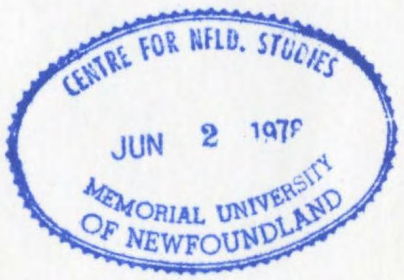
PIAGETIAN TASKS AS PREDICTORS OF BEHAVIORAL COMPETENCE IN THE AGED

JAMES J. CYR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PIAGETIAN TASKS AS PREDICTORS OF BEHAVIORAL COMPETENCE IN THE AGED

by

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ABSTRACT

It was hypothesized that two Piagetian tasks employed in assessing Piagetian cognitive development (namely, The Oscillation of a Pendulum and the Operations of Exclusion and Equilibrium in Balance) would be valid and reliable measures of cognitive ability of institutionalized aged adults. It was also hypothesized that these two tasks would be at least as good as other cognitive tasks (namely, the Vocabulary and Digit Span subtests of the W.A.I.S., Set Test, and Associate Learning subtest of the W.M.S.) in predicting the behavioral status (measured by the Stockton Geriatirc Rating Scale; SGRS) of the aged participants. The assessment of a young ($\underline{X}$ age = 27.2 years) and an institutionalized aged ($\underline{X}$ age = 83.0 years) sample population clearly demonstrated that although the I.Q. levels (measured by the W.A.I.S. Vocabulary subtest) were equal, the young sample performed significantly better on the Piagetian tasks (i.e., they functioned at a higher level of cognitive development) than the geriatric sample.

The results indicated that the Piagetian tasks are valid and reliable measures of cognitive ability with these institutionalized adults. They were found to be the best predictors of behavioral status in comparison with other cognitive tasks which are usually employed in assessing a geriatric sample. The SGRS scores were best predicted by a combination of the mean scores of the two Piagetian tasks, W.A.I.S. Vocabulary subtest, and the Set Test (accounted for over 25% of the variance). The remaining cognitive tasks, sex, and age, either alone or in combination with the three aforementioned cognitive tasks, account for relatively little variance in predicting the SGRS scores.

There was some evidence that the three best predictors of the SGRS lay on a bipolar dimension with the Piagetian tasks and the Set Test at one end and the W.A.I.S. Vocabulary subtest at the opposite end. It was suggested that this finding appears to be incompatible with Cattell's theory of fluid and crystallized intelligence.

It was concluded that the use of age as a predictor variable, in itself, provides little information about an individual that could not be discovered much more accurately with even minimal psychological testing. The importance of health factors, environmental influences, and the relationship between Piagetian theory and these environmental influences are discussed.

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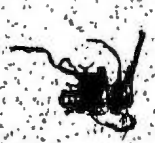


PIAGETIAN TASKS AS MEASURES OF COGNITIVE DEFICIENCY IN THE AGED

INTRODUCTION

Despite the number of people in our geriatric population, there has been proportionately little investigatory and therapeutic research done with this group (Lifshitz, 1960). Several investigators (e.g. Botwinick, 1973; Kimmel, 1974; Rao & Norris, 1971) contend that the number of old people, that is, those 65 years old and over, in the United States, constitutes approximately 10% of the total American population. This means that there are at least 14 million more elderly people than there were in 1900 (Goldfarb, 1967). Such an increase has also occurred in Britain where the elderly constitute approximately 12.5% of the British population with the age group of 75 years and over showing the most rapid rate of growth (Whanger & Busse, 1975), and in Japan where Kaneko (1975) predicts that the elderly will make up 12% of their total population by 1990. On a worldwide basis, a United Nations periodical (1971) reported that the world population over 65 years numbers about 200 million, with 24 million more people in 1971 than in 1966.

As a consequence, the proportion of geriatric patients in American state hospitals increased from 18% in 1940 to 31% in 1959 (Scott, Devereaux, & Janes, 1964). For example, Meer and Krag (1964) found that 38% of the patients in residence at the Stockton State Hospital were 65 years and older.

All this is not to say that the upper limit of the life-span of man has been extended appreciably - it has not. However, the percentage of people living all their years closer to their life potential is greater

(Botwinick, 1973).

Despite the substantial increase in the number of aged people living today, there has been, in recent years, still a relatively small proportion of research literature in the psychology of aging. Several studies undertaken by Birren and Woodruff (1973) revealed that literature related to adulthood and aging ranged from 3.6% to 9.5% of all the literature concerned with human development. The results of two surveys from the same authors indicated that 87% of the literature in developmental psychology dealt with the first 25% of the life-span. The content relevant to the lives of 140 million adults or 70% of the population is represented by 13% of the developmental literature. The literature specifically related to aging, however, constitutes only a fragment of this 13%.

This seems far from adequate to satisfy the ever-growing demands exerted from an increasing aged population. Our present level of knowledge about the aged is still at the embryonic stage. However, the gerontological research findings which have been reported have led some to attempt to delineate the processes involved in aging. Two research strategies related to assessing cognitive and behavioral functions frequently employed in this research area are:

(1) assessment of the cognitive processes and their impairment with advancing age as measured by clinical tests; and

(2) assessment of behavior, that is, the degree of disability and dependence on others (both physically and socially) and of its deterioration with advancing age as measured by a behavioral rating scale.

PIAGET'S THEORY

Piaget's theory of stages of cognitive development, which emerged from studies of children, is one of the more recent approaches employed by investigators to understand the ongoing process of aging. Piaget has defined four stages of cognitive development, namely, sensorimotor, preoperational, concrete operations and formal operations. Although the process of growth and individuation is continuous, its results are discontinuous; they are qualitatively different from time to time. Each is built upon and is a derivative of the earlier one. It is for this reason that Piaget has chosen to break the total course of development into small units called periods, subperiods and stages. Furth (1969) quite explicitly defines what is meant by stages:

> By stages Piaget refers to the lawful succession of relatively stable structures of knowing which characterize the behavior of the organism. Moreover, the structures are constituted such that the later ones incorporate what has been achieved at earlier stages and enrich the earlier structures by their reconstruction and extension on a higher plane (p. 18).

Genevan research (Inhelder, 1972; Inhelder & Piaget, 1958; Inhelder, Sinclair & Bovet, 1974; Piaget, 1953; Piaget & Inhelder, 1941; Piaget & Inhelder, 1964) as well as other research (Bruner, 1964; Smedslund, 1961) has already clarified the concept of developmental stages; it has revealed the constant order of their succession and the hierarchy of the underlying structures that become integrated with development according to certain laws. Piaget believes that no child can skip any stage since each new stage borrows from the accomplishments of the earlier ones. Every new experience is grafted onto what exists and there is always a

relation between the child's present ability and beliefs and all of his past.

Piaget's developmental and qualitative approach to the study of intelligence, which emphasizes stage rather than age, has been recognized as one of the major psychological contributions of the century (Brown, 1965). Eysenck (1945) commented on the appropriateness of Piagetian-type tasks with the aged. It was concluded that these types of cognitive tests were better understood and more effectively carried out by the elderly than other typically administered cognitive tests.

Although considerable attention has been directed toward the verification of the theory of cognitive development by Piaget (1950, 1970), almost no effort has been expended to investigate these concepts among matured and aged adults. Little attention has been given to possible changes in these processes with aging until recently. The few studies bearing upon this issue have found surprising developmental reversals in logical thought sequences among some aged persons (Ajuriaguerra, Boehme, Richard, Sinclair, & Tissot, 1967; Ajuriaguerra, Kluser, Velghe, & Tissot, 1965; Ajuriaguerra, Richard, Rodriquez, & Tissot, 1966; Papalia, 1972; Rubin, 1976).

Storck, Looft, and Hooper (1972) also have provided evidence to suggest that performance decrements are likely to appear in normal aged subjects on the more advanced, complex Piagetian tasks, that is, those tasks that are mastered later in the usual developmental sequence. With their small cross-sectional sample, there was strong suggestion that with advancing age, the normal developmental pattern is a "reversal of

horizontal decalage sequences" (e.g., mass, weight, volume) that appear in childhood. They found that performance was optimal on a measure of concrete operational thought (weight conservation) but considerably poorer on a measure of formal operational thought (volume conservation). Despite the fact that volume conservation is mastered only after the development of weight conservation, Rabinowitz (1976) has suggested that volume conservation is usually considered to be more characteristic of concrete operational thought rather than formal operational thought.

Sanders, Laurendeau, and Bergeron (1966) have studied the evolution of the concept of space in the aged in line with the developmental studies of Piaget with children. Their results suggested that new learning - new concept formation - was no longer available to the aged. Perhaps "old" concepts, old ways of problem solving, can still be used and applied when needed - but "new" problem solving, new concept formation, is no longer possible for the aged. Papalia, True, and Salverson (1972) reported that aged persons tended to "regress" with age to less advanced thinking processes (that is, "concrete operations" characteristic of school-age children) on Piagetian cognitive tasks. Piaget (1972) has reported that his laboratory has found similar "regression" from "formal" to "concrete" operations.

Ajuriaguerra and her associates have conducted research along the same line but with a sample population of demented, aged senile individuals, that is, geriatric patients who are inflicted with an organic pathology which is characterized by a moderate to severe cognitive and behavioral impairment. In one study (Ajuriaguerra & Tissot, 1968) it was observed that the process of cognitive disintegration in senile dementia was the

same as with those aged persons who were not demented; it proceeded in stages that were similar, but in reverse order, to those that evolved in infancy.

