealed by withdrawing the substance which elicits physical symptoms of various types. Unfortunately, the mechanisms of physical dependence and tolerance are largely unknown.

APPENDIX B

REFERENCES TO REVIEW OF LITERATURE

REFERENCES

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APPENDIX C

RESEARCH HYPOTHESES

RESEARCH HYPOTHESIS

The present study attempted to test the following hypotheses:

1. The performance of the drug-free and normal group will be at a developmentally less mature level under reward, when compared to performance under nonreward.

2. The performance of the drug group under reward will not differ from performance under nonreward.

3. The performance of the drug-free and normal groups under reward, will resemble the performance of the drug group under nonreward.

4. The performance of the drug group will be at a developmentally less mature level, under reward and nonreward , when compared to the other two groups.

5. The performance of the normal group will be no different than the performance of the drug-free group under either condition.

RESEARCH VARIABLES

Dependent Variables

The following dependent variables are utilized in the present design:

The following variables from the Holtzman Inkblot Technique, have been shown to be sensitive to developmental change (Thorpe & Swartz, 1965, 1966; Fabes, et al., in press).

1. Reaction Time (RT): The time in seconds from the presentation of the blot to the beginning of the primary response. Faster RT associated with more immature level of development.

2. Location (L): The tendency by the subject to perceive the blot by breaking it down blot into smaller fragments. Higher score associated with a more immature level of development.

3. Form Definiteness (FD): The definiteness of the form of the concept reported, regardless of the goodness of fit to the inkblot. A five-point scale with 0 for vague perception and 4 for highly specific, detailed perception. Lower score is associated with a more immature level of development.

4. Form Appropriateness (FA): The goodness of fit of the form of the percept to the form of the inkblot. A range of poor to good is possible, with a poor goodness of fit associated with a more immature level of development.

5. Color (C): The apparent primacy of color (including black, gray or white), as a response-determinant. Score 0 for no use of color, 1 for secondary to form, 2 when used as a primary determinant, but some form present, 3 for use as a primary determinant with no form present. A lower score is associated with a more immature level of development.

6. Shading (Sh): The apparant primacy of shading as a response-determinant (texture, depth, vista). Score 0 for no use of shading, 1 for use in a secondary manner, 2 when used as primary determinant with little or no form present. A lower score is associated with a more immature level of development.

7. Movement (M): The energy level of movement or potential movement ascribed to the percept regardless of the content. Score 0 for none, 1 for static movement, 2 for causal, 3 for dynamic movement, 4 for violent movement. A lower score is associated with a more immature level of development.

8. Integration (I): Score 1 for the organization of two or more, adequately perceived blot elements into a larger whole; otherwise, score 0. A lower score is associated with a more

immature level of development.

9. Human (H): Degree of human quality in the content of response. Score 0 for none, 1 for parts of humans, distortions, cartoons, 2 for whole human beings or elaborated human faces. A lower score is associated with a more immature level of development.

10. Pathognomic Verbalization (PV): Degree of autistic, bizarre thinking evident in the response as rated on a five-point scale. Score 0 for no pathology is present. Nine categories of PV with scores for different types of responses is possible with scoring ranges from 0 to 5. A higher PV is associated with more immature level of development.

The Weschler Adult Intelligence Scale

1. Heuristic Scales: Block Design, Picture Arrangement Object Assembly. Score based upon correct response within a given time period.

APPENDIX D

DATA ANALYSIS

ANALYSIS OF VARIANCE FOR 1-ST LOCATION
DEPENDENT VARIABLE - LOC1 LOC2 HOLTZMAN INKBLOT TECHNIQUE

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	10164.00000	1	10164.00000	587.73	0.0000
	GRP	16.28571	2	8.14286	0.47	0.6283
	TX	13.76190	1	13.76190	0.80	0.3783
	GT	18.38095	2	9.19048	0.53	0.5923
1	ERROR	622.57143	36	17.29365		
	D	58.33333	1	58.33333	6.84	0.0129
	DG	25.52381	2	12.76190	1.50	0.2374
	DT	9.33333	1	9.33333	1.09	0.3023
	DGT	84.95238	2	42.47619	4.98	0.0123
2	ERROR	306.85714	36	8.52381		

