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Cognitive Regression in Schizophrenia as Measured by Piagetian Tasks

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COGNITIVE REGRESSION IN SCHIZOPHRENIA
AS MEASURED BY PIAGETIAN TASKS

BY

JUDITH PUTNAM KALISKI

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
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Abstract

The hypothesis that schizophrenic thought disorder is characterized by cognitive regression is examined using tasks developed by Jean Piaget and his followers. Theoretical bases for the application of Genevan theory to this problem can be found in the writings of Arieti, Bado, and many others. Genevan theory has never been applied to schizophrenic cognitive regression at the conservation level, although Arieti's description of schizophrenic logic matches Piaget's of the pre-operational child rather closely.

Description
Special attention is paid to the characteristics of schizophrenia that may confound research in cognitive regression; field dependency, the loss of communicative skills, and the process-reactive dimension. Measures which tap these areas were given and positive correlations between verbal skill and conservation performance, verbal skill and age, and field dependency and hospitalization were found. Negative correlations, between field dependency and verbal skill and field dependency and conservation, pointed to field dependency as a hallmark of the cognitively regressed. ⁱⁿ Schizophrenics proved to be more field dependent than depressives who were more field dependent than normals. Schizophrenics' performance on the conservation tasks was erratic, both due to perceptual boundedness and to communicative difficulties. Normals and depressives performed

similarly on the conservation tasks, succeeding on most of them. Process schizophrenics were found to be less cognitively regressed but more field dependent than more reactive schizophrenics.

Dep Subjects consisted of 20 normal adults, 20 hospitalized schizophrenics, and 20 hospitalized depressives. The Goldschmid Concept Assessment Kit (Conservation) was used as the conservation tasks. An abbreviated form of Gottschalk's embedded figures provided field dependency data. Ullmann and Giovanni's self-report process-reactive scale provided the information that all the schizophrenics in this sample were process ones, but some were more process than others. The Peabody Picture Vocabulary Test was used as an example of a conventional IQ test.

Outcome Conclusions were that: 1.) schizophrenics were shown by the conservation tasks to be cognitively regressed, while normals and depressives were not; 2.) field dependency seems to go with cognitive regression; 3.) conventional IQ tests, such as the Peabody, do not fully tap cognitive regression, being too sensitive to verbal skills and formal education.

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I

The intent of this study is to investigate the theory that the conceptual behavior of schizophrenics resembles that of young children by means of Goldschmid's Concept Assessment Scale, which arises out of the theory of Jean Piaget. There are both methodological and theoretical reasons for the choice of this instrument, to be discussed in subsequent sections. The hypothesis of this study is that the performance of a group of schizophrenics on the Concept Assessment Scale will differ significantly from that of either normal adults or of hospitalized depressives. In this case the schizophrenics' performance would be described as similar to that of young children like those used to develop the scale, as the score attained on the scale measures concept attainment in terms of the stages of cognitive development gone through by children. This experiment is not intended to explore directly any other aspect of thought disorder in schizophrenia; nor is it intended to specify how else schizophrenic cognitive behavior may differ from that of normal adults and/or depressives.

II

As Buss and Lang (1965) have noted, the tenability of the

hypothesis that schizophrenic cognition differs from that of normal adults in that it resembles that of young children is open to question. There are a number of reasons for this, but the two most problematic are: 1) the large number of theories that attempt to explain in what respects the schizophrenic's conceptual behavior resembles that of young children, and; 2) the great variety of methods used to study this resemblance.

One school of thought described by Buss and Lang is that of Goldstein (1943), Vigotski (1934), and others, which attributes the schizophrenic's cognitive deficit to regression to the concrete level of thought from the later-developing "abstract attitude", which consists of the ability to: 1) assume a mental set voluntarily; 2) shift voluntarily from one aspect of a situation to another; 3) keep in mind various aspects of a problem simultaneously; 4) grasp the essentials of a given whole, break it down to its components and isolate them voluntarily; 5) generalize, abstract common properties, plan ahead, assume an attitude towards the "merely possible", think and perform symbolically; 6) detach one's own ego from the outer world (which seems to be equatable with a sense of self.) In 1959, Goldstein considered his own hypothesis

to be confirmed by the results that schizophrenics perform poorly on the Goldstein-Scheerer test and on the Vigotski blocks. However, Buss and Lang (1965) point out that actually these results are inconclusive because the Goldstein-Scheerer test is rated by an experimenter as to cognitive level, without quantified scoring, and the Vigotski blocks penalize slow performance, which confounds the issue especially with schizophrenics. Webb (1955) and many others reported in Buss and Lang have found that the performance of schizophrenics, on many tasks, deteriorates under threat of failure, which threat seems to be implied by the simple act of timing a task.

Moreover, others, the best known of whom are Hanfmann and Kasanin (1936, 1938, 1939, 1942) have found that the schizophrenic has the ability to abstract but does so in idiosyncratic, hard-to-communicate ways. This is consistent with the school of thought reported in Buss and Lang as espoused by McCaughan (1954, 1956) which attributes cognitive loss in schizophrenia to difficulties in communication. The resultant conceptual behavior is "private" and "closed" -- i.e., egocentric and paleo-logical, as is a child's, as opposed to that of a normal

adult which is "public" and "open". In short, the schizophrenic's cognitive processes resemble the child's only insofar as both the child and the schizophrenic see no need to explain the differences between their frame of reference and anyone else's. Once again, the results of these studies--i.e., McGaughan (1956) and Payne and Hewlitt (1960) as reported in Buss and Lang were inconclusive. With these experiments, which relied on sorting tasks to elicit typical conceptual behavior in the expression of the basis for sorting, the higher the IQ of the schizophrenic, the more "public" the bases for sorting--thus, another confounded result appears.