Even prior to the time of employing Piagetian notions as an approach to contribute to the understanding of the cognitive processes and of their increasing degree of impairment with normal aging and organic brain pathology, Pinkerton and Kelly (1952) administered a non-Piagetian task to assess abstract ability to a group of children and a group of senile demented patients. They found evidence which strongly suggested that the demented group lost their abstract ability gradually and presented a picture similar to a reversal of development of this ability in children. The most demented lost their ability, and were equivalent to children aged 5-6 who had not yet gained it. The medium group were in the process of losing it, and compared with the 7-8-9 age group who were in the process of gaining it. The least demented group retained something of their ability, and compared with the 10-11 age group who were in the process of consolidating a newly acquired ability.

Bromley (1971) has also identified the significance of a qualitative kind of decline in human intelligence with age, that is, a kind of degradation of the intellect so that cognition becomes more primitive - more literal, concrete, and uncritical, and less abstract and general. Instead of resorting to using a quantitative omnibus test of general intelligence, the utilization of an ordered sequence of tasks seems quite appropriate to demonstrate, qualitatively, the effects of normal aging and of an organic brain pathology. This is consistent with a Piagetian view.

This concept of a late-life regression in cognition to developmentally

more primitive levels of functioning is attractive to some researchers adopting a "life-span" approach to the study of intelligence. This may be demonstrated by the notion that the cognitive system, that is, the structure of the intellect, becomes both more differentiated and integrated through childhood to maturity, and then less and less differentiated and integrated through adult life and old age.

Bühler (1968) and Horner (1968), based on their studies of 400 biographies, proposed five phases of life which clearly exemplifies the notion of "regression" which some individuals experience:[1]

Age	Phase
0-15	Child at home; prior to self-determination of goals.
15-25	Preparatory expansion and experimental self-determination of goals.
25-45	Culmination: definite and specific self-determination of goals.
45-65	Self-assessment of the results of striving for these goals.
65 up	"Experience of fulfillment or failure, with the remaining years spent in either continuance of previous activities or a return to the need-satisfying orientations of childhood" (Horner, 1968, p. 65).

PIAGETIAN TASKS

It is quite apparent that the recent research findings have provided evidence to support the contention that assessing individuals' deterioration or degree of cognitive impairment by employing Piaget's

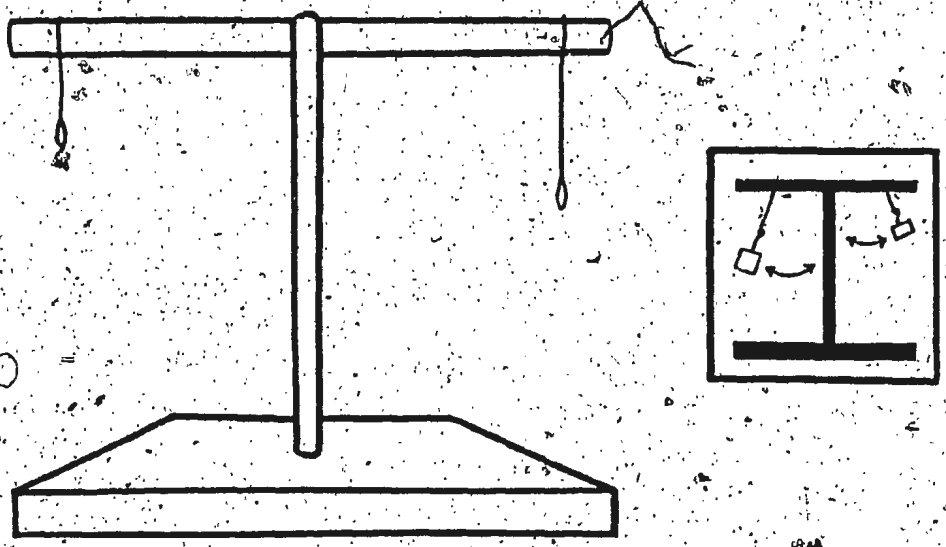
theory of cognitive development and his methods of identifying these various levels of cognitive functioning are appropriate with an aged population. Inhelder and Piaget (1958) have devised and employed tasks which enable one to identify, along the developmental continuum from sensorimotor to formal operations, precisely at what level an individual is functioning. Two of these tasks (The Oscillation of a Pendulum and the Operations of Exclusion, and Equilibrium in Balance; see Figure 1.) may not only be utilized to assess the levels of development or progression of cognition but also readily lend themselves to assess the levels of cognitive "regression" characteristic of the aged adults. The rationale for selecting these two particular tasks was based on each one's suitability to an old sample population as well as the fact that each discriminates among all four stages of cognitive development. Therefore, the individuals can be classified as functioning at one of the four developmental stages for each of the two tasks.

The Oscillation of a Pendulum and the Operations of Exclusion

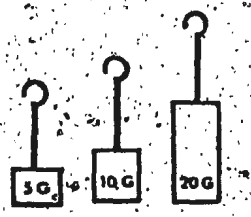
The task requires the individual to isolate several potentially relevant variables and then to determine which one actually plays a causal role; since the others have no effect they must be excluded after they have been isolated. The variables which one might think to be relevant are: the length of the string, the weight of the object fastened to the string, the height of the dropping point (i.e., amplitude of the oscillation), and the force of the push given by the individual. The individual is asked to indicate which factor is the most important in making the pendulum oscillate fast. In this case, since only the first of these factors is actually relevant, the problem is to isolate it from the other three and to exclude them. Only in this way can the individual

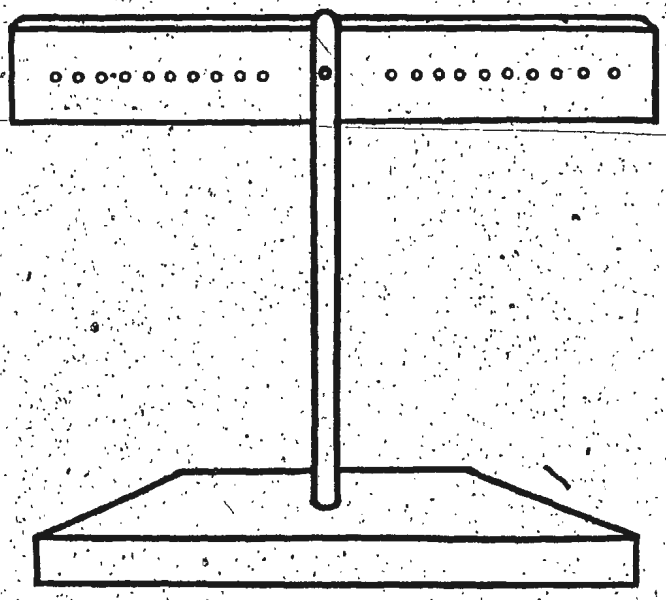
FIGURE 1

Piagetian apparatus with appropriate weights



A) **Pendulum problem apparatus; (inset – in operation)**





B) **Balance scale apparatus (inset – in operation)**

explain and vary the frequency of oscillations and solve the problem.

Equilibrium in Balance

This task employs a simple balance-type weighing instrument, a see-saw balance, with which the operational schema of equilibrium between action and reaction is found. The experimental task was set up in a way that would force the question of proportionality. A set of weights (no two are alike) is presented to the individual. He is asked to put two weights on the seesaw and to make the bar horizontal. The individual is forced to determine the law of proportionality, that is, the relationship between the weight and distance on the horizontal axis in order to balance it.

CLINICAL TESTS

Since the two Piagetian tasks just described have never been utilized as a means of assessing the level of cognitive functioning in aged adults, it is important to determine whether or not these tasks do in fact measure what has been clinically defined as cognitive ability. As previously mentioned, clinical tests have been frequently employed with the aged in the assessment of cognitive functioning. The utility of the Piagetian tasks may be determined by the degree of correlation with a number of well-established and frequently administered clinical tests which have been demonstrated to be quite sensitive in assessing the level of patients' cognitive functioning and degree of impairment.

When dealing with an old normal or more severely cognitively impaired sample population, three criteria should be kept in mind when selecting tests to administer to such a group:

(1) the tests should be reliable with such a sample population;

(2) the test instructions should be simple to comprehend; and

(3) the test should not be so tedious as to affect the individual's optimal level of performance.

Some tasks which meet these criteria are: 1) W.A.I.S. Vocabulary subtest; 2) W.A.I.S. Digit Span subtest; 3) Set Test; and 4) Verbal learning task.

W.A.I.S. Vocabulary subtest

Many investigators have provided findings which support the contention that a Vocabulary test gives an index of the maximal level of cognitive functioning which an individual has attained, whatever his present intellectual capacity may be (e.g., Davies, 1965; Esher, Raven, & Earl, 1942; Orme, 1957). Babcock (1930) was the first to systematically attempt to measure intellectual (cognitive) deficit by comparing a score on a vocabulary test, supposing this to be relatively impervious to decline and, therefore, to represent a maximum level of intellectual functioning, with scores on other kinds of tests more affected by the process of deterioration. Wechsler (1958) has also utilized the Vocabulary subtest from the Wechsler Adult Intelligence Scale (W.A.I.S.; Wechsler, 1955) as a "hold" item since it was believed to be resistant to deterioration. However, Dixon, (1965), Yates (1956), and Pinkerton and Kelly (1952) have obtained results which indicated that while vocabulary was resistant to decline in normal aging, it was not impervious to senile impairment. It is speculated that these three latter studies dealt with patients who were more severely cognitively impaired than those assessed by the investigators previously mentioned. It is reasonable to assume that once one has attained a certain degree of impairment, no task will "hold" or will be impervious to showing such a decline.