CELL MEANS FOR 1-ST DEPENDENT VARIABLE

GRP =	DRUG	DRUG	NONDRUG	NONDRUG	NORMAL	NORMAL	MARGINAL
TX =	REWARD	NONREWAR	REWARD	NONREWAR	REWARD	NONREWAR	
D							
LOC1 1	11.71429	10.00000	9.42857	11.57143	9.57143	8.71429	10.16667
LOC2 2	9.85714	12.14286	14.42857	10.85714	13.42857	10.28571	11.83333
MARGINAL	10.78571	11.07143	11.92857	11.21429	11.50000	9.50000	11.00000
COUNT	7	7	7	7	7	7	42

STANDARD DEVIATIONS FOR 1-ST DEPENDENT VARIABLE

GRP =	DRUG	DRUG	NONDRUG	NONDRUG	NORMAL	NORMAL
TX =	REWARD	NONREWAR	REWARD	NONREWAR	REWARD	NONREWAR
D						
LOC1 1	4.99047	2.16025	2.69921	4.72077	2.07020	1.25357
LOC2 2	2.91139	3.48466	4.19750	4.45079	4.79086	2.98408

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ANALYSIS OF VARIANCE FOR 2-ND REACTION TIME
DEPENDENT VARIABLE - RT1 RT2 HOLTZMAN INKBLOT TECHNIQUE

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	43840.01190	1	43840.01190	351.72	0.0000
	GRP	144.73810	2	72.36905	0.58	0.5647
	TX	324.10714	1	324.10714	2.60	0.1156
	GT	804.50000	2	402.25000	3.23	0.0514
1	ERROR	4487.14286	36	124.64286		
	D	7.44048	1	7.44048	0.21	0.6532
	DG	28.88095	2	14.44048	0.40	0.6743
	DT	0.29762	1	0.29762	0.01	0.9283
	DGT	39.30952	2	19.65476	0.54	0.5860
2	ERROR	1304.57143	36	35.23810		

CELL MEANS FOR 2-ND DEPENDENT VARIABLE

	GRP = TX = D	DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR	MARGINAL
RT1	1	30.71429	16.85714	19.85714	21.57143	24.57143	25.28571	23.14286
RT2	2	27.71429	16.28571	22.85714	20.57143	23.14286	24.71429	22.54762
	MARGINAL	29.21429	16.57143	21.35714	21.07143	23.85714	25.00000	22.84524
	COUNT	7	7	7	7	7	7	42

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STANDARD DEVIATIONS FOR 2-ND DEPENDENT VARIABLE

	GRP = TX = D	DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR
RT1	1	15.29395	6.17599	3.76070	8.48247	5.85540	6.12955
RT2	2	12.98351	7.06433	10.25392	7.04408	9.65105	8.30089

FORM DEFINITENESS
HOLTZMAN INKBLOT TECHNIQUE

ANALYSIS OF VARIANCE FOR 3-RD
DEPENDENT VARIABLE - FD1 FD2

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	44252.19048	1	44252.19048	2144.53	0.0000
	GRP	34.38095	2	17.19048	0.83	0.4429
	TX	4.76190	1	4.76190	0.23	0.6339
	GT	11.80952	2	5.90476	0.29	0.7528
1	ERROR	742.85714	36	20.63492		
	D	42.85714	1	42.85714	4.33	0.0445
	DG	2.57143	2	1.28571	0.13	0.8785
	DT	27.42857	1	27.42857	2.77	0.1045
	DGT	1.14286	2	0.57143	0.06	0.9439
2	ERROR	356.00000	36	9.88889		

CELL MEANS FOR 3-RD DEPENDENT VARIABLE

GRP =		DRUG	DRUG	NONDRUG	NONDRUG	NORMAL	NORMAL	MARGINAL
TX =		REWARD	NONREWAR	REWARD	NONREWAR	REWARD	NONREWAR	
D								
FD1	1	21.00000	23.00000	22.14286	24.14286	21.14286	22.00000	22.23810
FD2	2	22.85714	23.14286	24.71429	24.42857	24.42857	22.42857	23.66667
MARGINAL		21.92857	23.07143	23.42857	24.28571	22.78571	22.21429	22.95238
COUNT		7	7	7	7	7	7	42

STANDARD DEVIATIONS FOR 3-RD DEPENDENT VARIABLE

GRP =		DRUG	DRUG	NONDRUG	NONDRUG	NORMAL	NORMAL
TX =		REWARD	NONREWAR	REWARD	NONREWAR	REWARD	NONREWAR
D							
FD1	1	4.58606	4.28174	3.89138	3.93398	3.76070	1.15470
FD2	2	2.69951	3.28778	6.12955	4.07665	4.11733	3.04725