The most influential school of thought in the conception of the present project was that of Goldman (1962, in Buss and Lang), an extension of Werner's (1948, in Buss and Lang) ideas. This school holds that "regression" of conceptual behavior includes both a loss of powers of abstraction and a loss of communicative skills. As are the child's, the schizophrenic's modes of thought are considered private, labile, and concrete, as opposed to the adult's public, stable, abstract way of thinking. This notion of how the schizophrenic's cognition resembles that of the child has theoretical bases in Freud and in Arieti (1955, as reported in Buss and Lang, and 1948). Arieti (1948) terms this type of thought "paleologic", based upon the Von Dorasmus Principle, which is: "Whereas the normal person accepts identity only upon the basis of identical subjects, the paleologist accepts identity based upon identical predicates." (p. 169) Arieti himself refers to

the work of Piaget as supporting his hypothesis that this type of logic also exists in children. He describes the consequences of the use of paleologic:

"From the foregoing it appears that paleologic thinking is much less exact than Aristotelean. In the latter, only identical subjects may be identified. The subjects are immutable; therefore, only a few and the same deductions are possible. In paleologic thinking, on the other hand, the predicates lead to identification. Since the predicates may be extremely numerous and one does not know which one may be chosen by the patient, this type of thought becomes unpredictable, individualistic, and often incomprehensible." (p. 172)

It is interesting to compare this description with Furth's (1969) description of the child's response to conservation problems; Furth notes that as the child progresses from the pre-operational to the concrete-operational stage in the development of logic (according to Piaget's scheme), he loses degrees of freedom of possible responses; i.e., the response of the pre-operational child is much less predictable than that of the more advanced concrete operational child.

Arieti (1948) also states:

"...the autistic person has the tendency to live in a world of perception rather than a world of conception. The more autistically a person thinks, the more deprived he becomes of concepts or of Plato's universals. His ideas become more and more related to specific instances, and not concerned with classes, groups, or categories."
(p. 178)

Replace "autistic" with "pre-operational" and a fair description of the pre-operational child's mode of cognitive functioning emerges. Arieti's answer as to why the schiz-

ophrenic resorts to the use of a primitive system of logic which he has long since left behind in his cognitive development is simple:

"...one has the tendency to resort to paleologic thinking when one's wishes cannot be sustained by normal logic. If reality cannot grant gratification of wishes, a new system of logic, which will transform reality into a more complacent form, may be adopted." (p. 180)

Strangely enough, the studies done to date based on Arieti's theory (as reported in Buss and Lang) have neither been controlled nor reached quantifiable results. Most of the studies deal with the schizophrenic's use of language, which quite a few studies have shown to resemble that of children (Flavell, 1956; Feifel, 1949; Ellsworth, 1951, and Burstein, 1961 in Buss and Lang). That this approach is still considered useful is shown by Kloxman and Chapman (1969), which also supports the regression hypothesis via language usage.

It is interesting that only one set of studies (Trunnell, 1964, 1965) has applied the Piagetian theory of intellect to the problem of schizophrenic cognitive regression. Piaget's (1952) description of the cognition of the pre-operational child seems to resemble very closely, in some respects, Arieti's description of the cognition of the schizophrenic, as previously noted. Both the schizophrenic and the young child are perceptually stimulus-bound (or "concrete"), unpredictable in their responses to cognitive problems, and egocentric. If one does con-

sider the phenomenon of regression (cognitive or otherwise) to account for much of the bizarreness of thought and communication of the schizophrenic, then the logical way to test the hypothesis is to try to establish how schizophrenic cognitive behavior resembles that of young children by using those tasks which tap those kinds of behavior that differ qualitatively from childhood to adulthood; that is, those kinds of things on which children perform qualitatively differently from adults. Such tasks are those devised by Piaget. In Trunnell's study the prediction was that the schizophrenic would perform more like normal concrete operational children on a variety of tasks derived from Piaget's theory than they would like normal adults. His hypotheses were confirmed, in most cases beyond the .001 level. His conclusion was that schizophrenics, like normal children, are unable to hold two initial premises in mind at the same time, or to shift from one way of viewing a situation to another, possibly for the same reason (an egocentric viewpoint). An example of one of the tasks used was this:

"Edith is fairer than Suzanne who is darker than Lili. Who is the darkest of the three?"

Other tasks involved the formation of conjunctive classes, color-sorting of objects, a chemical experiment, and the figure at right, which is supposed to contain 26 capital letters.

Figure I: Trunnell's figure

First off, it seems that the figure (I) is somewhat inappropriate for use with a population known, or at least strongly suspected, to be field-dependent. (Sugarman and Cancro, 1964) Field - dependency is thought to be a personality variable as well as a developmental one. (Witkin, 1965) Secondly, one wonders whether or not the mention of people in the problems might have acted as an aversive stimulus to the schizophrenics. Buss and Lang report a number of studies whose results suggest that human stimuli are "affectively-laden", or otherwise distracting, to schizophrenics, and that their performance on cognitive tasks deteriorates in the presence of such stimuli. Thirdly, the color-sorting, as previously mentioned, is affected by the IQ of the subject. In short, the Trunnell studies yielded some very interesting results, which unfortunately were inconclusive due to a lack of appropriate controls, including a failure to define adequately the population from which the subjects came, and a lack of appropriate adaptations of the Piagetian scheme to the population involved. However, due to the extreme significance (statistically) of the results, it seems advisable to attempt further research into this area, with the following modifications: 1.) a better description of the population involved should be attempted by means of using other measures as well as Piagetian ones on the same subjects, i.e., a conventional IQ test, a field dependency

measure, and a process-reactive scale, for reasons which will be discussed later; 2.) use of conservation tasks as the Piagetian tasks, in order to assess the extent of the schizophrenics' cognitive regression, as it seems there is more similarity between the pre-operational child and Arieti's paleological schizophrenics than between the schizophrenics and the concrete operational child; 3.) addition of a non-schizophrenic, hospitalized group in order to control for the effects of general emotional disturbance and of the hospital environment.

III

Some of the reasons for these modifications have already been touched upon; others will be discussed now. The first has to do with other characteristics of schizophrenic thought which might conceivably interfere with schizophrenics' performance on the Piagetian tasks. The most striking of these characteristics is field dependency. Since the pre-operational child is described by Piaget as stimulus bound, and has also been found to be field-dependent (Witkin, 1965), it is difficult to say how these two are related. Certainly there are field-dependent adults who have passed beyond the pre-operational mode of cognitive functioning. Yet there do not seem to be pre-operational children who are as field-independent as are adults. Witkin (1965) reports that paranoid schizophrenics tend to be field-independent, while catatonics tend to be field dependent; process schizophrenics

seem to be more field dependent than do reactives. In any event, it does seem necessary to keep track of the field dependency of adult subjects who undergo the conservation tasks simply because of the conservation task's very nature which would make it harder for a field-dependent person to succeed on it than for a field-independent one. It is anticipated that in normal subjects this influence would be negligible--but in the schizophrenic and/or depressive subjects, a negative relationship could exist between field dependency and successful completion of the conservation tasks.