W.A.I.S. Digit Span subtest

Another subtest from the W.A.I.S. which has been readily employed in assessing cognitive impairment is Digit Span. Meer and Baker (1965) found this task to be reliable for both male and female patients and suggested that it is especially useful because the items in this subtest are graded in difficulty, which give all of the patients some feeling of success.

Gilbert (1941) and Bromley (1958) have reported little or no age decrement in forward digit span, whether auditory or visual. Drachman and Leavitt (1972) have also found that forward digit spans were not significantly different for young (mean 7.2) and aged (mean 6.3) adults. This finding is consistent with other experimental studies which reported no significant age-related differences in immediate memory span (Drachman & Hughes, 1971; Kriauciunas, 1968). In fact, Harwood and Naylor (1971) have found that the observed difference, such as it is, favored the elderly groups in the case of those between 70 and 89 years of age as compared with a group with an age range of 60-69 years.

According to those investigators who have found no decline in memory with age as measured by forward digit span, this lack of decrement may very well be attributed to the fact that the participants were merely required to store information "passively" and then recalled it. Where the task demanded that they manipulated or reorganized the material, on the other hand, the elderly were at a disadvantage (Craik, 1968). This notion was supported by the findings of Gilbert (1941) and Bromley (1958) who discovered that while digit span forward was little affected by aging, reversed digit span was significantly impaired. Reversed

digit span may prove to be a more sensitive test to indicate evidence of cognitive impairment.

Set Test

Another test which meets the relevant criteria and has been found to be quite useful in this area is the Set Test (Isaacs & Akhtar, 1972). The Set Test is a simple rapid test of mental function which requires an individual to recall items in four different common categories, namely, colors, animals, fruits, and towns. Among the advantages of the Set Test are that it is a simple rapid test of mental function and, therefore, avoids fatiguing the patient, a potential source of error in lengthy tests. Isaacs and Kennie (1973) found that the Set Test was usually enjoyed by the aged participants. The test scores obtained correlated closely with those obtained by other standard procedures (all significant at $p < .001$ level), namely, Mill Hill Vocabulary Test ($r = .40$), Raven's Progressive Coloured Matrices ($r = .41$), and a slight modification of the Crichton Memory and Intelligence Test ($r = .64$; Isaacs & Akhtar, 1972).

Verbal learning task

Verbal learning tasks are perhaps the most widely utilized for differentiating those who are cognitively impaired from those who are not. However, it appears that some verbal learning tasks are made more satisfactory than others due to procedural problems inherent with some of these tasks. Despite its favorable history (Inglis, 1957; 1959), Alexander (1973) found that the Paired Associate Learning Test (PALT) did not discriminate sufficiently clearly a brain-damaged, and, therefore, cognitively impaired group from either a normal or functional one, nor

did any systematic pattern of errors emerge which might have served as a basis for group differentiation. Not only the Inglis' PALT but also the Synonym Learning Test (SLT; Kendrick, Parboosingh, & Post, 1965, Kendrick, 1972) are subject to the following criticisms:

(1) if the task is found to be at all difficult by patients (which, with a geriatric group, is more the rule than the exception), then those patients tend to get easily frustrated and discouraged;

(2) with those patients who are having trouble with such a task, it is a very time consuming and laborious procedure for both patients and examiner to follow these tasks through to completion as is required by the tasks; and

(3) with those many patients who do find these tasks difficult and nonreinforcing, it poses a serious threat in maintaining the patients' level of interest, motivation, and may consequently contribute to sever any established rapport, thus making it very difficult to continue with further investigations.

One test which is not subject to the above criticisms is the Associate Learning subtest of the Wechsler Memory Scale (W.M.S.; Wechsler, 1945). An advantage of this test is that most patients are apt to get some paired-associates correct since they are divided into two categories: Easy and Hard. The incorporation of the easy list increases the probability that patients will be able to identify some pairs in the list which gives them a feeling of success and, therefore, will not be threatening to the continuation of the testing session (that is, the patients would not become uncooperative). Another advantage of this test is that it was designed so that the task terminates after only

three presentations of ten paired-associates. Therefore, the number of presentations is not contingent on the patients' performance which eliminates the self-defeating testing procedure of increasing the number of presentations as performance decreases (which is a feature of the Inglis' PALT). Kear-Colwell (1973) found the Associate Learning subtest to be one of the three subtests of the W.M.S. most affected with demented patients as compared with nondemented patients. In other words, it is a valuable and sensitive tool to detect the presence of cognitive impairment in those patients who are inflicted with organic brain pathologies.

All four tasks - Vocabulary subtest of the W.A.I.S., Set Test, Digit Span subtest of the W.A.I.S, and Associate Learning subtest of the W.M.S. - are feasible, practical, and reliable for geriatric patients and are crucial in that they measure an important dimension of intellectual functioning among the aged. As Miller (1973) suggested, memory disturbance is the most prominent behavioral deficit occurring in patients with dementia (that is, those patients who suffer from severe cognitive and behavioral deficits). In a study by Kral, Cahn, and Mueller (1964), it was concluded that the presence of an amnesic syndrome in an old person can be taken as a grave prognostic indicator of his general health as well.

RATING SCALES

In the final analysis, general impairment of the aged must be reflected in terms of behavioral status. Behavior rating scales are the most recent approach to a validity criterion of overall level of one's functional status.

There is evidence to suggest that the assessment of a patient's

behaviors in terms of social and physical dependence on others is at least as good as, if not better than, the usually-administered cognitive tests in determining degree of impairment with increasing age. For example, Simpson, Williams, Scott, and Crampton-Smith (1961), in a survey into the possible intellectual fall-off in older people following anaesthesia, applied both mental tests and rating scales to all patients over 65 years old who entered the United Oxford Hospitals for surgical procedures during the year 1959. The rating scales covered, amongst other things, daily activity, help required, and outside activity. Mental tests were also given to measure reasoning (Matrices), verbal learning (W.M.S.), and manual dexterity. Whereas no changes were found in any spheres which could be related to anaesthesia, the rating scales showed marked differences related to symptom alleviation, but the mental tests showed little variation.

Despite the fact that cognitive tests have been extremely useful in assessing an individual's level of cognitive functioning, there are immense difficulties inherent with these tests which stem principally from the wide range of baselines from which different individuals may start. The slight changes of ability shown by a person with an original I.Q. of 150 are very different from those shown by one of an I.Q. of 70, and no measuring scale which is sensitive enough to reflect the former would be certain to show up the latter (Williams, 1970). This is another reason why rating scales are often more adequate in this field than are cognitive tests.

In the cases where the individuals are more severely impaired, cognitive tests are too complicated, and may, therefore, be quite inappropr-

riate. Beyaert and Gras (1964) emphasized that behavior rating scales can yield valuable information on an individual, supplementary, to the usual clinical data. Klebanoff, Singer, and Wilensky (1954) noted that the tempo and degree of so-called deterioration in certain senile and organic conditions may be determined by the nature of social and other environmental factors.

A close correspondence exists between behavior rating scales and decision-making procedures with institutionalized patients. The effectiveness of these rating scales is measured in terms of how well they differentiate patients in various conditions. This, in turn, assesses the validity of behavioral rating scales which has been established by demonstrating their effectiveness in differentiating patients in open wards from those in closed wards (Ellsworth, 1962; Lorr, O'Connor, & Stafford, 1960; McReynolds & Ferguson, 1953), patients in remission from those not in remission (Ellsworth & Clayton, 1959; McReynolds & Ferguson, 1953) prediction of length of stay and post-hospital adjustment (Ellsworth & Clayton, 1959), and by efficacy in discriminating between groups which have received treatment from those which have not (Burdock, Elliott, Hardesty, O'Neill, & Sklar, 1960).

Meer and Baker (1966) developed the Stockton Geriatric Rating Scale (SGRS), a rating scale based on the observation of geriatric patients in their day-to-day behavior in a hospital setting. They found that two independent factor analyses yielded four stable factors which, although intercorrelated, tap somewhat different facets of elderly patients' daily behavior in a mental hospital setting. The four factors are: (1) Physical Disability (PD): items within this factor are directly

or indirectly concerned with the ability of the patient to take care of his day-to-day physical needs.

(2) Apathy (AP): items within this factor are concerned with the patient's involvement in his ward environment.

(3) Communication Failure (CF): the underlying dimension here is clearly communication and was not restricted to any particular medium.

(4) Socially Irritating Behavior (SIB): taps a dimension related to socially undesirable behavior.

The reliability of the factor scores, in terms of their internal consistency and interrater reliability, was deemed adequate for both research and clinical uses, particularly if two independent ratings are made on each patient. The validity of the factor scores was tested by relating them to three separate follow-up studies and by noting the changes in the factor scores (pre- and post-shock) of patients who responded extremely well to ECT. The results again verified the validity of the factor scores in predicting outcome and in being sensitive to changes in the patients' level of impairment.

The factor scores, with the possible exception of CF, have demonstrated adequate degrees of internal consistency (coefficients ranged from .77 to .92) and interrater reliability (coefficients ranged from .70 to .88). However, CF, despite its marginal interrater reliability, showed a surprising amount of power in every test of its validity. Meer and Baker (1966) have found the SGRS useful as a screening device for large numbers of chronic geriatric patients in terms of selecting those patients who have a good potential for leaving the hospital. King and

Krag (1967) have also found the SGRS extremely useful in placing patients in a particular ward depending on the severity of disability as measured by the SGRS.