ANALYSIS OF VARIANCE FOR 4-TH
DEPENDENT VARIABLE - FA1 FA2

FORM APPROPRIATENESS
HOLTZMAN INKBLOT TECHNIQUE

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	22148.76190	1	22148.76190	2165.05	0.0000
	GRP	92.16667	2	46.08333	4.50	0.0179
	TX	3.04762	1	3.04762	0.30	0.5886
	GT	0.73810	2	0.36905	0.04	0.9646
1	ERROR	368.28571	36	10.23016		
	D	2.33333	1	2.33333	0.37	0.5479
	DG	60.02381	2	30.01190	4.73	0.0150
	DT	3.85714	1	3.85714	0.61	0.4405
	DGT	6.50000	2	3.25000	0.51	0.6033
2	ERROR	228.28571	36	6.34127		

CELL MEANS FOR 4-TH DEPENDENT VARIABLE

GRP = TX = D		DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR	MARGINAL
FA1	1	13.00000	14.00000	16.85714	16.57143	18.28571	17.71429	16.07143
FA2	2	16.85714	15.42857	16.57143	16.28571	17.00000	16.28571	16.40476
MARGINAL		14.92857	14.71429	16.71429	16.42857	17.64286	17.00000	16.23810
COUNT		7	7	7	7	7	7	42

STANDARD DEVIATIONS FOR 4-TH DEPENDENT VARIABLE

GRP = TX = D		DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR
FA1	1	3.78594	3.31662	1.34519	3.20713	2.36039	1.97605
FA2	2	3.57904	1.51186	4.07665	2.75162	1.73205	3.19970

ANALYSIS OF VARIANCE FOR 5-TH
DEPENDENT VARIABLE - SH1 SH2

SHADING
HOLTZMAN INKBLOT TECHNIQUE

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	4860.96429	1	4860.96429	494.73	0.0000
	GRP	15.92857	2	7.96429	0.81	0.4525
	TX	16.29762	1	16.29762	1.66	0.2060
	GT	11.59524	2	5.79762	0.59	0.5596
1	ERROR	353.71429	36	9.82540		
	D	4.29762	1	4.29762	0.79	0.3798
	DG	43.02381	2	21.51190	3.96	0.0280
	DT	0.58333	1	0.58333	0.11	0.7451
	DGT	20.88095	2	10.44048	1.92	0.1613
2	ERROR	195.71429	36	5.43651		

CELL MEANS FOR 5-TH DEPENDENT VARIABLE

GRP = TX = D		DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR	MARGINAL
SH1	1	5.85714	8.42857	8.85714	7.71429	7.71429	8.42857	7.83333
SH2	2	7.85714	9.14286	6.71429	8.71429	6.00000	5.85714	7.38095
MARGINAL		6.85714	8.78571	7.78571	8.21429	6.85714	7.14286	7.60714
COUNT		7	7	7	7	7	7	42

STANDARD DEVIATIONS FOR 5-TH DEPENDENT VARIABLE

GRP = TX = D		DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR
SH1	1	2.26779	2.43975	2.26779	4.07080	2.05866	2.37045
SH2	2	2.19306	2.41030	2.75162	3.77334	2.16025	3.43650

ANALYSIS OF VARIANCE FOR 6-TH COLOR
DEPENDENT VARIABLE - C01 C02 HOLTZMAN INKBLOT TECHNIQUE

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	10496.67857	1	10496.67857	541.82	0.0000
	GRP	48.28571	2	24.14286	1.25	0.2997
	TX	0.96429	1	0.96429	0.05	0.8247
	GT	11.14286	2	5.57143	0.29	0.7518
1	ERROR	697.42857	36	19.37302		
	D	53.44048	1	53.44048	3.99	0.0533
	DG	3.52381	2	1.76190	0.13	0.8770
	DT	4.29762	1	4.29762	0.32	0.5744
	DGT	43.52381	2	21.76190	1.63	0.2108
2	ERROR	481.71429	36	13.38095		

CELL MEANS FOR 6-TH DEPENDENT VARIABLE:

GRP = DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR	MARGINAL
TX = D						
C01 1	11.57143	14.28571	12.00000	9.57143	12.00000	12.42857	11.97619
C02 2	11.85714	10.71429	9.42857	10.00000	10.85714	9.42857	10.38095
MARGINAL	11.71429	12.50000	10.71429	9.78571	11.42857	10.92857	11.17857
COUNT	7	7	7	7	7	7	42

STANDARD DEVIATIONS FOR 6-TH DEPENDENT VARIABLE:

