THE UNIVERSITY OF ALBERTA

SOME ADDITIONAL CORRELATES OF COMPLEXITY

by

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A THESIS

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ABSTRACT

The correlation between cognitive complexity and certain environmental variables was examined using 396 Education freshmen, in order to develop a nonpsychometric predictor of cognitive complexity as an aid to teacher-trainee selection.

It was expected to find significant correlations between cognitive complexity and Ss' (1)sex, (2) faculty of re-registration, (3) home address, (4) religion, (5) country of birth, (6) continuity of education, (7) living at home while attending university vs. living away from home, (8) father's occupation and (9) socio-economic status.

The only hypotheses supported were that Ss of foreign birth tended to be more complex than Ss of Canadian birth and that Ss living away from home while attending university tended to greater complexity than those living at home.

These results were explained in terms of content domain specificity of the instrument used, and supporting evidence was presented for this contention through the use of another instrument.

It was concluded that, while the prediction of cognitive complexity was not possible for the instruments and other variables of the present study, the general approach was worthy of possible further consideration.

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CHAPTER I

INTRODUCTION

The success of a society is dependent upon the ability of its members to function within it. As a society grows more complex, this ability becomes increasingly dependent upon the ability of the members of the society to deal with increasingly larger amounts of data. In our society the task of equipping its individual members with the ability to deal with ever-increasing complexity, with ever-increasing amounts of data, is largely entrusted to the schools.

In this paper, we will attempt to define the type of individual who can function in increasingly complex situations, consider some of the factors that lead to the formation of this type of individual, and attempt to develop a method of selecting teachers who will be capable of educating at least a portion of their students to the point of fulfilling these criteria.

The search for the type of individual described is not new. Terman, in his monumental Genetic Studies of Genius (1925-1959), defined the intelligent person as one who was able to make use of concepts, to relate them to one another (1956). As words are the tools most frequently used in conceptual manipulation, Terman chose an instrument strongly dependent on vocabulary to measure the range of conceptual manipulation of which an individual was capable, but did not concern himself with the ability to form novel

insights on the basis of material available.

Barron (1953) entered the area via an attempt to construct a non-verbal analogue to the MMPI, but his final instrument bore a closer resemblance to the Graves Design Test (1959). Findings for this study indicated that "complex" individuals—i.e. those who preferred subtlety and asymmetry among the various stimulus figures— tended to show greater creativity, flexibility of thought, than those Ss who chose simple designs. "Complex" Ss tended to be less dogmatic than "simple" Ss, but at the same time resisted social pressure to conform in their opinions in a social pressure situation. While the content of Barron's major instrument was concerned with esthetic judgement, his "simple" and "complex" Ss bear considerable resemblance to Harvey, Hunt & Schroder's (1961) System 1 and 4 representatives, respectively.

A study of creativity vs. intelligence by Getzels & Jackson (1962) showed one finding of interest here: while the parents of both high intelligence and high creative children showed more than average concern and gave more than average care, the parents of the former group tended to give far more direction to their children's activities, effecting control chiefly by means of approval/approval-withdrawal; parents of the latter group tended to be supportive of their children's endeavours without a concomitant superposition of their own values on the

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direction of these efforts.

Harvey (1966), Harvey, Hunt & Schroder (1961) and Schroder, Driver & Streufert (1967) investigated the area of, variously, cognitive/conceptual/integrative complexity—an area closely related to the two lines of research discussed above. Harvey et al.(1961) were concerned with those aspects of cognitive function that have to do with the differentiation and integration of concepts. The process was seen to be multi-dimensional and saccadic; the most important dimension was held to be concreteness-abstractness. These workers sought to

> . . .demonstrate that in the progressive development from a state of conceptual undifferentiation to differentiation and integration, from greater concreteness to increased abstractness, the conceptual system tends to pass through certain plateus or stages of varying time and breadth. . . the individual first evolves concepts that he applies categorically and absolutely; then he passes through a state of negativism and self-assertion to the development of sympathy role-playing and taking turns on to a state of higher independence and relativism marked by greater self-sufficiency and adequacy in coping with complexity and change. . .