Taylor and Bloom (1974) assessed a total population (n = 493) of hospitalized geriatric patients with the SGRS and further demonstrated its utility as a measure of functional social ward behaviors by conducting a cross-validation study upon such a population of geriatric patients whose primary diagnosis was organic (Chronic Brain Symdrome) rather than functional. They found the simplicity, utility, and consistency of the SGRS to be excellent. A recent review and evaluation of behavior rating scales rated the SGRS as the most promising of existing scales for rating geriatric patients (Salzman, Shader, Kochansky, & Cronin, 1972).

It is quite apparent, therefore, that the SGRS is probably the most suitable and applicable behavior rating scale for assessing the status of behavioral functioning for geriatric patients for the following reasons:

(1) it was specifically designed for assessing geriatric patients;
(2) the standardization samples included geriatric patients only;
(3) it does not require skilled clinical raters;
(4) it is not overly long and detailed;
(5) it does not require patient cooperation;
(6) it yields factor scores which have satisfactory internal consistency and interrater reliability.

INAPPROPRIATENESS OF GROUP DICHOTOMIZATION

It is rather unfortunate that many of the experimental designs in the studies related to aging make use of the distinction between "normal

aging" and "dementia". Such a dichotomy is quite gross and non-essential in identifying the cognitive processes involved. Granted, psychiatry is often concerned with those individuals for whom the process of development has been reversed to an atypically extreme degree, so that instead of evolution there is dissolution, instead of progression there is regression. However, Alexander (1972) asserts that although the concept of "senile dementia" has seen long service both in the clinical and literary fields, it has been employed in an ill-defined and over-inclusive fashion, and its development has been shrouded by the use of ambiguous and emotive language. Generally, it has accommodated a heterogeny of senile disorders and deviations.

It appears, therefore, that rather than dichotomizing groups of people, which seems a gross approach towards reliably identifying cognitive processes affected by aging, a more appropriate strategy would involve identifying these processes on a continuum. Thus, an aged population could be differentiated on a continuun from persons who are quite healthy (showing little or no cognitive and behavioral impairment) to persons who are markedly impaired (suffering disease or nearing death). The notion which is of crucial importance is that cognitive processes, or rather the impairment of these processes, can be measured in terms of <u>degree of impairment</u> on a continuum from normal cognitive functioning to severe impairment, rather than in terms of a simple dichotomy.

AIMS OF PRESENT RESEARCH

The studies referred to above add much support to the contention that the assessment of behavior, as measured by a behavior rating scale,

is the most appropriate strategy to employ in determining the degree of impairment in aged adults. In terms of specific procedures which one may employ, the Stockton Geriatric Rating Scale (SGRS) is the most adequate behavior rating scale in predicting overall impairment with the institutionalized elderly.

It is expected that the four cognitive tests selected, namely, Vocabulary and Digit Span subtest of the W.A.I.S., the Set Test, and the Associate Learning subtest of the W.M.S., should highly intercorrelate with each other (since all four tasks are related to memory functions).

In order to measure level of performance on the Piagetian tasks, each of the four hypothetical levels of cognitive development, that is, from sensorimotor to formal operations, will be assigned the values of 1 to 4, respectively. Hence, direct comparisons may then be made between the scores obtained on the two Piagetian tasks with scores obtained from the four clinical cognitive tests as well as with the behavior rating scale scores. The two Piagetian tasks are expected to highly correlate with one another. Since investigators have claimed that the clinical tests and the Piaget-ian tasks tap a cognitive dimension, these should also correlate with one another. That is to say, as the scores decrease on the clinical tests, so should the Piagetian levels of cognitive development decrease, and vice versa.

From the evidence provided by Anderson and Davidson (1975) that there is a positive relationship between mental status and behavioral (social health) status of aged adults, such a relationship should also be found with the Piagetian tasks, the clinical tests, and the behavior rating scale scores.

Since, as previously demonstrated, behavior rating scales are the most valid measures available in assessing degree of overall impairment in the aged in nursing homes, and since the SGRS is the most adequate behavior rating scale, it will be used as the criterion. The Piagetian tasks are expected to be at least as good as the clinical tests in predicting scores obtained on the behavioral rating scale.

In order to eliminate the confounding variable of dichotomization of groups which appears to yield little information about the actual ongoing cognitive processes, the geriatric sample populations' results will be treated as continuous rather than as dichotomous variables.

METHOD

SAMPLE POPULATIONS

The geriatric sample population consisted of 40 aged patients (age range: 60 - 104 years) from the Hoyles Home for the Aged and St. Patrick's Mercy Home in St. John's, Newfoundland. All patients were screened to exclude:

(1) any physical disabilities which were not direct consequences of an ongoing brain pathology (Organic Brain Syndrome);

(2) any gross auditory, visual, and tactile impairment; and

(3) any who were not willing to fully cooperate with the examiner for complete assessment.

Fifteen younger individuals (age range: 18-46 years) were obtained from both the secretarial and janitorial staff from Memorial University of Newfoundland. They were assessed for purposes of a control group to ascertain that these younger individuals were able to perform at a higher level of the Piagetian hierarchy than the older group when controlling for Vocabulary scaled scores. This procedure was necessary since Piaget has not conducted the appropriate standardization for his tasks on a sample constituting this particular age range.

PROCEDURE

Each individual patient was evaluated on the Stockton Geriatric Rating Scale (SGRS) by two independent ward nurses who were quite familiar with these patients. The nurses were instructed to base their ratings on at least one week's observation of the patients. They were told to simply indicate, for each of the 33 statements of the SGRS, which of the 2 or 3 items following each statement best described the patients.

Each patient was administered, in a random order, the two Piagetian tasks, The Oscillation of a Pendulum and the Operations of Exclusion, and Equilibrium in Balance. The reason for administering the two Piagetian tasks prior to any of the other four cognitive tasks was to secure the patients' interest in taking part in the assessment procedures. This was done since the former tasks were found to be most enjoyable and least threatening by most patients. It reduced the possibility of terminating the session before assessment was completed. All patients were encouraged at all times by the examiner to perform at their maximum level as is required by the administration of all Piagetian tasks. All responses were recorded on a Sony portable tapecorder (model TC-110 B) to be later rated by three raters. The scoring criteria for all of these tasks for each stage of development are presented in the Appendix.

Each patient was then administered, in a random order, the following clinical tests:

(1) Set Test: the individuals were required to generate instances (up to a maximum of ten) from each of four conceptual categories (colors, animals, fruits, and towns). One point was awarded for each instance generated, with a maximum of forty points awarded over the entire test.

(2) Digit Span subtest of the W.A.I.S.: the Digits Forward and Backward were administered separately. For both, the digits were presented at the rate of one per second, not grouped. The score for Digits Forward was the number of digits in the longest series repeated without error in Trial I or Trial II (maximum score: 9). The score for Digits Backward

was the number of digits in the longest series repeated backwards without error in Trial I or Trial II (maximum score: 8). The total score for the Digit Span test was the sum of the scores on Digits Forward and Digits Backward (maximum score: 17).

(3) Vocabulary subtest of the W.A.I.S.: a 40 word list was placed before the patient who was instructed to tell the examiner what each word meant after the examiner had pronounced and pointed to the appropriate word. Each individual was started with the first word and continued until five consecutive words were failed. Each of items 1-3 was scored 2 or 0 and each of items 4-40 was scored 2, 1, or 0. The common meanings, specific scoring criteria, and sample answers presented by Wechsler (1955) were employed to determine the appropriate scores for each of the 40 words.

(4) Associate Learning subtest of the W.M.S.: three presentations of 10 random paired-associates were given to each individual. One credit was awarded for each response given within a 5-second period. The total score was calculated in the following manner: (1) totalled all credits obtained on <u>easy</u> associations in the three recalls and divided this sum by 2; (2) totalled all credits obtained on <u>hard</u> associations; (3) combined the values from (1) and (2) to obtain the final score for the test. A maximum score of 21was obtainable.

RESULTS

COMPARISON OF THE YOUNG AND AGED SAMPLE POPULATIONS

Since several researchers in this area (e.g., Eisdorfer, Busse and Cohen, 1959; Harwood and Naylor, 1971; Meer & Baker, 1966; have found gender to be an important variable, it was included in all analyses of the present study. As TABLE 1 depicts, the males and females from the young sample population (control group) did not significantly differ on Age (t (13) = 0.08, $p > .05$), Vocabulary scaled scores (t (13) = -0.51, $p > .05$), nor on the mean scores on the two Piagetian tasks (t (13) = 0.20, $p > .05$).

The interrater reliabilities on the two Piagetian tasks ranged from .85 to 1.00 (see TABLE 2). The inter-task reliability however, was quite low (r = .07, $p > .05$), although, as TABLE 3 illustrates, the means did not differ significantly from each other (t (14) = -0.40, $p > .05$).

The males and females from the aged sample population also did not significantly differ on Age (t (38) = 0.01, $p > .05$), Vocabulary scaled scores (t (38) = -0.75, $p > .05$), nor on the mean scores on the two Piagetian tasks (t (38) = 1.15, $p > .05$; see TABLE 4).

TABLE 5 indicates that the interrater reliabilities on the two Piagetian tasks for the aged sample population ranged from .86 to .94. Unlike the young sample population, the inter-task reliability of the two Piagetian tasks was satisfactory (r = .87, $p < .05$).

Since the variances of the young and the aged samples differed significantly for both the Vocabulary scaled scores (F (39, 14) = 6.59, $p < .001$) and the mean scores of the two Piagetian tasks (F (39, 14) = 5.62,

TABLE 1. SEX DIFFERENCES ON THREE VARIABLES FOR THE YOUNG (CONTROL) SAMPLE POPULATION.