GRP = DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR
TX = D					
C01 1	4.82553	5.21901	1.91485	2.87849	4.47214	4.03556
C02 2	2.96808	5.67786	4.07665	2.82843	4.09994	3.90969

ANALYSIS OF VARIANCE FOR 7-TH
DEPENDENT VARIABLE - PV1 PV2

PATHONOGMIC VERBALIZATION
HOLTZMAN INKBLOT TECHNIQUE

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	116.67857	1	116.67857	34.23	0.0000
	GRP	9.07143	2	4.53571	1.33	0.2770
	TX	2.01190	1	2.01190	0.59	0.4473
	GT	41.02381	2	20.51190	6.02	0.0056
1	ERROR	122.71429	36	3.40873		
	D	0.10714	1	0.10714	0.06	0.8068
	DG	0.50000	2	0.25000	0.14	0.8685
	DT	1.44048	1	1.44048	0.82	0.3724
	DGT	1.88095	2	0.94048	0.53	0.5916
2	ERROR	63.57143	36	1.76587		

CELL MEANS FOR 7-TH DEPENDENT VARIABLE

	GRP = TX = D	DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR	MARGINAL
PV1	1	0.57143	3.00000	1.42857	0.42857	1.57143	0.28571	1.21429
PV2	2	0.42857	2.57143	1.14286	0.85714	1.00000	0.85714	1.14286
	MARGINAL	0.50000	2.78571	1.28571	0.64286	1.28571	0.57143	1.17857
	COUNT	7	7	7	7	7	7	42

STANDARD DEVIATIONS FOR 7-TH DEPENDENT VARIABLE

	GRP = TX = D	DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR
PV1	1	1.13389	2.58199	1.51186	0.78680	1.81265	0.75593
PV2	2	0.78680	2.76026	1.95180	0.89974	1.41421	1.21499

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ANALYSIS OF VARIANCE FOR 8-TH DEPENDENT VARIABLE: 41 H2

HUMAN
HOLTZMAN INKBLOT TECHNIQUE

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	4710.01190	1	4710.01190	251.04	0.0000
	GRP	122.95238	2	61.47619	3.28	0.0493
	TX	2.01190	1	2.01190	0.11	0.7452
	GT	4.09524	2	2.04762	0.11	0.8969
1	ERROR	675.42857	36	18.76190		
	D	14.58333	1	14.58333	2.42	0.1282
	DG	18.38095	2	9.19048	1.53	0.2308
	DT	0.58333	1	0.58333	0.10	0.7573
	DGT	24.38095	2	12.19048	2.03	0.1466
2	ERROR	216.57143	36	6.01587		

CELL MEANS FOR 8-TH DEPENDENT VARIABLE:

GRP =		DRUG	DRUG	NONDRUG	NONDRUG	NORMAL	NORMAL	MARGINAL
TX =	D	REWARD	NONREWAR	REWARD	NONREWAR	REWARD	NONREWAR	
H1	1	8.42857	8.00000	8.14286	9.14286	6.42857	7.28571	7.90476
H2	2	6.14286	8.42857	9.42857	8.57143	5.42857	4.42857	7.07143
MARGINAL		7.28571	8.21429	8.78571	8.85714	5.92857	5.85714	7.48810
COUNT		7	7	7	7	7	7	42

PAGE 6 DISSERTATION

STANDARD DEVIATIONS FOR 8-TH DEPENDENT VARIABLE:

GRP =		DRUG	DRUG	NONDRUG	NONDRUG	NORMAL	NORMAL
TX =	D	REWARD	NONREWAR	REWARD	NONREWAR	REWARD	NONREWAR
H1	1	3.77964	5.65685	3.02372	3.53217	1.61835	1.60357
H2	2	4.48808	3.35942	4.03556	3.95209	2.50713	2.43975

ANALYSIS OF VARIANCE FOR 9-TH MOVEMENT
DEPENDENT VARIABLE - M1 M2 HOLTZMAN INKBLOT TECHNIQUE

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	11620.76190	1	11620.76190	188.55	0.0000
	GRP	652.45238	2	326.22619	5.29	0.0097
	TX	160.19048	1	160.19048	2.60	0.1157
	GT	185.88095	2	92.94048	1.51	0.2350
1	ERROR	2218.71429	36	61.63095		
	D	5.76190	1	5.76190	0.39	0.5386
	DG	37.33952	2	18.65476	1.25	0.2992
	DT	3.85714	1	3.85714	0.26	0.6146
	DGT	70.92857	2	35.46429	2.37	0.1077
2	ERROR	538.14286	36	14.94841		