> (Harvey, 1966, p. 44)

Harvey et al. (1961) presented extensive theoretical and empirical bases from which four stages along the developmental continuum described above were drawn. Each stage was treated as a different conceptual system, assumed to represent nodal points or ranges on the continuous dimension between concreteness and abstractness.

The salient characteristics of these four Systems may be summed up as follows (after Cornfield, 1967 and Harvey, 1966).

System 1 functioning, which lies toward the concrete end of the concreteness-abstractness continuum of modes of construing and relating to the world, is characterised by high absolutism and closedness of beliefs; high evaluativeness; high positive (sic) dependence on representatives of institutional authority; high identification with social roles and status positions; high conventionality; high ethnocentrism. In many respects, System 1 functioning is related to the syndrome of authoritarianism. Membership within this System is assumed to evolve from a training history in which the individual has been restricted in exploration of his environment, especially that part of his world concerned with values and power relationships. Along with minimal exposure to diversity in relation to social norms, the individual's rewards and punishments are contingent upon his ideas and approaches to problems conforming to the omnipotently and omnisciently imposed standards of the training agent.[1]

System 2 functioning, above System 1 in abstractness, is characterised by a high drive toward autonomy, and avoidance of dependence on God, tradition, and most of the referents that serve as positive guides for System 1 individuals. System 2 representatives, more than persons

of any other System, seem to be in a psychological vacuum,
guided more by rebellion against social prescriptions than
by positive adherence to personally derived standards.
Membership within this System is assumed to be a result of
capricious and arbitrary child-rearing practises which,
owing to failure to provide any stable or predictable
referent points in an unstructured world, present the
developing child with a diversity far in excess of the
optimal. While such vacillation and varied inputs tend to
result in higher differentiation than the training
environment of System 1 functioning, it also produces
deep feelings of uncertainty, distrust of authority,
rejection of the more socially approved guidelines to
action, while at the same time other stable referents
are lacking.

System 3 functioning, the next to highest level of
abstractness, is characterised by the development of
fairly high skills in effecting desired outcomes through
techniques of having others bring about these desired ends.
While oriented toward establishing dependencies on others
to avert the helplessness that would result from being
placed on his own, the System 3 representative nonetheless
develops more autonomous internal standards, especially in
the social sphere, than does the System 1 individual, and
more positive ties to the prevailing social norms than
does the System 2 person. Membership in System 3 is

assumed to evolve from a history of childhood over-protection and over-indulgence which, with one or both parents serving as a buffer between the individual and environmental demands, prevents the child from exploring his physical world and restricts the explorations of his social world to activity relating to manipulating people through dependency upon them.

The System 4 individual, who functions toward the abstract end of the concreteness-abstractness continuum, comes to have a highly integrated cognitive structure, and is consequently more flexible, more creative and more reflective in thought and action than are the members of other Systems. More than persons of any of the other Systems, the System 4 individual has a set of internal standards that are more truly independent of external criteria, in some cases coinciding with social definitions and in others not. Membership within this System is assumed to be the consequence of childhood freedom to explore both the social and physical aspects of one's environment, to establish and to rely upon values derived from one's own experience and thought, and to solve problems and evolve solutions without fear of punishment for deviating from established truth. The System 4 representative is the recipient of diversity along with stability as a developing child, and is of high perceived self-worth despite momentary frustrations

and deviation from the normative.

It is of interest that Systems 3 and 4 of Harvey et al. (1961) coincide closely to the descriptions given by Getzels & Jackson (1962) of high I. Q. and high creativity individuals, respectively. Also of interest is that the factors listed by both groups of researchers as being of importance in the formation of these individuals are in close agreement, to the point where one may equate at least some of the efforts in the study of creativity with parallel lines of research into complexity.