The second confounding characteristic is that of process-reactive differences among schizophrenics. As Becker (1956), Wittman (1941) and many others have noted, the process schizophrenic is the one who shows the most cognitive deficit. A less well-known connection, however, is that suggested by Gibeau (1965): the process schizophrenic will be more field dependent than will the reactive. Hence, the process schizophrenic is more likely to fail the conservation tasks than is the reactive for two reasons.

Finally, the use of conservation tasks as opposed to that of formal operations tasks has a heretofore unmentioned advantage. Smedslund (1968) has demonstrated that conservation as a concept can be attained in the normal course of development, or can be attained through specific training using a "cognitive conflict" model. More interestingly, however, he demonstrated that both kinds of conservation can be extinguished. This finding is all the more convincing because it was somewhat unintended. Smedslund's

original intent was to demonstrate that conservation behavior could be taught, but that naturally-acquired conservation was superior. To his surprise, he found that roughly half of those subjects who had naturally acquired conservation lost it in the face of dissonant evidence. (He used sleight-of-hand.) This sort of evidence does not exist for formal operational tasks. Perhaps, then, one might hypothesize that some people simply have, and always have had, a more tenuous hold on this concept (conservation) which Piaget called "...a necessary condition for all rational activity...the need for conservation appears then to be a kind of functional a priori of thought." (pp. 3-4) Perhaps, one might also hypothesize, these are the very people who are prone to thought disorders of the type most blatantly seen in schizophrenia.

IV

Method *idw*

Subjects: Subjects were 60 adults comprising three groups: one group of 20 were hospitalized schizophrenics, one group of 20 were hospitalized depressives, and one group contained 20 normal adults of varying occupations. There were ten men and ten women in each group, in order to control for sex as a variable, since sex has been shown to be a significant variable in field dependency studies (Witkin, 1949). Subjects were matched for age, education, and, where appropriate, length of hospitalization. Education was matched in the hopes of weeding out the retarded, as

✓

Lovell, Mitchell, and Everett's study (as reported in Sigel and Hooper, 1968) shows that the retarded are unable to perform the conservation tasks--or rather perform as do pre-operational children--regardless of chronological age. It was also hoped that the educational level would give some idea of the patients' level of pre-morbid cognitive functioning. Length of hospitalization was matched in order to avoid effects due to prolonged hospitalization, which is generally considered not only unstimulating but also reinforcing of some regression. Table I shows matching data.

<u>Group</u>	<u>$\bar{x}$</u>	<u>Age</u> Range	<u>Education</u> $\bar{x}$ Range	<u>Hosp.</u> $\bar{x}$ Range
Schizo-phrenic	37.1	22-72	9.95 4-16	8.3 1-30
Depres-sives	41.5	13-71	9.65 5-16	10.3 1-30
Normals	43.2	24-68	10.55 7-14	-----

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Table I: Matching data, in years

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Measures: All subjects were given the following measures, in the following order:

1.) Goldschmid's Concept Assessment Scale (Conservation), Form B. (See Appendix B) This is a recently-standardized form of Piaget's conservation tasks, which in effect yields two scores, one for conservation and the other for the explanation of conservation. The subject is asked whether two quantities are the same or different in amount (yielding a conservation score) and then is asked why he answered the way he did, yielding a score for explanation. Scores on this measure range from 0 to 12.

2.) Field dependency measure. This consists of an

abbreviated form of Gottschalk's embedded figures (Witkin, 1950). The subject is shown a simple figure for ten seconds, after which time the card is removed from sight. Then the subject is asked to locate the simple figure within a more complex one. The subject is allowed to see the simple figure again (once) on request, but during that time the complex figure is hidden from view. The score is the amount of time necessary for the subject to locate and trace the outline of the simple figure within the complex one. If the subject fails to do so, his score is recorded as five minutes, which is the time limit for any one card. There are eight sets of cards plus a practice set, which the subject is shown first. If he cannot find the simple figure in the practice card, it is pointed out to him. No further help is offered on any subsequent cards. Maximum score, indicating high field dependency, is 40 minutes.

3.) Peabody Picture Vocabulary Test. This is a short IQ test given all subjects in order to assess the relationship, if any, between conventional IQ score, field dependency, and performance on the conservation tasks in adults.

4.) In addition, the schizophrenic group is given Ullmann and Giovannoni's (1964) self-report process-reactive scale, a true-false scale whose items are largely case-history-type information such as, "My top wage in the last five years was less than \$1.25 an hour (True) (False)." Where possible, these responses were validated by checking the ward record of the patient. A high score (more than

13 out of 25 items) indicates the "reactivity" of the subject's schizophrenia.

V

Results

Table II shows the intercorrelations of the measures used:

	CAK	FD	IQ	Age	Ed.	Hosp.
CAK	---	---	---	---	---	---
FD	-.49020*	---	---	---	---	---
IQ	.48259*	.48344*	---	---	---	---
Age	-.01459	.00185	.34170*	---	---	---
Ed.	.22255	.00659	.18475	.02223	---	---
Hosp.	-.07274	.94317*	.05326	-.27891	-.07915	---

Table II: Intercorrelations for all subjects (N=60)
 (CAK=Conservation tasks; FD= Field Dependency;
 IQ = Intelligence as measured by Peabody Test.)
 Asterisk indicates that $p = .01$ or less.

As predicted, in general it proved harder for field-dependent people to succeed on the conservation tasks, possibly due to the closeness of some conservation tasks to some field dependency measures. Piaget and his followers (Sigel and Hooper, 1968; Phillips, 1969) have always indicated that the pre-operational child can be described as perceptually-bound: hence this finding is consistent with Genevan theory.

Again, logically, success on the conservation tasks had a strong positive relationship with conventional IQ. This finding will be discussed later, in view of Tables III, IV, and V, which show the intercorrelations within each diagnostic group.

The strong negative correlation between field dependency and conventional IQ is consistent with Witkin's (1965) findings, and with the idea that young children are field dependent.