CELL MEANS FOR 9-TH DEPENDENT VARIABLE

	GRP = TX = D	DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR	MARGINAL
M1	1	9.14286	17.85714	12.00000	15.85714	10.14286	7.14286	12.02381
M2	2	13.14286	16.57143	11.14286	14.00000	6.71429	7.42857	11.50000
	MARGINAL	11.14286	17.21429	11.57143	14.92857	8.42857	7.28571	11.76190
	COUNT	7	7	7	7	7	7	42

STANDARD DEVIATIONS FOR 9-TH DEPENDENT VARIABLE

	GRP = TX = D	DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR
M1	1	7.24405	10.17232	5.13160	3.89138	6.36209	4.37526
M2	2	5.42920	7.20780	5.63999	6.87992	3.81725	5.22357

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ANALYSIS OF VARIANCE FOR 10-TH DEPENDENT VARIABLE - I1 I2

INTEGRATION
HOLTZMAN INKBLOT TECHNIQUE

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	900.29762	1	900.29762	128.61	0.0000
	GRP	45.23810	2	22.61905	3.23	0.0512
	TX	5.25000	1	5.25000	0.75	0.3922
	GT	3.71429	2	1.85714	0.27	0.7685
1	ERROR	252.00000	36	7.00000		
	D	14.58333	1	14.58333	5.01	0.0315
	DG	2.95238	2	1.47619	0.51	0.6066
	DT	1.44048	1	1.44048	0.49	0.4864
	DGT	0.65667	2	0.33333	0.11	0.8922
2	ERROR	104.85714	36	2.91270		

CELL MEANS FOR 10-TH DEPENDENT VARIABLE

GRP = TX = D	DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR	MARGINAL
1 1	4.57143	5.00000	3.42857	4.00000	2.71429	2.42857	3.69048
2 2	2.71429	4.14286	2.71429	3.42857	2.00000	2.14286	2.85714
MARGINAL	3.64286	4.57143	3.07143	3.71429	2.35714	2.28571	3.27381
COUNT	7	7	7	7	7	7	42

PAGE 7 DISSERTATION

STANDARD DEVIATIONS FOR 10-TH DEPENDENT VARIABLE

GRP = TX = D	DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR
I1 1	2.87849	2.94392	2.22539	1.73205	0.75593	1.81265
I2 2	1.88982	2.91139	2.36039	2.29907	1.41421	2.41030

ANALYSIS OF VARIANCE FOR 11-TH
DEPENDENT VARIABLE - BD1 BD2

BLOCK DESIGN
WECHSLER ADULT INTELLIGENCE SCALE

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	11715.04762	1	11715.04762	1529.63	0.0000
	GRP	119.59524	2	59.79762	7.81	0.0015
	TX	0.42857	1	0.42857	0.06	0.8143
	GT	23.21429	2	11.60714	1.52	0.2334
1	ERROR	275.71429	36	7.65873		
	D	10.71429	1	10.71429	7.26	0.0107
	DG	1.35714	2	0.67857	0.46	0.6351
	DT	0.76190	1	0.76190	0.52	0.4771
	DGT	0.02381	2	0.01190	0.01	0.9920
2	ERROR	53.14286	36	1.47619		

CELL MEANS FOR 11-TH DEPENDENT VARIABLE

	GRP = TX = D	DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR	MARGINAL
BD1	1	9.57143	9.85714	11.57143	12.57143	13.28571	11.85714	11.45238
BD2	2	10.28571	11.00000	11.71429	13.14286	14.00000	12.85714	12.16667
	MARGINAL	9.92857	10.42857	11.64286	12.85714	13.64286	12.35714	11.80952
	COUNT	7	7	7	7	7	7	42

STANDARD DEVIATIONS FOR 11-TH DEPENDENT VARIABLE

	GRP = TX = D	DRUG REWARD	DRUG NONREWAR	NONDRUG REWARD	NONDRUG NONREWAR	NORMAL REWARD	NORMAL NONREWAR
BD1	1	1.39728	1.67616	2.29907	1.61835	2.75162	1.67616
BD2	2	2.42997	1.41421	2.49762	1.95180	2.82843	2.41030