At this point it may be advisable to pause to examine some of the factors that influence complexity, with a view to later integration of these data with some of the foregoing in an effort to develop criteria for the screening and identification of teacher candidates who are likely to increase the complexity of their students.

The descriptions of the Systems of Harvey et al. (1961) listed a number of factors that influence the complexity of the individual. Little control can be exercised over those factors that are a part of the home environment, but there are indications that teacher behaviour does have influence on pupil complexity. Getzels & Jackson (1962), Pavlovich (1970) and Reynolds (1970) have variously reported that pupils of creative/complex teachers tend to acquire this trait. Unfortunately, other studies indicate that complex teachers are rare: Harvey, Prather, White & Hoffmeister

(1968) found that out of 67 elementary teachers, some 50
belonged to System 1 (very concrete) while only 8 were
"weak instances" of System 4 (highly complex). The effects
on teaching performance of such a preponderance of simple
teachers may be deduced in part from a study by Joyce,
Lamb & Sibol (1966), who concluded, in part, that the
reason why teacher trainees are often unable to make
effective decisions when presented with behavioural data
may well be cognitive simplicity. Studies with complex
teachers (Harvey, White, Prather, Alter & Hoffmeister, 1966;
Harvey et al., 1968), on the other hand, have indicated that
abstract teachers were more resourceful, less dictatorial
and less punitive than concrete teachers. The students of
the more complex teachers tended to be more involved, more
active, higher in achievement, and more abstract than those
of concrete teachers.

Individuals who differ in cognitive complexity are
also likely to differ over a considerable range of
behaviours. Various researchers have found that the level
of cognitive complexity relates to decision-making
behaviour (Sieber & Lanzetta, 1964, 1966; Stager, 1967);
problem-solving (Karlins, Coffman, Lamb & Schroder, 1967;
Sieber, 1964); and the toleration of stress (Driver, 1962;
Harvey & Ware, 1967). Harvey (1966) reported that Ss
of differing levels of complexity differed in cue
utilization, in the ability to change set, and in

creativity (pp. 54-55).

While the application of optimum amounts of stress or environmental complexity will increase the level of cognitive functioning of most individuals (Schroder, Driver, & Streufert, 1967, p.40) up to a point, there is nothing in the literature to indicate that the cognitive function of an adult may be moved from the concrete to the abstract with any degree of permanence. Nor are there any indications that the cognitive function of an adult may be shifted to a higher System. In the absence of any available method of training teacher candidates for higher complexity, the only avenue remaining if we wish to increase the complexity of teachers is to select from the mass of teacher trainee candidates those who are most complex, and to screen out those who are most simple. A program of testing each applicant for complexity would be possible, but unwieldy. Far simpler in terms of time and cost would be to examine the backgrounds of applicants for indicators of cognitive complexity, and to use these indicators for at least the initial screening.

Sex is one obvious source of possible variation, in view both of the differing expectations of behaviour assigned to the sexes and of the differing methods of rearing applied to each sex. Little (1968, 1969) added support for this contention in his finding that females appear to be more complex than males when "psychological"

variables are considered, while males exhibit greater complexity in dealing with material objects and events.

Support was added to the above contention by Rosen & Connaway (1968) in their conclusion that categorizing behaviour is susceptible to influence by instructions. "Instruction" given to children may be expected to vary not only with sex, but also with religion, socio-economic status (Orliandi, 1969), sub-culture membership (Flores, 1969).

Attainment of concepts is dictated by the amount and type of information available (Siegel, 1969), and the latter factor is in turn influenced by a child's home environment, through which much information is filtered. Both form and content of home environment are affected by culture, socio-economic status, address, etc., insofar as these latter factors affect information available. While the effects that the foregoing factors may have on style of child-rearing and consequent complexity of the adult are largely self-evident, they are fairly well documented in the literature (Harvey, 1966; Harvey et al., 1961; Getzels & Jackson, 1962; Laing & Esterson, 1964; Orliandi, 1969).