VARIABLE	SEX	N	$\bar{X}$	S.D.	t*
AGE	MALE	4	27.50	6.35	0.08
	FEMALE	11	27.09	9.91	
VOCABULARY	MALE	4	7.25	1.71	-0.51
	FEMALE	11	7.75	1.56	
PIAGETIAN TASKS	MALE	4	3.38	0.48	0.20
	FEMALE	11	3.38	0.32	

*All values for t are not significant ($p > .05$); df = 13.

TABLE 2. INTERRATER RELIABILITIES ON TWO PIAGETIAN TASKS FOR THE YOUNG (CONTROL) SAMPLE POPULATION.

	RATER COMPARISONS		
PIAGETIAN TASK	1 x 2	1 x 3	2 x 3
BALANCE SCALE	.85	1.00	.85
PENDULUM	.87	1.00	.87

TABLE 3. MEAN DIFFERENCES ON TWO PIAGETIAN TASKS FOR THE YOUNG (CONTROL) SAMPLE POPULATION.

PIAGETIAN TASK	N	$\bar{X}$	S.D.	t
BALANCE SCALE	15	3.31	0.46	-0.40*
PENDULUM	15	3.38	0.49	

*Value for t is not significant ($p > .05$); df = 14.

TABLE 4. SEX DIFFERENCES ON THREE VARIABLES FOR THE AGED SAMPLE POPULATION.

VARIABLE	SEX	N	$\bar{X}$	S.D.	t*
AGE	MALES	13	83.00	9.12	0.01
	FEMALES	27	83.04	8.69	
VOCABULARY	MALES	13	6.62	4.03	-0.75
	FEMALES	27	7.63	3.89	
PIAGETIAN TASKS	MALES	13	2.55	0.88	1.15
	FEMALES	27	2.23	0.80	

*All values for t are not significant ($p > .05$); df = 38.

TABLE 5. INTERRATER RELIABILITIES ON TWO PIAGETIAN TASKS FOR THE AGED SAMPLE POPULATION.

	RATER COMPARISONS		
PIAGETIAN TASK	1 x 2	1 x 3	2 x 3
BALANCE SCALE	.91	.91	.94
PENDULUM	.92	.89	.86

$p < .001$), Wilcoxin (Rank Sum) Tests were performed on both sets of scores. A z - score of -1.17 was obtained for the Vocabulary scaled scores which yielded a rather high probability value of .2420. On the other hand, a z - score of -4.48 was obtained for the Pendulum task, a z - score of -3.31 for the Balance Scale, and a z - score of -4.39 for the mean scores on the two Piagetian tasks, which were all highly significant ($p < .001$). This indicated that although the young and the old individuals did not differ on the Vocabulary scaled scores, the young group was able to perform much better on the Piagetian tasks than the older group.

ANALYSES OF PREDICTED AND PREDICTOR VARIABLES

The following statistical analyses are based on the aged sample's data. The interrater reliability on the predicted variable, the Stockton Geriatric Rating Scale (SGRS), was +.88. Four factors of the SGRS, namely, Apathy (AP), Physical Disability (PD), Socially Irritating Behavior (SIB), and Communication Failure (CF), yielded interrater reliabilities of .93, .92, .66, and .66, respectively.

Pearson Product Moment Correlation Coefficients (r) between SGRS and several predictor variables are illustrated in TABLE 6. Since the number of paired associates for the Easy and Hard Lists of the Associate Learning subtest were different, percentages for these two lists were calculated for each individual to equate the two sets of scores for further statistical analyses. All predictor variables (with the exception of the Hard List of the Associate Learning subtest and Sex) significantly correlated with the predicted variable. The two highest correlations were between the predicted variable and the Set Test ($r = -.766$, $p < .001$) and the mean scores of the two Piagetian tasks

TABLE 6. PEARSON PRODUCT-MOMENT CORRELATION COEFFICIENTS BETWEEN SGRS AND 11 PREDICTOR VARIABLES.

PREDICTOR VARIABLES	CORRELATION WITH SGRS	VARIANCE	P
PIAGETIAN TASKS ($\bar{X}$)	-.728	.530	< .001
VOCABULARY SUBTEST	-.314	.099	< .05
SET TEST	-.766	.587	< .001
ASSOCIATE LEARNING (EASY)	-.611	.374	< .001
ASSOCIATE LEARNING (HARD)	-.302	.091	NS
ASSOCIATE LEARNING SUBTEST	-.564	.318	< .001
DIGIT SPAN (FORWARD)	-.313	.098	< .05
DIGIT SPAN (BACKWARD)	-.459	.211	< .003
DIGIT SPAN SUBTEST	-.431	.185	< .006
AGE	+.358	.128	< .02
SEX	-.291	.084	NS

($r = -.728$, $p < .001$). Although Age did significantly correlate with SGRS, it accounted for relatively little variance in predicting SGRS scores, when compared with the variance accounted for by the Set Test and the Piagetian tasks. However, from such a simple bivariate analysis, natural phenomena cannot be adequately understood and explained because of the complex interactions of the predictor variables as they impinge upon the predicted variable. Bivariate methods of analyses assume orthogonality between the predictor variables when in fact the correlations may be confounded by intercorrelations among these variables.

For the above reasons, a multivariate analysis was performed on the data. It is quite apparent from the correlation matrix (TABLE 7) that the predictor variables were not orthogonal and multiple regression analysis was, therefore, necessary to take these high intercorrelations into account. In fact, not only were the correlations between the SGRS and the cognitive tests significant (all $ps < .05$), but also the intercorrelations of all the cognitive tests (all $ps < .01$).

Although all predictor variables are presented in TABLE 7, this should not be taken to be taken to imply that only one regression analysis was performed on the data. On the contrary, two separate regression analyses were computed since the components as well as the total scores of some of the tasks were treated as predictor variables. Otherwise, if the components and the total scores were both included in the same correlation matrix, either would have acted as a "suppressor" variable. This would consequently increase the intercorrelations among the predictor variables and inevitably decrease the amount of variance accounted for by each of the components and the total score.

TABLE 7. CORRELATION MATRIX OF 14 VARIABLES.

VARIABLES	PEN-DULUM	BA-LANCE	PIA-GET (X)	VOCAB	SET	ALEZ	ALHD	ASS-LRN	DSFD	DSBD	DIG-SPN	AGE	SEX
SGRS	-.72	-.69	-.73	-.31	-.77	-.61	-.30	-.56	-.31	-.46	-.43	.36	-.29
PENDULUM		.87	.96	.58	.71	.68	.34	.63	.44	.58	.56	-.39	.16
BALANCE			.97	.58	.59	.63	.39	.62	.37	.58	.54	-.36	.19
PIAGET (X)				.60	.67	.68	.38	.65	.42	.60	.57	-.39	.18
VOCAB					.43	.72	.40	.68	.45	.57	.58	-.43	-.12
SET						.77	.47	.74	.28	.47	.41	-.44	.29
ALEZ							.59	.96	.22	.52	.41	-.60	.15
ALHD								.80	-.12	.25	.10	-.49	-.02
ASSLRN									.12	.48	.34	-.62	.10
DSFD										.54	.76	-.10	-.13
DSBD											.93	-.37	-.02
DIGSPN												-.22	-.06
AGE													-.00

TABLE 8 presents the results of the multiple regression analyses performed on the data. Three features of these analyses should be noted: First, the only predictor independent variables which accounted for significant amounts of variance were the mean scores of the two Piagetian tasks (as well as each task independently) and the Set Test. Second, with the exception of the Vocabulary subtest, the amount of variance accounted for by each of the remaining predictor variables, as well as the combination of these remaining variables, was less than 1% of the variance in SGRS. Finally, the Vocabulary subtest, although clearly a better predictor than the remaining predictor variables (of course, excluding the Piagetian tasks and the Set Test), failed to reach significance. On the other hand, the incremental variance which the Vocabulary subtest contributed, when combined with the Piagetian tasks and the Set Test, was 3.87%. This increase in prediction is considered to be a substantial enhancement in the predictive power of these three tests. This is especially true when it is considered that this enhancement accounts for more than 4 times the variance accounted for by any of the remaining predictor variables and almost 6 times better in prediction than the combined effects of these variables. For these reasons, the Vocabulary subtest should be included with the Piagetian tasks and the Set Test. These three measures together accounted for more than 25% of the variation in SGRS which was highly statistically significant (F (3, 32) = 9.44, $p < .001$).