The positive correlation between age and conventional IQ is probably an artifact peculiar to vocabulary tests; the more one experiences, converses and reads, the larger one's vocabulary should be if one has normal powers of incidental learning.

Finally, the extremely strong positive correlation between field dependency and length of hospitalization confirms what many mental health workers have suspected for many years: in all likelihood, the understimulating, overstructured environment of a state hospital, combined with years of day-to-day exposure to other patients, most of whom are schizophrenic, leads not only to cognitive but also to perceptual change. A state hospital, no less than any other institution, is a society with its own system of rewards and punishments, and with more than the usual press for conformity; a press which often falls upon those people most susceptible to it.

	CAK	FD	IQ	Age	Ed.	Hosp.
CAK	1.0000					
FD	-.19125	1.0000				
IQ	.53580*	.06519	1.0000			
Age	-.02887	.28186	.42199	1.0000		
Ed.	.38021	.01304	.41826	-.20439	1.0000	

Table III: Intercorrelations for normals (N=20)
Asterisk indicates $p = .05$ or less.

The only significant correlation for normal subjects is between IQ and performance on the conservation tasks. This finding may seem somewhat surprising at first; all normal adults were expected to complete all the conservation tasks successfully. However, an inspection of the conservation scores of the normal group reveals that those subjects who lost points on the conservation task, lost them on the explanation section of the test. When one considers the Peabody scores simply as measures of verbal ability the picture becomes clearer; perhaps some of the subjects, some of whom were undereducated, blue collar workers, and some of whom spoke languages other than English as mother tongues, knew what they wanted to say, but could not frame it properly! (Of course this idea is even more *à propos* of the hospitalized subjects.)

Almost equally interesting is the lack of correlation between field dependency and anything else in normals. It is as if field dependency, within normal limits, has little connection with cognitive behavior, but beyond normal limits exemplifies cognitive loss.

	CAK	FD	IQ	Age	Ed.	Hosp.
CAK	---	---	---	---	---	---
FD	-.22424	---	---	---	---	---
IQ	.38305	-.60639*	---	---	---	---
Age	-.21103	.17543	.09178	---	---	---
Ed.	-.15122	-.25970	.58223*	-.38665	---	---
Hosp.	-.40460	.26713	-.08181	.81376*	.06609	---

Table IV: Intercorrelations for depressives (N=20)

Asterisk indicates that $p = .01$ or less.

The most interesting correlation here is between IQ and field dependency. As predicted, field dependency is negatively correlated with conventional IQ. If this is seen in terms of resisting the perceptual style of those around you, perhaps the more verbal, alert depressives are less suggestible; or, those who appear more conventionally-intelligent are those who have more confidence in their own senses.

It seems, as shown by the positive correlation between IQ and education, that the Peabody Test Scores might be spuriously high when it comes to educated people. After all, education more or less forces the expansion of one's vocabulary.

There seems little need for an explanation of the relationship between age and hospitalization, which exists both for depressives and for schizophrenics.

	CAK	FD	IQ	Age	Ed.	Hosp.
CAK						
FD	.00746					
IQ	.26289	-.17882				
Age	-.15814	.08006	.64525**			
Ed.	.16029	.01549	.33995	.22020		
Hosp.	.11070	.13227	.51021*	.49831*	.49759*	

Table V: Intercorrelations for schizophrenics (N=20)
 * indicates $p = .05$ or less; **, $p = .01$ or less.

In considering the relationships among measures for the schizophrenic group, one is struck by the fact that the significant relationships are either self-evident (as in

the positive relationship between age and length of hospitalization) or most likely artifacts (as in the relationship between age and IQ). Table V suggests that the schizophrenic who has been hospitalized for some time is older, more educated, and scores higher on the Peabody than does his counterpart who is a relatively recent arrival. It is obvious, for example, that a 22-year-old who was admitted at age 17 is far less likely to have completed high school, let alone college, than is the 50-year-old who was admitted at age 30. And, since the Peabody is most likely very sensitive to educational level, the 50-year-old is still likely to score higher on it than is his younger counterpart, in spite of the effects of his additional years of hospitalization. So it appears that education is a more potent variable than is hospitalization in its effects on the Peabody scores. Indeed, it seems that the simple process of aging adds more to one's vocabulary than hospitalization detracts from it. It is interesting to note that the relationship between the Peabody score and the conservation tasks fails to attain statistical significance. It seems that, for schizophrenics (and to a lesser degree for depressives), the conservation task results are in large part tapping something other than conventional IQ, which is in large part accounted for by formal education. (This finding is supported by the fact that, although neither relationship attains significance, the relationship between education and conventional IQ is about twice as high--that is, positive--

as is the relationship between education and performance on the conservation task.)

What is interesting is the lack of relationship between performance on the conservation task and field dependency among schizophrenics. (Both the normal and the depressive groups show negative, if non-significant, relationships between these two measures, which is as predicted.) As Table VI shows, the schizophrenic group is significantly more field dependent than either the normals or the depressives.

Effect	χ^2	df	s^2	F
Group	2436.46	2	1218.23	26.101*
Sex	136.16	1	136.16	2.917
Interaction	75.99	2	37.99	1.628
Within	2520.36	54	46.67	0.00
Total	5168.95	59		

Table VI: Analysis of Variance, field dependency data. The statistical significance of this finding is sufficiently strong ($p = .01$ or less), and in the expected direction (see Table VII), that it is possible that field dependency

Group	Male	Female	Group Total
Schizophrenics	256.2	292.8	548.8
Depressives	184.3	187.8	371.8
Normals	93.7	142.7	236.3
Total by Sexes	534.2	623.3	

Table VII: Total scores on field dependency measure, by diagnostic group and sex.

ceases to affect conservation performance in a linear manner above or below a certain point. That is, if his field dependency score falls below a certain level, a subject will be able to complete the conservation tasks successfully, regardless of how far below that level his score falls. In other words, a certain degree of field independence is necessary in order to complete the tasks successfully. Perhaps, if there were degrees of success possible on the conservation tasks, the relationship between field independence and performance on these tasks would be completely linear. However, since only success and degrees of failure is possible, it is not. Conversely, if one's field dependency score falls above a certain point, he will be unable to complete the conservation tasks. It was observed that the schizophrenics did not always pass the easier items and fail the harder ones on the conservation scale; often the pattern seemed completely erratic. It is possible that the schizophrenics were able to do those tasks that most resembled the ones they encountered in everyday life; however, this is pure speculation.