That problem-solving strategies used by simple and complex individuals differ has been recognized, and the question has been explored by Sieber & Lanzetta (1964), with results largely in conformance with predictions made

by Harvey et al. (1961): persons having a history of positive reinforcement for exploration of environments and for elaboration of alternative means and goals of problem solving will employ more complex strategies than will persons who have been reinforced primarily for employing strategies dictated by some other person. Later support for this view was given by Biggs (1969), who added in a discussion of coding and problem-solving strategies that ". . . while there may be genetically determined limits to the extent to which an individual can use these strategies, it is also . . . clear that they are. . . learnable, up to those limits." That modeling may change cognitive style (Rindberg, Parke & Hetherington, 1971) points equally to the need for screening teacher candidates and to the need to examine their school backgrounds: complex candidates are likely to have had superior teachers. In Alberta, where a chronic teacher shortage persisted until only two years ago, it is likely that this factor will be tied to candidates' addresses: teachers with a choice of jobs prefer the higher pay and better working conditions in urban schools in "good" districts, with the result that deprived urban districts and rural schools, until recently, were able to hire teachers who were demonstrably more poorly qualified, or demonstrably poorer teachers, than those in the cities.

That conditions of measurement of complexity will

have a bearing on scores obtained has been posited by
Schroder et al. (1967), who held that arousal will have
an inverted U relationship to complexity. Miller (1968)
found that Ss in a test situation were generally less
complex under stressful instructions: this being the case,
it may be supposed that adequate arousal is generated by
placement in a test situation, and that both instrument
and instructions selected should have as a criterion for
that selection that they be neutral or reassuring to Ss.
The ideal instrument to be used should perhaps not have
the format of a psychological test that might be used to
"analyze" Ss, in their estimation.

Dallas & Gaier (1970), along with earlier studies
by Barron (1953), Gough (1961) and MacKinnon (1961),
presented results that suggest strongly that the ideal
test stimuli for the measure of complexity are those that
are sufficiently ambiguous that the Ss may read into them
the degree of complexity that is optimum for them.

A possible candidate for such a stimulus situation
could be ranking/grouping/comparing nations, in that there
exist many possible criteria for comparison, the number of
which is limited only by the information-handling capacity
of the S. At the same time, there are within the culture
stereotypes of national characteristics, which present the
illusion of stimulus simplicity to those Ss who favour
this condition. One further advantage of the use of

nations as test stimuli in a complexity-measuring situation
is that there exists a substantial body of literature on
the use of this approach. Bower (1969), Driver (1962),
and Scott (1966, 1969), while employing different
techniques of analysis, have all reported success in
differentiating between levels of complexity using this
class of test stimuli. One weakness of this approach is
that the dimensionality of $\underline{S}$ judgement is affected by the
information he has: greater amounts of pertinent data
lead to greater complexity of judgement (Scott, 1962, 1963,
1969; Seferi, 1968). This point will be covered later,
under the discussion heading, but it seems not inappropriate
to mention it here.

The correlation found to exist between the complexity/
creativity of an individual and the field of endeavour
chosen by him (Maier, 1955; Maier & Hoffman, 1961) has
been found to hold true at the university undergraduate
level—Eisenman (1969) found that business majors tended
to be considerably less creative than English majors.
The latter result indicates that, if one wishes to increase
teacher complexity, it is appropriate to do so at the
university level. In the absence of adequate training
techniques, this may be accomplished by either attracting
more complex individuals to the teaching profession or by
screening out the less complex individuals from the mass
of applicants. If a significant correlation may be found

to exist between complexity and external criteria, the
tasks of attracting and screening may be much simplified
from what would be the case otherwise. Given a population
the characteristics of which are known, recruiting appeals
may be conducted with sufficient specificity to attract
mainly the desired individuals. Conversely, screening of
applicants on the basis of external criteria is much
simpler than is subjecting applicants to a battery of tests.
There are numerous indications that there are such criteria:
for example, the relation between religious behaviour and
cognitive complexity is summed up in Table 1. It is not
unreasonable to suppose that there exist other such
relationships, such as some of the factors mentioned
earlier, and that some of these may be available in extant
data on students, on their registration forms. The
matter was judged to be of sufficient interest to be
the direct object of the study that follows.