A canonical correlation analysis, a generalization of the multiple regression analysis to any number of predicted variables, was performed with the 4 factors of the SGRS as predicted variables and the 7 predictor

TABLE 8. SUMMARY OF THE RESULTS OF THE MULTIPLE-REGRESSION ANALYSES OF PREDICTOR VARIABLES ON SGRS.*

VARIABLES	VARIANCE	F-RATIO	df	p
PIAGETIAN TASKS ($\bar{X}$)	.08664	9.50	1,32	< .01
BALANCE SCALE	.10110	11.39	1,32	< .01
PENDULUM TASK	.06401	6.48	1,32	< .025
SET TEST	.07363	8.07	1,32	< .01
VOCABULARY SUBTEST	.02048	2.25	1,32	NS
ASSOCIATE LRNG. (EASY)	.00479	0.49	1,32	NS
ASSOCIATE LRNG. (HARD)	.00893	1.01	1,32	NS
ASSOCIATE LRNG. SUBTEST	.00000	0.00	1,32	NS
DIGIT SPAN (FORWARD)	.00784	0.79	1,32	NS
DIGIT SPAN (BACKWARD)	.00077	0.09	1,32	NS
DIGIT SPAN SUBTEST	.00476	0.52	1,32	NS
AGE	.00110	0.12	1,32	NS
SEX	.00103	0.11	1,32	NS
FULL MODEL	.70820	11.09	7,32	< .001
PIAGETIAN TASKS ($\bar{X}$) + VOCABULARY SUBTEST + SET TEST	.25820	9.44	3,32	< .001
PIAGETIAN TASKS ($\bar{X}$) + SET TEST	.21953	12.04	2,32	< .001
ASSOC. LRNG. SUBTEST + DIGIT SPAN SUBTEST + AGE + SEX	.00654	0.18	4,32	NS

*Calculated by means of the Statistical Packages for the Social Sciences (Nie, et al., 1975).

variables. All scores for each of the four factors of the SGRS were converted to percentages due to the varying number of statements contributing to the total of each factor. Through least squares analysis, two linear composites were formed, one for the predicted variables and one for the predictor variables. The canonical correlation (R), that is, the correlation between the two composites, was .85. Therefore, 72% of the variance is shared by these two composites which is a fairly substantial relation. It should be noted from TABLE 9 that the greatest contribution to the correlation comes from the Piagetian tasks, the Vocabulary subtest, the Set Test (predictor variables) and Apathy, and to a lesser extent, Physical Disability (predicted variables). In other words, the three predictor variables which were found to be the best predictors of variance in SGRS in fact predict variance in much more specific factors, namely, Apathy and Physical Disability. This is not surprising as these are the two more reliable factors according to Meer & Baker (1964). Another interesting feature of the results from this analysis was that the coefficients of the three predictor variables which made the greatest contributions to the canonical correlation lie on a bipolar dimension with the Piagetian tasks and the Set Test at one end and the Vocabulary subtest at the other end of the dimension. Lastly, canonical correlation analysis provided support for the contention that the Vocabulary subtest does in fact make a significant contribution in predicting variation in the SGRS.

TABLE 10 indicates that the components of the Digit Span subtest (Digit Span Forward and Digit Span Backward) and the components of the Associate Learning subtest (Easy and Hard Lists) were found to be sig-

TABLE 9. CANONICAL CORRELATION COEFFICIENTS ON 4 FACTORS OF SGRS AND 7 PREDICTOR VARIABLES.*

PREDICTED VARIABLES	COEFFICIENTS	PREDICTOR VARIABLES	COEFFICIENTS
PD	0.17546	PIAGETIAN TASKS	-0.62903
AP	0.79126	SET TEST	-0.52358
CF	0.02860	VOCABULARY SUBTEST	+0.32500
SIB	0.09999	ASSOCIATE LEARNING SUBTEST	-0.00542
		DIGIT SPAN SUBTEST	-0.08934
		AGE	+0.08240
		SEX	-0.04165

*Calculated by means of the Statistical Packages for the Social Sciences (Nie, et al., 1975).

nificantly different (t (39) = 10.49 and 6.61, $p < .001$, respectively). This clearly illustrates that the aged did considerably better with Digit Span Forward than Digit Span Backward and with the Easy List than the Hard List of the Associate Learning subtest.

TABLE 10. COMPONENT DIFFERENCES WITHIN TWO COGNITIVE TASKS.

VARIABLE	COMPONENTS OF THE VARIABLE	N	$\bar{X}$	S.D.	t
DIGIT SPAN	FORWARD	40	5.38	1.21	10.49*
	BACKWARD	40	2.98	1.69	
ASSOCIATE LEARNING	EASY LIST	40	.36	.35	6.61*
	HARD LIST	40	.06	.12	

*$p < .001$; $df = 39$.

DISCUSSION

The present study supports the contention that Piagetian tasks are very useful measures in assessing cognitive deficiency in the institutionalized elderly. The results indicate that the average score obtained by administering two Piagetian tasks is the most predictive of an aged individual's overall mental and behavioral status. As previously demonstrated, the combination of the mean score of two Piagetian tasks, the Set Test, and the W.A.I.S. Vocabulary subtest, is more highly predictive than any other combination.

DIFFERENCES IN INFORMATION PROCESSING

The present finding of a significant difference between Digit Span Forward and Digit Span Backward as well as between the Easy and Hard Lists of the Associate Learning subtest (TABLE 10) illustrates the relevance of these tasks in contributing to the enhancement of our knowledge concerning ongoing cognitive processes in the elderly in nursing homes. This parallelling research evidence obtained with both digit span tasks and the paired-associate scores is compatible with Craik's (1968) theory on information processing. As previously noted, Craik has advanced the theory that "passively" storing information (as required by the W.A.I.S. Digit Span Forward and the Easy List of the W.M.S. Associate Learning subtest) has little age decrement compared with having to manipulate or reorganize the material (as required by the W.A.I.S. Digit Span Backward and the Hard List of the W.M.S. Associate Learning subtest) which has a substantial age decrement.

SEX DIFFERENCES

The finding of a nonsignificant score difference by sex corroborates

the results by Plutchik, et al., (1970) and Storck, et al., (1972) but is counter to the findings of Meer and Baker (1966) and Taylor and Bloom (1974). This lack of a significant finding is a direct consequence of the method employed in selecting the aged sample. As previously outlined, restrictions were set in terms of which patients in the institutions were suitable for the present study. This strategy appears to have eliminated many who were uncooperative and may, therefore, have been subsequently more cognitively impaired than those patients who were willing to subject themselves to assessment. This may have consequently equated both sexes in terms of degree of cognitive and behavioral impairment.

COMPARISON BETWEEN YOUNG AND AGED SAMPLES

The finding of a significant difference on the Piagetian tasks between the young and the old samples without differing on the W.A.I.S. Vocabulary subtest (which, as Foulds & Raven (1948) indicated, is the best estimate of I.Q.) is in agreement with conclusions reached by several other investigators (Papalia, et al., 1972; Sanders, et al., 1966; Storck, et al., 1972) that the elderly do not possess the ability to reason abstractly to the same degree as the younger individuals. Because they are unable to abstract as well does not mean that they have lost this ability since it remains to be demonstrated that they originally acquired it. Such a conclusion may not be drawn from a simple cross-sectional design. It is not yet possible to state that the elderly have "regressed" to a lower level of cognitive functioning. What has been demonstrated is that, in contrast to their younger counterparts, the aged individuals were not able to demonstrate as much ability to reason abstractly as defined by the Piagetian stage of formal operations. A

more appropriate research design would be the three component method of analysis proposed by Schaie (1965, 1967). In addition to cross-sectional and longitudinal comparisons, the three component method includes a necessary timelag comparison. Neither the traditional cross-sectional nor the less common longitudinal designs allow the investigator to unconfound socio-historical from individual-temporal changes. However, with a time-lag design, the comparison is of different cohorts, each measured at a different period of time.

By combining Piagetian cognitive developmental theory with the three component method of analysis, the kind of qualitative decline described by Bromley (1971) and Papalia, et al., (1972) may be experimentally demonstrated. Now that a strong relationship has been demonstrated between the Piagetian cognitive tasks and the SGRS, the identification of the extent or degree of "regression" to which some unhealthy aged adults have reverted is now possible; that is, the more one becomes behaviorally impaired, the lower in Piaget's hierarchy of cognitive development will he be assessed as functioning when measured over an extended time period.

FLUID AND CRYSTALLIZED INTELLIGENCE

The evidence of a bipolar dimension with the Piagetian tasks and the Set Test at one end and the W.A.I.S. Vocabulary subtest at the opposite end in predicting the four factors of SGRS appears incompatible with Cattell's (1963, 1967) theory of fluid and crystallized intelligence. Fluid intelligence represents

> processes of perceiving relations, educing correlates, maintaining

> span of immediate awareness in reasoning, and abstracting in both speeded and unspeeded tasks of a relatively culture-fair kind but involving figural, symbolic, and semantic content (Horn & Cattell, 1966, p. 268).

On the other hand, crystallized intelligence represents

> processes of perceiving relations, educing correlates, etc., in speeded and unspeeded tasks involving various kinds of content, but tasks requiring considerable pretraining to acquire techniques representing the accumulated wisdom of a culture (Horn & Cattell, 1966, p. 268).

Cattell (1963) also proposed that these two abilities are differentially affected with increasing age. He predicted and found evidence to suggest that although both abilities appear to develop simultaneously, fluid intelligence slowly decreases with age while crystallized intelligence is relatively uneffected. Recent evidence by Cunningham, Clayton, and Overton (1975) has substantiated this proposition. They found that the correlation between the Raven's Progressive Matrices (R.P.M. - a measure of fluid intelligence) and the W.A.I.S. Vocabulary subtest (a measure of crystallized intelligence) was high for a sample of young adults (r = .672) and was substantially lower for an elderly sample (r = .386).

Storck, et al., (1972) found that Piagetian measures were more closely related to an index of fluid intelligence (measured by R.P.M. and a psycho-motor speed task) than to an index of crystallized intelligence (measured by the Stanford-Binet Vocabulary subtest). These results are in essential accord with Clayton's (in Storck, et al., (1972) findings concerning a W.A.I.S. verbal subtest, the Raven test, and an index of

Piagetian formal reasoning.