ANALYSIS OF VARIANCE FOR 12-TH PICTURE ARRANGEMENT
DEPENDENT VARIABLE - PA1 PA2 WECHSLER ADULT INTELLIGENCE SCALE

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	11178.10714	1	11178.10714	1737.74	0.0000
	GRP	66.07143	2	33.03571	5.14	0.0109
	TX	2.67857	1	2.67857	0.42	0.5228
	GT	0.07143	2	0.03571	0.01	0.9945
1	ERROR	231.57143	36	6.43254		
	D	41.44048	1	41.44048	23.47	0.0000
	DG	0.88095	2	0.44048	0.25	0.7806
	DT	3.44048	1	3.44048	1.95	0.1713
	DGT	3.16667	2	1.58333	0.90	0.4169
2	ERROR	63.57143	36	1.76587		

CELL MEANS FOR 12-TH DEPENDENT VARIABLE

GRP =		DRUG	DRUG	NONDRUG	NONDRUG	NORMAL	NORMAL	MARGINAL
TX =		REWARD	NONREWAR	REWARD	NONREWAR	REWARD	NONREWAR	
D								
PA1	1	9.42857	10.00000	11.57143	11.28571	11.57143	11.14286	10.83333
PA2	2	10.71429	11.00000	12.57143	13.57143	12.28571	13.28571	12.23810
MARGINAL		10.07143	10.50000	12.07143	12.42857	11.92857	12.21429	11.53571
COUNT		7	7	7	7	7	7	42

STANDARD DEVIATIONS FOR 12-TH DEPENDENT VARIABLE

GRP =		DRUG	DRUG	NONDRUG	NONDRUG	NORMAL	NORMAL
TX =		REWARD	NONREWAR	REWARD	NONREWAR	REWARD	NONREWAR
D							
PA1	1	2.43975	2.38048	1.61835	2.28869	1.51186	2.41030
PA2	2	2.13809	1.52753	1.99238	1.51186	1.49603	2.56348

ANALYSIS OF VARIANCE FOR 13-TH
DEPENDENT VARIABLE - DA1 DA2

WECHSLER ADULT INTELLIGENCE SCALE
OBJECT ASSEMBLY

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	12434.33333	1	12434.33333	2202.00	0.0000
	GRP	83.73810	2	41.86905	7.41	0.0020
	TX	15.42857	1	15.42857	2.73	0.1070
	GT	20.21429	2	10.10714	1.79	0.1815
1	ERROR	203.28571	36	5.64683		
	D	105.19048	1	105.19048	45.01	0.0000
	DG	13.16667	2	6.58333	2.82	0.0730
	DT	1.71429	1	1.71429	0.73	0.3974
	DGT	4.78571	2	2.39286	1.02	0.3695
2	ERROR	84.10286	36	2.33730		

NUMBER OF INTEGER WORDS OF STORAGE USED IN PRECEDING PROBLEM 4037
CPU TIME USED 0.645 SECONDS

CELL MEANS FOR 13-TH DEPENDENT VARIABLE

GRP =		DRUG	DRUG	NONDRUG	NONDRUG	NORMAL	NORMAL	MARGINAL
TX =		REWARD	NONREWAR	REWARD	NONREWAR	REWARD	NONREWAR	
D								
DA1	1	10.00000	10.42857	11.57143	10.71429	13.28571	10.28571	11.04762
DA2	2	12.00000	11.71429	12.85714	12.85714	15.85714	14.42857	13.28571
MARGINAL		11.00000	11.07143	12.21429	11.78571	14.57143	12.35714	12.16667
COUNT		7	7	7	7	7	7	42

STANDARD DEVIATIONS FOR 13-TH DEPENDENT VARIABLE

GRP =		DRUG	DRUG	NONDRUG	NONDRUG	NORMAL	NORMAL
TX =		REWARD	NONREWAR	REWARD	NONREWAR	REWARD	NONREWAR
D							
DA1	1	1.29099	1.39728	1.81265	1.60357	1.38013	2.13809
DA2	2	2.23607	1.60357	1.86865	2.91139	1.77281	3.04725

APPENDIX E

INSTITUTIONAL APPROVAL

APPROVED: May 3. 1984

I.R.B. ID #: 02533

TITLE: "Reward and Performance in Drug Patients

The University of Oklahoma
Oklahoma City Campus-Health Sciences Center

INSTITUTIONAL REVIEW BOARD

May 3, 1984

Earl Young, Ph.D. / Glenda McGaha, R.N.
Psychiatry and Behavior Sciences
Building 3 Room 101 OUHSC

Dear Glenda,

The Institutional Review Board reviewed the captioned application which will involve human subjects and approved the study. It is the opinion of this Board that the rights and welfare of the individuals who are to be studied will be completely respected; that informed consent will be obtained in a manner consistent with the Code of Federal Regulations, Title 45, Part 46, "Protection of Human Subjects" of January 26, 1981, and that the risks to the individuals are so outweighed by the benefits to the subject and the importance of the knowledge to be gained that it warrants the decision to allow the subjects to accept these risks.