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1. The summaries given in this chapter for the four
   Systems have been taken, with considerable editing
   and paraphrasing, from Cornfield (1967, pp. 22-24)
   and Harvey (1966, pp.44-46). Because of paraphrasing
   and transposition of statements within the summaries,
   it was not possible to set this section in the form
   of a quotation, but it is wished to assign credit
   where it is due.

Table 1

Relationship between Religious Behaviour

and System Membership

System	1	2	3	4
attends church	yes	–	no	–
states that is not very religious	yes	–	yes	–
states that is not at all religious	–	yes	–	yes
states that there is only one true faith	yes	–	–	–
states that there is too much emphasis on religion	–	yes	–	–

Compiled from information in Harvey (1966). Individuals giving the patterns of answers illustrated above in attitude surveys tend to belong to the indicated Systems. A dash (–) in a cell indicates that opinions expressed in the indicated cases do not aid in differentiating between the Systems.

CHAPTER II

HYPOTHESES

Among the instruments used by Bower (1969), in a
study using freshmen Education students in the attempt
to isolate a general complexity factor was the <u>Similarities</u>
<u>Among Nations Test</u> (<u>SANT</u>)(See Appendix 1), an instrument
derived from Driver (1962) and Scott (1962-1969). Scores
obtained by Bower on this test were used as a measure of
cognitive complexity of the sample for the present study.
Details of sample composition, scoring of tests and coding
are given in the next chapter.

The factors dealt with in the present study were
those obtainable from the students' registration records:
(1) sex, (2) whether or not $\underline{S}$s returned to the Faculty
of Education after the completion of their first year,
(3) home address, (4) religion, (5) Canadian vs. non-
Canadian birth, (6) whether education was interrupted,
(7) whether student continued to live at home while
attending university, and (8) father's occupation.
Blishen's (1968) Revised Index of Socio-Economic Status
(9) was used as a measure of SES. Details on the coding
of these factors is given in Appendix 2.

On the basis of material presented in the previous
chapter, it was expected to find results as follows:

(1) <u>Sex</u>

Males would, in general, score as more complex on
the <u>SANT</u> than would females. This prediction is based on

work by Little (1968, 1969), who found that female complexity was highest when dealing with interpersonal variables, a universe of dimensions not of much use in the present test situation. A significant positive correlation between complexity as measured by the SANT (variance) score and sex (0=female; 1=male) is expected.

(2) Faculty of Re-registration

Highly structured course settings may be expected to appeal less to complex individuals than to those who are accustomed to accept omniscient direction. It is expected that a small negative correlation will be found between return (=1) vs. non-return (=0) to Education for the term following the one in which testing took place and measured cognitive complexity. Only a small correlation is expected, as factors such as economic exigency probably play a greater role in determining continued enrollment than does interest.

(3) Home Address

Urban environments offer a greater variety of stimuli relevant to the test situation than do small towns or rural settings. It is thus expected that that there will be a positive correlation between the size of the centre in which the student was raised (1=rural; 4=large urban) and his SANT-measured complexity.

(4) Religion

That religious behaviour is correlated with and indicative of complexity has been established (cf. Table 1)

It is posited here that an extension of this principle
will also hold, that there is a positive correlation
between professed religion (sect, coded as 1=great
insistence on adherence to dogma; 9=low dogmatism) and
measured cognitive complexity. The more authoritarian
faiths, such as certain fundamentalist sects, demand of
their members unswerving belief in a set dogma; other
denominations are less rigid in this regard. The spectrum
of rigidity of dogma will, it is believed, be reflected
in the measured complexity of the communicants of the
various faiths.