Since the Set Test (Isaacs & Akhtar, 1972) is a relatively new test, no investigator has yet attempted to relate this test with the theory of fluid and crystallized intelligence. By definition, it should be classified as a measure of crystallized intelligence since it taps information stored in memory and it is dependent on the accumulated wisdom of a culture which requires pretraining. However, Isaacs and Akhtar (1972) found a significant negative correlation between age and score on the Set Test ($r = -.529$, $p < .001$). Such a decrease with age in the number of instances generated with the word fluency task is compatible with results from the present ($r = -.44$, $p < .01$) and other studies (Schaie & Strothers, 1968; Stones, unpublished). As previously discussed, such a decline with age is characteristic of measures of fluid intelligence. Also, it is evident from TABLES 10 and 11 that a much closer relationship exists between the Set Test and the Piagetian tasks (measures of fluid intelligence) than with the Vocabulary subtest (a measure of crystallized intelligence). Therefore, the fact that the Set Test scores decrease with age and, based on the present research evidence, that these scores on the same end of a bipolar dimension with a task characteristic of fluid intelligence is in opposition to Cattell's formulation.

AGE AS A PREDICTOR VARIABLE

The present findings as well as those of several other investigators (e.g., Birren, 1970; Fozard & Thomas, 1975) provided convincing evidence that age in itself is a weak variable. That is, age alone indicates very little about an individual that could not be discovered much more accurately with even minimal psychological testing. The notion of

"decline with age" does not appear to be accurate and meaningful in many instances. What should be emphasized instead is a decline of behavioral and cognitive status. This need of change in emphasis is well demonstrated in a study by Pinkerton and Kelly (1952) who found that, with 50 patients who were graded clinically into 5 groups, A to E, E being the most demented, there was no significant correlation between clinical rating and age. Kahn, Goldfarb, Pollack, and Gerber (1960) also found that mental status was superior over age as an index for the prediction of physical functional status. Since age is apparently an insignificant predictor variable, it is crucially important to determine which factors are in fact paramount in assessing the functional status of the elderly.

HEALTH - A NEGLECTED VARIABLE

Birren (1970) advanced the hypothesis that change in intelligence in late life, as measured by conventional techniques, is not normally distributed. It was noted that in some healthy senior men very little change occurred even into the ninth decade while a small number of others showed striking declines in scores on the W.A.I.S. and R.P.M. which seemed also to correlate with probable survival.

The assessment of the role of health was also implicit in a study by Botwinick and Birren (1963) which attempted to examine older men who were so unusually healthy as to be atypical or non-representative of people of their ages. They were selected to meet the requirement of no apparent disease of any kind even after intensive medical examination (Group I). A second Group (II) was composed of men who were medically separated from the highly select sample but who were still much healthier than those normally seen in a representative sample of similar age. The

men of both Groups I and II were given several cognitive tasks and it was found that the actual scores were poorer for the less healthy group than for the optimally healthy group in all but two tests. From these results, the authors concluded that even slight alterations of optimum health of the elderly can adversely affect their intellectual functioning. An even more convincing set of results was presented by Harwood and Naylor (1971). They found that with an above average physical and social activity level an elderly group between the ages of 70 and 89 years actually obtained higher Digit Span scores than a much younger group.

The parallellism between physical and mental status, as evidenced by the previous research findings, appears not to have been supported by the present results since the cognitive tasks predicted Apathy rather than Physical Disability. It is possible that this outcome may have occurred as a result of institutionalization. A post hoc analysis of the data, removing the Apathy factor, very clearly indicates that the cognitive tasks do in fact predict Physical Disability (TABLE 11). The significance of the Apathy factor in relation to the mental status of the institutionalized elderly is discussed below. There is no doubt, therefore, that the present results are in accordance not only with the previously mentioned studies but also with the conclusion drawn by Kahn, et al.. (1960) that physical and mental aspects of functioning cannot be compartmentalized in aged persons.

ENVIRONMENTAL INFLUENCES

Some investigators have found increased cognitive impairment with institutionalized as compared with non-institutionalized individuals. This is exemplified in a study by Denney and Cornelius (1975) which

TABLE 11. CANONICAL CORRELATION COEFFICIENTS ON 3 FACTORS OF SGRS AND 7 PREDICTOR VARIABLES.*

PREDICTED VARIABLES	COEFFICIENTS	PREDICTOR VARIABLES	COEFFICIENTS
PD	0.85581	PIAGETIAN TASKS	-0.51779
CF	-0.02923	SET TEST	-0.57769
SIB	0.34247	VOCABULARY SUBTEST	+0.24841
		ASSOCIATE LEARNING SUBTEST	+0.05424
		DIGIT SPAN SUBTEST	-0.22543
		AGE	+0.00519
		SEX	-0.08689

*Calculated by means of the Statistical Packages for the Social Sciences (Nie, et al., 1975).

employed class inclusion and multiple classification tasks and administered them to two separate age groups as well as to three samples of aged individuals residing in various environments. They found that the middle-aged group performed better than all of the elderly groups on both the class inclusion and multiple classification tasks. For the multiple classification scores, they found that the middle-aged group scored significantly higher than both the community elderly and institutionalized elderly groups; the community elderly group scored significantly higher than the institutionalized group.

Lewandowski (1962) has also observed that if elderly men and women are left alone (as was found to be the case with the present aged sample), "they tend to become more and more withdrawn, disinterested and apathetic; they deteriorate intellectually, mentally and physically" (p. 528). It is not surprising, therefore, that the cognitive measures in the present study clearly predicted Apathy first and once this factor was removed, significantly predicted Physical Disability. It is evident that mental and physical status are very highly interrelated and that apathy may be a confounding variable with the institutionalized elderly which may subsequentally enhance decline in these two functions.

Another aspect of environmental influence which affects the older person is the additional strain of the negative attitudes and inadequacies of a society that fails to meet his special needs and which downgrades the value of experience and age. MacMillan (1960) has noted that when an old person lives in isolation, deterioration - either psychological because of lack of interest, antagonism, self-pity or resentment on the

part of relatives, or actual, because of solitude - sets in. He feels that when the emotional needs of an old person have been unsatisfied for any length of time, senile deterioration with subsequent onset of senile psychosis begins.

The work of Schonfield (1967, 1973) and Schonfield and Hooper (1973) has made a significant contribution in demonstrating the need for change in attitude toward aging. A switch of emphasis from the negative consequences of aging to the positive attributes of successful aging has been emphasized by these investigators. Such an approach in perceiving these individuals creates a healthy attitude which may subsequently enhance our understanding of the elderly. It is only when health care professionals and the general public interact with older individuals as individuals, regardless of their labels, and learn to interpret behavior with regard to the environmental context, will progress be made in providing appropriate living conditions for these people.

PIAGETIAN THEORY AND ENVIRONMENTAL INFLUENCES

Piagetian theory emphasizes the individual's interaction with his environment and the gradual elaboration of cognitive schemes which follow this interaction. The transitions from one state of knowledge to the following stage can thus be seen as phenotypical transformations which account for modification in the individual's cognitive competence. Mussen (1963) summarizes the relationship of cognitive development and the environment as "a continuous creation of increasingly complex forms and the progressive adaptation of these forms to the environment" (p. 52).

Since Piagetian theory emphasizes the role the environment plays in cognitive development, performance on the Piagetian tasks should be

sensitive to the adverse as well as the beneficial environmental influences of institutionalization. Such an interdependence between an individual and his environment has theoretical as well as practical implications.

Many questions are provoked by this speculation: Are the institutionalized elderly apathetic and to a large extent physically and mentally handicapped prior to institutionalization or does institutionalization produce a decrease in these functions? Another problem which arises from this speculation is a cart and horse problem: Do institutionalized patients become apathetic and consequently become inept in effectively dealing with their environment or do they become apathetic as a result of the growing realization that they are inevitably losing ground in these functions? Since the present study indicates that apathy is a confounding variable in assessing the cognitive functions of the institutionalized elderly, are the cognitive measures widely used in such institutions appropriate? Do they actually tap a cognitive dimension or does the precision of the measure fluctuate with level of apathy? Only future research can even attempt to answer these questions and to isolate confounding variables.

One of the major deficiencies in intellectual assessment is that most tests of intelligence (e.g., W.A.I.S.) are not based on an intrinsic part of a developmental theory of intelligence. The two major exceptions are the work of Cattell (1963) and Horn (1967, 1968, 1970) and also of Piaget (1950, 1970) and Inhelder and Piaget (1958) who have proposed models of intelligence that are closely tied to developmental considerations.

Savage (1975) clearly states the orientation which should be taken in gerontological research:

> There have been numerous publications on the effects of age on cognitive functioning which illustrate how this area is beset with difficulties and how a radical rethinking of the situation is only just emerging. The theoretical and practical problems are now being revealed and adequately tackled; until recently, the measures available to assess cognitive functioning in the elderly were far from satisfactory, despite the fact that intellectual functioning is vital to adaptability. More widespread knowledge of the normative data on intellectual levels in the aged, how they change over time and more adequate understanding of the structure of intellect in normal and abnormal elderly people are urgently required (p. 399).

The assessment of cognitive functioning should be stressed as extremely important in that it has implications for the way in which health care professionals are able to advise and handle the elderly. It may help them in coping more effectively in a variety of situations. Again, Savage (1975) clearly illustrates this point:

> Accurate, reliable knowledge of the intellectual functioning of an individual can help us advise that person or family on how to cope in society, at home, and in numerous personal and family situations. It can also have important implications for the advice given to society on social care, on needs - personal, social and physical of the elderly in relation to the community at large: to what extent community care, hospitalization, etc., are necessary (p. 404).

The present study was an effort to extend an important research area to a portion of the life-span wherein there has been little work done of this kind. There is a substantial body of evidence on changes in performance on traditional, quantitative measures of intelligence.

It is time to shift emphasis away from this quantitative age-norm view toward an approach that considers the qualities of thought in later life. From the present viewpoint, the presence of qualitative decrements in Piagetian-type cognitive functioning during the aging years remains a distinct possibility and warrants further research.