Group	Total Conservation Score	$\bar{x}$
Schizophrenic	140	7.00
Depressive	210	10.50
Normal	231	11.55

Table VIII: Total conservation scores and conservation means, by diagnostic groups.

A test for homogeneity of variance on the data from

Table VIII revealed that the distributions of the three groups were too heterogeneous for an analysis of variance to be performed. Yet the groups plainly performed differently, a difference which is heightened when the distributions are plotted.

Figure II: Distributions of conservation scores by diagnostic groups. (Solid line = schizophrenics; broken line = normals; crossed line = depressives)

The normal and depressive groups' distributions both were highly leptokurtic and skewed in the same direction. On the other hand, the schizophrenic group's distribution was highly platykurtic and almost bimodal.

Inspection of the schizophrenic group, to try to establish why some subjects fell under one mode and some under another, yielded little except that the higher-scoring schizophrenics on the conservation tasks were slightly more likely to score higher on the Peabody and slightly more likely to score low on the process-reactive scale. (A high score on the process-reactive scale indicates that

that patient is a reactive, or acute, schizophrenic rather than a process, or chronic, schizophrenic. However, none of the subjects of this study scored above 13, the midway point of the scale, indicating that while all the schizophrenics were process ones, some were more process than others.)

Breaking down the conservation tasks into the components (conservation and explanation of conservation) proved rather illuminating. While the distributions of the normal and depressive groups show relatively small differences according to task aspect, that of the schizophrenic group shows a consistent shift.

Figure III: Distribution of Normals' conservation scores by task aspect. (Solid line = behavior scores; broken line = explanation scores.)

Figure IV: Distribution of Depressives' conservation scores by task aspect. (Solid line = behavior scores; broken line = explanation scores.)

In all figures, the solid line represents scores on the behavioral aspect of the conservation task, while the broken line represents scores on the explanation aspect. No schizophrenic attained a perfect score

on the explanation aspect of the task; further, the two modes are much more sharply defined for the explanation aspect than for the entire task or for the behavioral aspect of the task. Hence it appears that

Figure V: Distribution of schizophrenics' conservation scores by task aspect.

one of the reasons for the sharp differences between the non-schizophrenics (normals and depressives) and the schizophrenics on the conservation task is that the schizophrenics are less able to communicate their reasons for conservation. It should be noted that, according to Piaget's scheme (Phillips, 1969 and Sigel and Hooper, 1968), a child cannot be counted as a "consistent conserver" until he is able to explain why he conserves, by use of one of three principles: reversibility ("If you made it as it was, the two would look the same"), invariance of amount ("You neither added nor took away from it"), or compensatory qualities ("That one is longer but it's thinner"). These are the principles used in the scoring of the Goldschmid Concept Assessment Scale. From the schizophrenics one is more likely to get the type of explanation offered by the pre-operational child--romancing ("Because my brother says so") or perceptually-bound confusion ("That one's bigger, no that one, I dont know") as reported in Sigel and Hooper (1968).

	CAK	FD	IQ	Age	Ed.	Hosp.
P-R	-.36607	.14648	.06658	.61302*	.05487	.36478

Table IX: Correlations between process-reactive scores and other measures. Asterisk indicates $p = .01$ or less.

The only significant correlation in the process-reactive data is between process-reactive score and age. This is not surprising, since Ullmann and Giovannoni (1964) admit that for persons under 25 years of age, the scale is less valid. The reason for this is fairly obvious: since many of the items in the scale have to do with what the subject has accomplished in life (marriage, etc.), the person under 25 has had less time in which to accomplish anything. It is not too unexpected that this factor should enter into this relationship in linear fashion; the older the subject is, the more likely he is to have accomplished those things that Ullmann and Giovannoni label "reactive". Other examples of items on this scale are holding a job for two years or more, buying a house, falling in love. (See Appendix D.)

The relationship between length of hospitalization and reactive scores, which is not statistically significant, can also be explained in terms of age; the older person is more likely to have been in the hospital a longer time.

The relationship between reactive score and poor performance on the conservation task is not statistically significant but puzzling; it is the opposite of the predicted result. Perhaps again, since the older person tends to score "more reactive" on the Ullmann scale, and since he is also more likely to have been hospitalized for an extended period of time, the effects of prolonged hospitalization are making themselves felt. As previously noted,

length of hospitalization is related to field dependency. Perhaps heightened field dependency, as suggested, increases the difficulty of the conservation task.

In summary, the schizophrenic group performed worse, and more erratically, on the conservation tasks than did either normals or depressives. This supports the central hypothesis of this study. In addition, field dependency was found to be negatively related to good performance on the conservation task, which is also as predicted. Conventional IQ was positively related to good performance on the conservation task, but mainly in normals. Field dependency was negatively related to conventional IQ, which supports Witkin's (1965) findings. Age was related to conventional IQ, which was felt to be due to the nature of the test. Field dependency was highly correlated with length of hospitalization, suggesting effects of lack of stimulation and of constant exposure to field-dependent schizophrenics. Finally, schizophrenics were more field dependent than were depressives who were more so than normals.

Appendix A: Theoretical Implications

The theoretical implications of the results of this study fall into three categories: 1.) implications about cognitive functioning and cognitive loss in general; 2.) implications about schizophrenic "cognitive loss", and; 3.) implications about the effects of hospitalization on cognitive and perceptual processes. All three categories of course are related in theory, but the implications contained in each spring from different sets of results.