(5) Birth

If Scott's (1969) findings apply to informal learning
situations, exposure to more than one culture would tend
to increase the measured complexity of the S on the SANT.
Information about ethnic origin would have been of help
here, but this question is not asked on registration forms
after 1965. The remaining possible measure, the country
of birth, is not wholly satisfactory, since we are in
effect comparing a sub-population of individuals of a
multi-cultural background to a population which contains
an unknown proportion of individuals of a like background.
for this reason, we may expect at best to find only a
very small positive correlation between measured complexity
and foreign (=1) vs. Canadian (=0) birth.

One possible adjustment is the creation of an ad hoc

sample consisting of Canadian-born Ss with Anglo-Saxon
surnames, and the subsequent comparison of this sample to
the foreign-born sample. This procedure will eliminate
most of the bias introduced by having an unknown proportion
of multi-cultural individuals in the standard population,
but will introduce the error of using only one sub-culture
out of the many in Alberta for a standard. Nonetheless,
it is expected that for the ad hoc sample the correlation
between foreign vs. Canadian birth and complexity will be
greater than in the former instance.

(6) Continuity of Education

Individuals who have interrrupted their education
may reasonably be expected to have been exposed to a
wider range of stimuli than have those who have maintained
a continuous school career. This exposure may be expected
to increase the complexity of affected Ss, and it is
expected that there will be a significant positive
correlation between continuous (=0) vs. interrupted (=1)
education and SANT-measured complexity.

(7) Live Home?

For any but an infant, new data from the home
environment are nearly nil. A person who lives away
from home, particularly, as in the case of many of the
present Ss, for the first time, will be exposed to new
data and/or to new relationships between known data.
Such a change may be expected to increase the measured

complexity of the affected $\underline{S}$s, and it is expected that
there will be a small positive correlation between
complexity and living at home (=0) vs. living away from
home (=1).

(8) <u>Father's Occupation</u> and (9) <u>Blishen Scale</u>

The last two variables to be considered in the
present study, father's occupation and father's socio-
economic status (Revised Blishen Index, 1968), may be
considered together since the Blishen measure of SES is
derived from occupational categories. The major
distinction between the Blishen Index and the occupational
rating scale used for Father's Occupation is that the
former is well-standardised, while the latter is an
experimental scale constructed for the present study
(see Appendix 2).

Since the range of data available to an individual
are to a considerable extent governed by the economic
and professional circumstances of his parents, it is
expected that a significant positive correlation will be
found, respectively, between father's occupation (scaled
from 01=low to 69=high) and Blishen Index (1=low; 9=high),
and measured complexity. Details of both scales are given
in Appendix 2.

The foregoing hypotheses, it may be seen, are strongly
based on Harvey's (1966) descriptions of the four Systems
and the circumstances postulated to lead to an individual's

classification within a given System. Since _Conceptual_

Systems _Test_ scores were available for the sample, it was

decided to include these in the correlations to be made,

on the grounds that these latter scores, based as they

are on an instrument constructed on the basis of Harvey's

theory by that author, should also reflect the correlations

outlined above. A further benefit of this procedure, it

was felt, would be to provide a comparison of these two

instruments' ability to predict external correlates to

cognitive complexity. No hypothesis about the superiority

of either instrument was drawn, as only a simple comparison,

rather than a statistical analysis of predictive validity,

was wanted.

CHAPTER III

METHOD

Subjects were 583 students enrolled in the first-year Educational Psychology course (Ed. Psy. 269-271) at the University of Alberta in the Fall term 1968-69. From the total sample 51 Ss were dropped because SANT scores were not available. Another 136 Ss were lost for various reasons, such as unavailable registration forms, incomplete records in the Faculty office, and grossly incomplete registration forms, giving a net sample of N=396.

Access to student registration forms was obtained from the Student Records Office, Faculty of Education, and information as to sex, return to the Faculty of Education, home address, religion, country of birth, interruption of education, whether student continued to live at home, and father's occupation was gathered. These data were coded as described in Appendix 2, and Blishen's Index was computed and assigned to each S following published (1968) procedure.