SUMMARY

The amount of literature on the elderly is disproportionate to the increasing number of people constituting this aged population. This minority group warrants more attention than what it has been paid in the past.

Two research strategies most frequently employed in conducting research with the elderly are the assessment of cognitive processes and the assessment of behavior. One of the more recent approaches used by investigators to understand the ongoing process of aging is Piaget's theory of stages of cognitive development. Although there has been relatively little attention given to possible changes in these processes with aging, the few studies bearing upon this issue have found surprising developmental reversals in logical thought sequences among some aged persons.

Two Piagetian tasks which were found to be suitable in identifying the various stages of cognitive development are: 1) The Oscillation of a Pendulum and the Operations of Exclusion, and 2) Equilibrium in Balance. Some other cognitive tasks which have been demonstrated to be reliable with elderly adults are: 1) W.A.I.S. Vocabulary subtest; 2) W.A.I.S. Digit Span subtest; 3) Set Test; and 4) Associate Learning subtest of the W.M.S.

Since the research findings by various investigators supported the contention that the assessment of behavior is the most appropriate strategy to employ in determining the degree of overall level of functioning in institutionalized aged adults, it was deemed appropriate to use a behavior rating scale score for each individual as the criterion (pre-

dicted variable). The two Piagetian tasks and the four clinical tests were treated as predictor variables. In order to eliminate the confounding standard procedure of group dichotomization (which has been demonstrated to yield little information about ongoing cognitive processes), all scores were ordered on a continuum in terms of degree of degradation from healthy cognitive and behavioral functioning to severe impairment in these functions. It was hypothesized that the two Piagetian tasks would be at least as good as the four other cognitive tasks in predicting behavioral status.

The results clearly indicated that the Piagetian tasks are valid and reliable measures of cognitive ability in the institutionalized elderly. The contention that Piagetian tasks are very useful measures in assessing a geriatric sample population was supported by the present study. They were found to be the best predictors of behavioral status in comparison with cognitive tasks which are usually employed in assessing the elderly.

Although the only predictor variables which accounted for significant amounts of variance were the mean scores of the two Piagetian tasks (as well as each task independently) and the Set Test, the W.A.I.S. Vocabulary subtest provided a substantial incremental variance in predicting SGRS scores when combined with the two Piagetian tasks and the Set Test. This increase in prediction was considered to be a substantial enhancement in the predictive power of these three tests.

There was some evidence from the canonical correlation analyses that the three best predictors of SGRS lay on a bipolar dimension with the Piagetian tasks and the Set Test at one end and the W.A.I.S. Voca-

bulary subtest at the opposite end. It was demonstrated that this finding is in opposition to Cattell's theory of fluid and crystallized intelligence.

Differences in information processing was found as measured by the Easy and Hard Lists of the W.M.S. Associate Learning subtest and the Digit Span Forward and Backward of the W.A.I.S. These results were explained in terms of Craik's (1968) theory of the process of storing information in short-term memory. No sex difference was found on any measure which was attributed to the strategy used in selecting the patients who took part in the study. It was also found that although the young and the geriatric samples did not differ on the W.A.I.S. Vocabulary subtest, they differed significantly on their performance on the two Piagetian tasks. This indicates that even though these two groups shared the same I.Q. level, the aged adults, on the average, were unable to perform at as high a level of cognitive development (i.e., formal operations) in comparison with their younger counterparts.

It was concluded from the present findings, as well as those of several other investigators, that the use of age as a predictor variable, in itself, provides little information about an individual that could not be discovered much more accurately with even minimal psychological testing. The notion of "decline with age" does not appear to be accurate and meaningful in many instances. What should be emphasized instead is a decline of behavioral and cognitive status.

Research evidence was presented to demonstrate that health factors, although neglected, are of crucial importance in the assessment of the elderly. The contention that either physical or mental status should

not be assessed separately because they are highly interrelated was well-supported by the present findings.

It has also been suggested that environmental influences (e.g., institutionalization) may have a detrimental effect on the physical and mental status of aged adults. Institutionalization may enhance apathy among the elderly which seems to serve as a confounding variable in the assessment of these individuals. Another aspect of environmental influence which affects the older person is the additional strain of the negative attitudes and inadequacies of a society that fails to meet his special needs and which downgrades the value of experience and age.

Finally, it was contended that some relationship may exist between Piagetian theory and environmental influences. The interdependence between an individual and his environment (an important component of Piagetian theory) has theoretical as well as practical implications, especially since environmental factors may influence the physical and cognitive status of aged adults. It is important to take environmental influences into account in assessing the elderly in order to isolate the consequent confounding variables (e.g., apathy) produced by these environmental influences (e.g., institutionalization).

FOOTNOTES

1. Taken from Kimmel, 1974, 17.

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APPENDIX 1.

RESPONSE CRITERIA EMPLOYED FOR RATING THE PARTICIPANTS ON ALL 4 STAGES FOR TWO PIAGETIAN TASKS

The following are the response criteria employed by the three raters in determining at which of the four levels of cognitive development each individual was assessed as functioning on the two Piagetian tasks:

I. The Oscillation of a Pendulum and the Operations of Exclusion (Inhelder & Piaget, 1958). The stages, designated as 1, 2, 3, and 4 correspond to the sensorimotor, preoperational, concrete operational, and formal operational stages of development, respectively.

STAGE 1.

The individuals at this stage are quite incapable of completing the task due to either a physical (i.e., behavioral) and/or a verbal deficiency.

STAGE 2.

The individuals' physical actions still entirely dominate their mental operations and they more or less fail to distinguish between these actions and the motion observed in the apparatus itself. In fact, nearly all of the explanations in one way or another imply the impetus imported by the individual is the real cause of the variations in the frequency of the oscillations. It is obvious that they constantly interfere with the pendulum's motion without being able to dissociate the impetus which they give it from the motion which is independent of their action.

STAGE 3.

These individuals are able to order the length, elevation, etc.

serially and do judge the difference between observed frequencies objectively. Thus they achieve an exact formulation of empirical correspondences but do not manage to separate the variables, except insofar as the role of the impetus is concerned.

Since the ordering serially of the other factors is accurate, the individual discovers the inverse relationship between the length of the string and the frequency of the oscillations at this and succeeding levels. However, since they do not yet know how to isolate variables, they conclude that the first variable is not the only relevant one in the problem. Moreover, if they attribute causal roles to the weight and the dropping point as well, it is because they vary several conditions simultaneously.

The latter part of this stage is one of progression to accurately order the effects of the weight, but the factors cannot always be separated. They tend to modify all factors simultaneously so as to accomplish more impressive transformations.

STAGE 4.

At the lower formal level, the individual is able to separate out the factors when he is given combinations in which one of the factors varies while the others remain constant. In this case, he reasons correctly. But he himself does not yet know how to produce such combinations in any systematic way -- i.e., formal operations are already present in a crude form, making certain inferences possible, but they are not yet sufficiently organized to function as an anticipatory schema.

In the latter part of this stage, individuals are able to isolate all of the variables present by the method of varying a single factor

while holding "all other things equal". But, since only one of the four factors actually plays a causal role in this particular problem, the other three must be excluded. This exclusion is a new phenomenon that contrasts sharply with the earlier part of this stage where such an operation was still impossible.

II. Equilibrium in Balance (Inhelder & Piaget, 1958). The stages and levels of development correspond as defined above in the first Piagetian task.

STAGE 1.

The individuals at this stage show complete inability to take part in such a task either due to physical (i.e., behavioral) and/or verbal deficiency.

STAGE 2.

These individuals cannot guarantee equilibrium simply by distributing weights but intrude in the working of the apparatus with their own actions, which they fail to distinguish from the actions of the objects that they are trying to control. In constantly interfereing with the apparatus in order to correct the position of the balance arm, the individuals expect the apparatus to conserve the results of their manipulations. Thus the instrument and their own actions are not distinguished. Generally, the individuals are not interested nor concerned with the question of distances from the axis and do not look for any equality or coordination between the distances and the weight.

During the latter part of this stage, the individuals understand that weight is needed on both sides to achieve a balance and even that

the weights should be approximately equal. But they do not yet know how to proceed toward this equalization in a systematic way. Similarly, they proceed in adding and subtracting, but without accurate equalizations. Their actions are successive corrections and are not yet strictly reversible.

STAGE 3.

At this stage, weights are equalized and added exactly, while distances are added and made symmetrical. But coordination between weights and distances as yet goes no further than intuitive regulations. The individuals discover by trial and error that equilibrium between a smaller weight at a greater distance and a greater weight at a smaller distance is possible, but they do not yet draw out general correspondence. Thus, from this point on, the individuals can order serially the weights as they come across as well as determine whether they are equal. They can add them in a reversible manner and correctly compare one pair of weights with another pair. Even when they discover by experimentation that a large weight at a small distance to the right of the axis balances a small weight at a large distance to the left, they do not yet know how to invert these relations from one side to the other until it is too late (i.e., after the experiment).

At the earlier part of this stage, when the individuals come across two weights which do not come into equilibrium, they work mostly with substitutions -- additions and subtractions. In this way, they achieve certain equalizations by displacement, but only exceptionally and by groping about. On the other hand, during the latter part of this stage,

the individuals who come to two unequal weights try to balance them by means of an oriented displacement on the hypothesis that the same object "will weigh more" at a greater distance from the axis and less when brought closer to it. They are working toward the law, but without metrical proportions and by simple qualitative correspondences.

STAGE 4.

At this stage, the individuals are able to discover the law (the relationship between weight and distance) and are later able to explain it.