In the category of the implications of the results on cognitive function and loss in general, it seems that field dependency is, as earlier implied, "the hallmark of the cognitively regressed" rather than simply a personality variable as was originally believed. However, this seems not to be a simple, linear relationship; rather, field dependency's effect within the low range (i.e., the range of more field-independent people) is negligible; in all likelihood the subject who takes two minutes thirty seconds to find all the embedded figures will not prove to be any more "cognitively regressed" than is the subject who can find all the figures in one minute forty seconds. As psychophysicists have shown, ^{CONCISE} there is a fair range of individual difference in perception. Combining this with the other attributes necessary to finish the task quickly--good hand-eye coordination, normal visual acuity, smooth, controlled motor responses, and even speedy transmission of the neural

impulses which represent extero- and proprioceptive feedback--it is readily apparent that a slight deficit in any of these areas (a deficit perhaps not even noticeable to the subject himself) might affect a field dependency score without causing any difficulty in the subject's everyday life. When one's score exceed this level, field dependency goes hand-in-hand with cognitive deficit. One will have trouble with problems of logic (especially problems involving perception in any way) to the degree to which one is field-dependent. The ability to abstract, as stressed by Goldstein, the ability to free oneself from the concrete perception, is the main ingredient of cognitive functioning. As one's score rises into the markedly field-dependent range--one which most schizophrenics inhabit--one is more or less hopelessly lost when it comes to logic in the Aristotelean mode. One is overwhelmed by the perceptual world so that the abstract one is beyond reach. As quantities and perceptions change, so do logical identities. In schizophrenia, paleologic replaces Aristotelean.

The schizophrenic is both cognitively regressed and highly field dependent. Both his conventional IQ and his concept attainment level are lowered. His logic is regressed to a level most people leave behind at puberty, if not before. His use of language also resembles that of a child. These disparate conclusions can be tied together several ways. Plainly Goldman's hypothesis, that the cognitive deficit of schizophrenia consists both of commun-

icative difficulties (à la Cameron) and of a loss of the powers of abstraction (à la Goldstein, Vigotsky, and others), is supported by these findings. Rado's theory (1956), on the other hand, can explain the perceptual aspect of the cognitive loss phenomenon.

Rado maintains that the schizophrenic shows an anhedonia (hardly a novel theory) but also that the schizophrenic has a proprioceptive deficit, with an accompanying disturbance of the concept of the "action self". The "action self" is a kind of more active Sullivanian concept--the child's own feedback adding to his self-image in the same way as do his parents' opinions of him. In other words, through his actions and the success (success being defined more in terms of positive proprioceptive feedback than of external reinforcement) with which these actions meet, the child develops a concept of the "self as doer". When a proprioceptive deficit exists, this concept is impaired, and the child loses not only a sense of competence but also begins to mistrust his own senses. He sees himself an inanimate bit of flotsam floating on an unpredictable sea of an environment. He has lost his sense of control, of the possibility of action. Thus the environment almost assumes a life of its own. The schizophrenic cannot see the possibility of altering his environment through action; it impinges on him rather than he on it.

Keep in mind that, in Piaget's system, knowledge, logic, concept attainment, and cognitive development are

all active processes. "The organism" (person) not only reacts to his environment, he acts upon it, organizing it so as to make the most sense of it, expanding his system of logic so as to encompass new, dissonant bits of information (which he decides to admit to his perceptual field when he is ready for them) into an integrated conception--of the world, of number, of physical causality, etc. Also central to Piaget's scheme is the idea of invariate stages--that is, all children in their cognitive development pass through various stages in fixed order, although not necessarily at a fixed rate. No child can pass through conservation of volume, for example, until he has passed through conservation of number.

Where Piaget and Rado meld is at the sensorimotor state of development. As Piaget expresses it, this is the period wherein the child learns that his own actions bring about results in the environment. (Interestingly enough, Phillips claims that separation anxiety cannot begin before this stage.) Rado describes this point in life as the time during which the "action self" arises. In any event, a disturbance of this stage--due to proprioceptive deficit, separation anxiety, or whatever--should lead to the child's increasing difficulty in passing through subsequent stages, which include the pre-operational and concrete operational, as well as the last-developing formal operations stages. Smedslund has shown that conservation can be trained in those not

developmentally "ready" for it, and extinguished even in those who are, which has a place in this theory as well. Evidently the proprioceptively-impaired child may limp through the later developmental stages, carrying his own time bomb in the sense that his hard-won logic will disintegrate twice as quickly as would a normal's in the face of contradictory sensory data.

The schizophrenic's dilemma is deepened by his very helplessness in the face of the environment. On the one hand, as Rado posits, he is starved for pleasure of the sort that other people get from their achievements. On the other hand, he has no idea of how to produce such pleasure. Once he hits upon the idea of fantasy, the remnants of his attempts at logical organization of the world, in a sense, demand that he re-organize it for consistency's sake. Pushed both by his craving for the pleasure of achievement (which pleasure he lacks even if he objectively does achieve something) and by his vestigial need to organize the world in some way, he regresses to his only-half-abandoned pre-operational (or paleological) Weltanschauung. Arieti has noted that the schizophrenic regresses to paleologic in order to make his wishes somewhat possible (and his fantasies somewhat believable). This can be taken a step further: the schizophrenic not only wants to regress in this way, he has to.

The final category of theoretical implications has to do with the effects of hospitalization on cognit-

ive and perceptual processes. It is enough simply to reiterate the results: length of hospitalization is negatively correlated with cognitive ability (both conservation and verbal skill) and positively correlated with field dependency. While it is possible, of course, that the cognitively-impaired, field-dependent patient is less likely to be discharged from a state psychiatric hospital, it is unlikely that this alone explains that correlation, since the hospitalization-field dependency correlation is twice as strong, as the negative hospitalization-conservation performance correlation four times as strong, in the depressives as in the schizophrenic group. The depressive group was more intelligent, more successful on the conservation tasks, and less field-dependent, than was the schizophrenic group. Once again, the middle range of functioning seems to be the most affected by a variable--in this case, the variable is hospitalization time. It seems that the unstimulating, somewhat repressive hospital environment, including exposure to field-dependent and cognitively-regressed schizophrenics, might well effect a change in one's conceptual and perceptual style, especially when one's energy is depleted, as the depressive's often is. Perhaps, too, overworked ward personnel, who usually are unsure both of a given patient's diagnosis and of what a specific diagnosis means in terms of the level of functioning, cognitive or otherwise, of a patient, contribute an expectancy factor. One practical implication is that perhaps the mingling of patients by age and sex,

rather than by level of functioning, is less beneficial to the extremely disturbed than it is deleterious to the relatively intact. Beyond that, the reader is left to draw his own conclusions.