Scores for the Similarities Among Nations Test were obtained from Dr. Bower, as were two scores for each S for the Conceptual Systems Test (see Appendix 1).

The SANT requires the subject to rate each of forty-five pairs of nations on a seven-point scale from 1= extremely similar to 7=extremely dissimilar. These 45 scores for each S were formed into a 10 x 10 matrix, with

zeros in the diagonal (that is, perfect similarity, the comparison of a nation with itself). From this matrix, profiles of nation similarity were obtained by comparing the similarities of each nation of each possible pair of nations with the eight remaining nations. The profiles so obtained were inter-correlated. The correlations so obtained were taken to be a measure of inter-nation similarity. These correlations were placed in a new 10 x 10 matrix.

Each $\underline{S}$ used several parameters, or factors, in his decisions as to the similarity of nations, and these factors were reflected by the correlation matrix. By computing the characteristic roots of the matrix, it was possible to identify both the number and relative importance of the factors used by the $\underline{S}$. Since the size of the characteristic root, or eigenvalue, is a measure of the weight (relative importance) of the factor with which it is associated, the variance among eigenvalues was taken to be a measure of cognitive complexity: if, out of the factors used by the $\underline{S}$, one or two predominate, the variance among the eigenvalues of his matrix will be large; if all the factors carry about the same weight, the variance will be small. A high variance thus indicates low complexity.

The $\underline{S}$'s score was the variance among the five largest eigenvalues.

A possible scoring method based on the Tucker-Messick (1960) individual differences model was considered. This

method relies on an earlier proof that factors with eigenvalues of less than one do not play a significant part in the $\underline{S}$'s judgement, and consists of a count of eigenvalues greater than one. Since in the present study $\underline{S}$ judgements were on the basis of only 10 stimuli, the number of eigenvalues greater than one ranged only 2 - 4, from simple to complex. This range of variation did not permit sufficient discrimination for our purpose, and this method of scoring was accordingly not used.

A copy of the SANT may be found in Appendix 1.

Two scores for each $\underline{S}$ were obtained on the CST. The Systems score was obtained by Bower on the basis of information received from Harvey. Each of the 49 items received a score from 1=completely disagree to 6=completely agree, with items 42 and 44 scored in the reverse direction. Means were obtained for the six subtests and the $\underline{S}$s were classified into the four Systems on the basis of profile means. Classification criteria may be found in Appendix 1.

The Combined score was obtained by summing the means of the six subtests. This latter score, as yet not published, was to offer the advantage of differentiation between levels of complexity with considerably simpler scoring, but Bower's (1969) analysis indicated that it did not measure the same factors as the Systems score, although the two are highly correlated. The Combined score is used in the present study as another measure of cognitive complexity, supplementing the validated Systems score.

On the <u>CST</u>, a Systems score of 1 indicates low complexity and 4 indicates high complexity; on the Combined score, high subtest scores indicate low complexity.

The <u>ad</u> <u>hoc</u>. sample of uni-cultural vs. multi-cultural <u>S</u>s consisted of all 38 foreign-born <u>S</u>s and of 38 other <u>S</u>s with Anglo-Saxon surnames randomly drawn from the remaining sample, for a total of <u>N</u>=76.

CHAPTER IV

RESULTS

A summary of the results obtained is presented in Table 2. It will be noted that correlations of the variables under study with CST scores are also included in this table, in spite of the fact that the SANT is the primary focus of the present study. The reason for this inclusion is to permit observational comparison of the respective ability of each instrument to predict the variable under consideration. Two correlations for each variable are given for the CST: CST_s and CST_c; the former is the standard Systems score, and the latter the experimental Combined score.

Correlation coefficients significantly differing from zero were obtained between SANT and (1) sex, (2) foreign vs. Canadian birth (ad hoc. sample), and (3) living at home vs. away from home. All other correlations were nonsignificant.