The Board would like to call your attention to the following obligations as Principal Investigator of this study. Under the terms of our approved Institutional Assurance to DHHS, you must provide us with a progress report at the termination of the study, or at the annual anniversary date of the approval, whichever comes first. If the study will be continued beyond the initial year, an annual review by the Board is required, with a progress report constituting an important part of the review.

Any substantive changes in the protocol such as a change in the investigator, procedure or number of subjects should be reported immediately to the Board. These conditions are spelled out in detail in the Institutional Assurance under Item II, B4, "Continuing Review of Research."

Finally, we urge you to review your professional liability insurance to make sure your coverage includes the activities in this study.

Sincerely yours,

Fletcher B. Taylor, Jr., M.D.
Chairman, Institutional Review Board
FBT: gs

Post Office Box 26901 Library Building, Room 115 Oklahoma City, Oklahoma 73190 (405) 271-2090

Veterans Administration

Memorandum

Date: April 3, 1984

To: Chairman, Research and Development Committee (151)

Subj: Review of "Reward and Performance in Drug Patients," Glenda McGaha, R.N., M.S.N., Principle Investigat

1. First reviewer:	Scientific merit	3.3
	Effect on VA	NA
	Investigator	4.0
	Overall	3.8
Second reviewer:	Scientific merit	3.7
	Effect on VA	NA
	Investigator	4.0
	Overall	3.8

2. The proposed project is a doctoral dissertation in nursing by Glenda McGaha, R.N., M.S.N. The investigator proposes to investigate how material rewards affect cognitive performance in patients receiving methadone for narcotic addiction as compared to matched patients not receiving methadone and to patients not on drug treatment.

3. The proposal does not contain specific differential predictions of how material reward should affect the problem of: methadone patients, opiate abusers not receiving methadone, or control patients. The rationale proposed is that material rewards have been shown to impair cognitive performance in humans working on tasks which are engaging in problem solving. The investigator speculates that certain rewards may produce a regression of cognitive functioning and that this regression may be due to an effect that rewards have on endogenous opiates (endorphins). In animal studies endorphins have been shown to respond to rewards. The investigator further speculates that since the use of exogenous opiates (e.g. methadone) affect the endogenous opiate system (endorphins), that the effect of reward on cognitive function should be studied in patients taking methadone for opiate addiction.

4. The proposal suffers significant logical weakness which stems from proceeding from a well verified, but not fully tested empirical finding that reward depresses cognitive functioning. From this empirical finding the investigator makes three speculations: 1) cognitive function regresses under reward; 2) regression may be due to the endogenous opiate system; and 3) the effect may be modified in opiate users.

.2.

Review of "Reward and Performance in Drug Patients"
April 3, 1984

5. The basic effect that reward depresses cognitive function may have a number of possible causes. Each of these is in need of testing prior to proceeding into specific tests with patients.

6. The proposal is given a low numerical rating but the recommendation from the ad hoc committee is approval with communication of comments to the P.I. There are no risks to VA patients, the clinical impact costs are minimal and the proposal potentially will contribute information important in treatment of opiate dependent patients.

Veterans Administration

Memorandum

Date: 4/18/84

From: Administrative Officer
Research Service (151)

To: Glenda McGaha, R.N.
Earl R. Young, Ph.D. (116C)

Subj: Notice of R&D Committee/Subcommittee actions on research proposal

1. Title of project: Reward and performance in drug patients

2. Date of meeting: 4/3/84

3. Recommendation:
   A. Approval X*.
   B. Conditional approval for scientific merit; pending response/revisions by responsible investigator _____ and/or completion of negotiations with PI for reimbursement to Director's GPF account _____.
   C. Disapproval _____; comments/criticisms of review committee are appended.

4. Subcommittee recommendations:

A. Animal Studies:	Approval		Conditional Approval	
	Disapproval			
B. Biohazards:	Approval		Conditional Approval	
	Disapproval			
C. IRB (Human Studies):	Approval	X**	Conditional Approval	
	Disapproval			
D. RSC (Radio-isotopes):	Approval		Conditional Approval	
	Disapproval			

5. Remarks: *Comments from the reviewing committee are attached for your consideration/information. As soon as A) you have final notice of Institutional Review Board approval, and upon the VAMC Director's approval/signing the official Minutes of the 4/3/84 Research and Development Committee meeting, you may begin this project.