Appendix B: Concept Assessment Kit--

Conservation (Form B)

		Scores	
Task	Behav.	Explan.	TOT.
		A	*
		B	
		C	
		D	
		F	
		Total	

Name _____ Date _____

D.O.B. _____ Age _____ Sex _____

School _____ Grade _____

Examiner _____

Comments _____

(A) TWO-DIMENSIONAL SPACE

Item	Directions	Verbal Instr.	Resp.	Score
I. 2 equal rectangles	Build 2 rectangles, each with 8 blocks of wood, say:	Watch what I do.		
S				
a
b
E				
	When finished, ask:	Is there as much wood <u>here</u> (a) as <u>there</u> , (b) or does one have more?		
	If S says they are the same, say:	Yes, they are both the same.		
	If he says they are not the same, say:	Look. This one is just as big as that one. See, they are both the same.		
	Demonstrate to the subject that they are the same by pointing.			
	When he agrees, go on.			

II. 2 unequal rectangles	Take 2 extra blocks; say:	Look. I am putting these blocks here.		
S				
a
b
E				
	Then, say:	Now tell me. Is there as much wood <u>here</u> as <u>there</u> , or does one have more?		
	Record. Then ask:	Why?		
	Records; say:	OK, let's go on.		

Item	Directions	Verbal Instr.	Resp.	Score
III. 2 equal squares.	Build 2 squares of 16 blocks each, saying:	Watch what I do.		
	When finished, ask:	Is there as much wood <u>here</u> as there, or does one have more?		
a	If S says they are the same, go to (IV).			
b	If he says they are not the same, say:	Look. This one is just as big as that one. See, they are both the same.		
	Demonstrate by pointing, go on to (IV).			
IV. Square vs. single line	Then, take blocks from right square to build a single line with all 16, saying:	Watch what I do.		
a	When finished, ask:	Is there as much wood in <u>this</u> one as in <u>that</u> one, or does one have more?		
b	Record. Ask: Record.	Why?	<div> <div>same</div> <div>a > b</div> <div>b > a</div> </div>	
(B) NUMBER				
I. Parallel egg-cups & eggs	Place 6 egg cups in line 4 ins. apart. Parallel to these, stand 6 eggs next to cups, saying:	Watch what I do.		
a	When finished, say:	Now I want you to put each of <u>these</u> (eggs) in the cup next to it.		
b	Remove eggs from cups.			
II. eggs vs. egg-cups	Spread out cups (6" apart) and move eggs nearer (2"), saying:	Watch what I do.		
a	Then ask:	Are there as many <u>eggs</u> as <u>cups</u> , or does one have more? Why?	<div> <div>same</div> <div>a > b</div> <div>b > a</div> </div>	
b	Record. Ask: Record.			

Item	Directions	Verbal Instr.	Resp.	Score
(C) SUBSTANCE				
I. 2 equal balls.	Make 2 equal balls of play doh; say:	Here are 2 balls of play doh. Is there the same amount of doh in each ball, or does one have more?
<p>S</p> <p>E</p>	<p>If <u>S</u> says they are the same, go on to (II).</p> <p>If he says they are not, say:</p>	<p>Let's make them the same. I am taking some from this one and adding it to that one.</p>		
	Adjust balls until <u>S</u> says they are the same.			
II. ball vs. pancake	Flatten one ball out to pancake (4" diameter), saying:	Watch what I do. I am making this ball a pancake.
<p>S</p> <p>E</p>	<p>When finished, ask:</p> <p>Record. Then ask:</p> <p>Record.</p>	<p>Is there as much doh in <u>this</u> one as in <u>that</u> one, or does one have more?</p> <p>Why?</p>	<p><u>same</u></p> <p><u>a > b</u></p> <p><u>b > a</u></p>	
(D) CONTINUOUS QUANTITY				
I. 2 large glasses	Place 2 large glasses with equal fullness before child. Say:	Here are 2 glasses filled with the same amount of water.
<p>S</p> <p>E</p>	<p>Then ask:</p> <p>If <u>S</u> says they are the same, go on to (II).</p> <p>If he says they are not, say:</p>	<p>Is there as much water in <u>this</u> one as in <u>that</u>, or does one have more?</p> <p>Let's make them the same. I am pouring some from this one into that one.</p>		
	Adjust until he says they are the same.			

Item	Directions	Verbal Instr.	Resp.	Score
II. 2 unequal glasses <div style="text-align: center;"> <p>S</p> <p>a b</p> <p>E</p> </div>	Pour 25 ml of water from extra glass into b. Say: Then, ask: Record. Ask: Record.	Watch what I do. I am pouring some from this glass into this one. Is there as much water in <u>this</u> one as in <u>that</u> one, or does one have more? Why?	same <u>a</u> > b <u>b</u> > a	
III. large glass vs. 5 small ones. <div style="text-align: center;"> <p>S</p> <p>a b</p> <p>E</p> </div>	Pour water from fuller glass into 5 small ones, saying: When finished, ask: Record. Ask: Record.	Watch what I do. Does <u>this</u> glass have as much in it as <u>these</u> glasses together, or does one side have more? Why?	same <u>a</u> > b <u>b</u> > a	
IV. 2 equal large glasses <div style="text-align: center;"> <p>S</p> <p>a b</p> <p>E</p> </div>	Place 2 large glasses equally full before S, saying: Then, ask: If S says they are the same, go on to (V). If not, adjust water level, saying: Adjust until S says they are the same.	Here are 2 glasses both with the same amount of water. Is there as much in <u>this</u> one as in <u>that</u> one, or does one have more? Let's make them the same. I am pouring some from this one into that one.		
V. large vs. 5 small glasses <div style="text-align: center;"> <p>S</p> <p>a b</p> <p>E</p> </div>	Pour water from b into 5 small glasses, say: Then ask: Record. Ask: Record.	Watch what I do. Is there as much water in <u>this</u> glass as in all <u>these</u> together, or does one have more? Why?	same <u>a</u> > b <u>b</u> > a	

(E) WEIGHT

Item	Directions	Verbal Instr.	Resp.	Score
I. 2 equal balls	Make 2 equal balls of doh, saying: Give balls to <u>S</u> , saying: If <u>S</u> says they weigh the same, go on to (II). If not, say: Give ball back, and say: Adjust until <u>S</u> says they are the same.	Here are 2 balls of doh. Is one ball as heavy as the other, or does one weigh more? Let's make them the same. I am taking some from one and adding to the other. Now are they the same or is one heavier?		