**It is our understanding that IRB approval was contingent upon your making some changes within the protocol and providing letters from both your Advisor and Dr. Earl Young.

THOMAS M. TIERNEY

*** Spoke to Mrs. Robinson 4/24 telling her my letter from IRB did not require letter from Dr Young - Stated this statement was not based on letter officially sent from IRB.

VA FORM DEC 1981

Medical Center
921 Northeast 13th Street
Oklahoma City OK 73104

Veterans Administration

March 16, 1984

In Reply Refer To: 635/05

Glenda S. McGaha
1050 E. 53rd St.
Tulsa, Ok 74105

Dear Ms. McGaha:

Welcome to the Veterans Administration. You will be assigned to our facility as ~~Research Student~~ from 2/15/84 through 8/15/84 under authority of 38 U.S.C., 4114(a)(1)(A). During your period of affiliation with our facility, you are authorized to perform services as directed by the Chief, ~~Research Service~~.

In accepting this assignment you will receive no monetary compensation and you will not be entitled to those benefits normally given to regularly paid employees of the Department of Medicine and Surgery, such as leave, retirement, etc. You will, however, be eligible to receive the benefits indicated below. Cash cannot be paid in lieu of any of these benefits.

☐ Quarters ☐ Subsistence ☐ Uniforms ☐ Laundering of Uniforms

If you agree to these conditions, please sign the statement below and return the letter in the enclosed postage-free envelope. This agreement may be terminated at any time by either party by written notice of such intent.

Please indicate your veteran status by circling the appropriate number below.

Sincerely yours,

MARGARET H. SANFORD
Acting
Chief, Personnel Service

Enclosure

I agree to serve in the above capacity under the conditions indicated.

Signature Glenda S. McGaha

Date April 23, 84

Veteran Status
*1—Vietnam Veteran **
2—Other Veteran
3—Non-Veteran
** For this purpose, a Vietnam Veteran is one with service between August 5, 1964, and May 7, 1975.*

(Over)

FL 10-294
Oct 1980(RS)

Hello:

I am a graduate student at Oklahoma State University and as part of my work with the school, I am conducting a research project in the clinic beginning in June. The purpose of the project is to look at types of problem solving present in several groups of people. I would like to invite you to participate in the study by taking a brief series of puzzles, solving problems which will be enjoyable and take relatively little time. This will involve meeting with me here at the clinic, at a time which best suits you for a total of two meetings, each lasting about 40 minutes. Your personal background are not a part of the study and your name will not be used in the materials at any time. The clinic staff and counselors are not allowed to see the results of our meetings and this study is not a part of your program here. Also, nothing in the study is harmful to you or your program in any way. After the project is completed, I will be happy to share the results with you and provide you a copy in writing if you wish.

I hope you will decide to participate, as I think you will enjoy doing so and your help will be appreciated.

You can contact the secretary here at the clinic at any time to sign up for participation. I will be in the clinic during operating hours and will be happy to answer any questions you may have if you will let me know.

Thank you for your help.

Glenda McGaha

Glenda McGaha
Graduate Student

Oklahoma State University

VITA

Glenda Sharp McGaha

Candidate of the Degree of

Doctor of Philosophy

Thesis: THE EFFECTS OF MATERIAL REWARD ON PERFORMANCE IN DRUG DEPENDENT SUBJECTS

Major Field: Home Economics - Family Relations and Child Development

Biographical:

Personal Data: Born in Ft. Stockton, Texas, June 20, 1953, the daughter of Mr. and Mrs. W. A. Craven.

Education: Graduated from Spring Valley High School, Columbia, South Carolina, in June, 1971; received Bachelor of Science in Nursing degree from the University of South Carolina, Columbia, South Carolina in December, 1974; received Master of Science in Nursing degree from the University of Alabama in Birmingham, in August, 1979; completed requirements for the Doctor of Philosophy degree at Oklahoma State University in December, 1984.

Professional Experience: Staff nurse, Selma Medical Center, Selma, Alabama, 1974-1975; Director of Nursing Services, Warren Manor Nursing Home, Selma, Alabama, 1975-1977; Coordinated health care services, Central Alabama Youth Services, Selma, Alabama, 1977-1979; Clinical specialist in pediatrics, St. Francis Medical Center, Tulsa, Oklahoma, 1979-1980; Assistant Professor, University of Tulsa, College of Nursing, Tulsa, Oklahoma, 1980-1984; Associate Professor, Coordinator of Bachelor of Science program, Southeast Missouri State University, Department of Nursing, 1984-present.