II. ball vs. 5 little balls

Make b into 5 little balls, saying:

Watch what I do. I am making little balls out of this one.

When finished, ask:

Is there as much weight here, as in all the little balls together, or is one side heavier?

— same
— a > b
— b > a

Record. Ask: Why?
Record.

(F) DISCONTINUOUS QUANTITY

I. 2 equal large glasses

Place 2 glasses, equally full of corn, before S, saying:

See, here are 2 glasses filled with the same amount of corn.
Is there as much corn here as there, or does one side have more?

If S says they are the same, go on to (II).
If not, say:
Adjust until S says they are the same.
Let's try to make them the same. I am pouring some of the corn from this glass into that one. Now are they the same?

Item	Directions	Verbal Instr.	Resp.	Score
II. Large glass vs. tall glass	Pour the corn from b into a tall thin glass, saying:	Watch what I do. I am pouring the corn from this glass into that one.		
<div data-bbox="225 288 249 314" data-label="Text">S</div> <div data-bbox="149 555 168 576" data-label="Text">a</div> <div data-bbox="325 555 344 576" data-label="Text">b</div>	When finished, say:	Now, is there as much corn in <u>this</u> one as in <u>that</u> one, or does one have more?		
	Record, ask: Record.	Why?	<div data-bbox="1120 586 1200 607" data-label="Text">same</div> <div data-bbox="1120 617 1200 637" data-label="Text">a b</div> <div data-bbox="1120 647 1200 668" data-label="Text">b a</div>	

Appendix C: Gottschalk's Embedded Figures (Abbreviated)

The simple figures are designated by a letter; the complex figures by a letter and a number, the letter corresponding to that of the simple figure it contains. Figures P and P-1 are practice figures.

The specific colors used in each complex figure are represented by numbers; and wherever necessary the area covered by a given number is indicated by wavy lines radiating from the number. Figure a-2 remained uncolored. The colors to which the numbers refer are as follows: 1-red, 2-blue, 3-orange, 4-yellow, 5-brown, 6-dark green, 7-light green, 8-black. (From Witkin, 1950, p. 3)

Appendix D: Ullmann and Giovannoni's Self- Report

Process-Reactive Scale

Reactive answers are encircled.

1. When I leave the hospital, I will live with my wife
(husband). True False
2. I am married now. True False
3. I have children. True False
4. I have been married. True False
5. Before I was seventeen, I had left the house I was
raised in and never went back except for visits.
True False
6. When I leave the hospital, I will live with one or both
of my parents. True False
7. As a civilian I have worked steadily at one job or for
one employer for over two years. True False
8. I finished at least one year of education after high
school--trade apprenticeship, business school, college,
etc. True False
9. Adding up all the money I earned for the last three
years, it comes to less than \$700. before deductions.
True False
10. In my teens I was a member of a group of friends who
did things together. True False
11. I hardly ever went over to another kid's house after
school or on weekends. True False
12. When I was in school I didn't like physical education
classes. True False
13. Alcohol has nothing to do with my difficulties. True
False

14. I have paid regularly to buy a house. ☒ True ☐ False
15. More than once in the last year I have stayed on after some group meeting and talked with some other members about something that went on. ☒ True ☐ False
16. Shortly before I came into the hospital there was some major change in my life--such as marriage, birth of a baby, death, injury, loss of a job, etc. ☒ True ☐ False
17. I have been deeply in love with someone and have told them about it. ☒ True ☐ False
18. In the kinds of work I do, it is expected that people will stay for at least a year. ☒ True ☐ False
19. My top wage in the last five years was less than \$1.25 an hour. True ☒ False
20. I have earned my living for longer than a year at fulltime civilian work. ☒ True ☐ False
21. I have had to stay in a mental hospital for more than one year at a time. True ☒ False
22. Within the last five years I have spent more than half of the time in a mental hospital. True ☒ False
23. In my teens I was a regular member of a club or organization that had a grown-up who came to meetings.
(Scouts, school club, 4-H, church groups, etc.)
☒ True ☐ False
24. In my teens there was more than one girl (boy) with whom I had more than two dates. ☒ True ☐ False

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Appendix F: Practical and Research Implications

Practical implications can be divided into testing and treatment considerations. The implication as far as testing goes is that the Concept Assessment Kit provides a relatively clear-cut, non-threatening test of cognitive functioning for schizophrenics who may be too regressed or frightened to be tested by conventional means. It avoids many of the possible pitfalls of conventional tests as well--timed tests, tests using human stimuli, unquantifiable tests are more often used but each has its own disadvantages, none of which characterize the Concept Assessment Kit.

Treatment implications refer to considerations concerning the care of hospitalized patients. The finding that length of hospitalization is correlated with cognitive and perceptual changes in patients suggests that several things about hospital care might be altered in order to optimize the patients' chances of maintaining their intellectual functioning. For one thing, perhaps patients should be assigned to wards on the basis of their level of functioning rather than on the basis of their hospitalization time, sex, or former drug use. Possibly also reinforcement contingencies could be set up to reward such behaviors as newspaper reading, intelligent conversation, etc. The theory of the "soothing" understimulating, regimented hospital could be dropped in favor of a more stimulating, instructive one.

Research implications are numerous. One possibility is the study of lobotomized patients; one would then have some idea of what the influence of lobotomies on cognition and perception might be. For example: are lobotomized or cingulotomized patients field dependent? Can they do the conservation tasks? How do these results relate to conventional IQ scores for the lobotomized? Similar questions of course might well be asked about reactive schizophrenics. Would the reactive schizophrenic be more able to perform tasks because he has had a longer time to establish firm foundations in abstraction and logic, or is the reverse true--that the reactive schizophrenic is too rattled by the new experience of psychosis to be able to concentrate on cognitive tasks?

Other questions: is field dependency a precursor or result of schizophrenia? One study which would be interesting would follow a number of children over a period of years, and test this type of characteristic periodically, to see which of those who later become schizophrenic followed the predicted pattern of perceptual oddities first, schizophrenia second. (Of course large samples would be needed.)

Finally, an extremely interesting concept would be that of a test for proprioceptive deficit--which would be the tool which would ultimately confirm or refute Rado's hypothesis.