In terms of the hypotheses stated, these results may be interpreted as follows:

(1) Sex

This correlation, while highly significant, was in the direction opposite to that predicted: females scored higher than males on the SANT in measured complexity, leading to the rejection of this hypothesis.

(2) Faculty of Re-registration

That there would be a small negative correlation between complexity and return (=1) vs. non-return (=0) to

Table 2

Correlation between Cognitive Complexity on

the SANT and CST with Other Variables: Total Sample

Variable	$r(CST_c)$ $r(CST_s)$	Pr	$r(SANT)$	Pr
Sex (F=0; M=1)	0.235 0.084	<.0001 >.15	-0.164	.001
Faculty of Return (Educ=1; Other=0)	-0.044 -0.032	>.25 >.50	0.018	>.50
Home Address (Rural=1; City=4)	0.004 -0.011	>.9 >.85	0.060	>.15
Religion (High dogmatism=1; Low dogmatism=0)	0.177 0.265	<.01 <.00001	0.017	.45
Birth (Canadian=0; Foreign=1)	0.085 0.069	>.15 >.20	0.080 0.229*	.17 <.05*
Continuity of Education (Continuous=0; Interrupted=1)	0.137 0.022	<.02 >.70	0.045	>.54
Live Home? (lives home=0; away=1)	0.010 0.040	>.85 >.50	0.103	<.02

Table 2 (Continued)

Correlation between Cognitive Complexity on

the SANT and CST with Other Variables: Total Sample

Variable	$r(CST_c)$ $r(CST_s)$	Pr	$r(SANT)$	Pr
Father's Occupation (Labour=1; Capitalist=69)	0.032 0.050	>.50 >.40	0.024	>.50
SES (Low=1; High=9)	0.040 0.307	>.49 .61	0.030	>.50
CST (Combined)	1.000 0.570	- «.00001	0.010	>.72
CST (System)	0.570 1.000	«.00001 -	0.040	.47

* Figures drawn from ad hoc. sample

Education: rejected. The very small correlation observed was far too small to be significant. ($r=.02$; $p=.50$)

(3) <u>Home</u> <u>Address</u>

That there would be a positive correlation between home address (1=rural; 4=large urban) and <u>SANT</u>-measured complexity: rejected. The observed correlation was too small to indicate the possibility of a trend ($r=.06$; $p>.15$).

(4) <u>Religion</u>

That there would be a positive correlation between cognitive complexity and professed faith (1=high insistence on dogma; 9=low insistence on dogma): rejected. While the observed correlation was in the direction predicted, it was too low to be considered significant ($r=.02$; $p>.44$).

(5) <u>Birth</u>

That there would be a correlation between Canadian (=0) vs. non-Canadian (=1) birth and complexity: the correlation for the sample as a whole was $r=.08$ ($p>.15$). The use of the ad hoc. sample raised r to .23 ($p<.05$).

(6) <u>Continuity</u> <u>of</u> <u>Education</u>

That measured complexity would increase with the interruption of education: rejected. While the correlation was in fact in the direction predicted, it was far too small to permit the rejection of H_0.

(7) <u>Live</u> <u>Home?</u>

That living at home (=0) vs. living away from home (=1) would correlate positively with measured complexity

yielded an observed r=.10 ($p<$.02).

(8) <u>Father's Occupation</u> and (9) <u>Blishen Index</u>

That father's occupation (01=labourer; 69=capitalist) and SES (1=low; 9=high) would be a significant predictor of cognitive complexity: rejected. Correlations of r=.02 and r=.03, respectively, were far too low to conclude that a relationship existed.

It is of some interest that the <u>CST</u> Combined scores showed a very significant correlation with sex (r=.24; $p<$.00001) in the predicted direction, and that both <u>CST</u> measures were highly correlated in the predicted direction with religion (1=high dogmatic; 9=low dogmatic): r=.18 ($p<$.005) for Combined scores and r=.26 ($p<$.00001) for Systems scores.

Also on the <u>CST</u>, correlation between cognitive complexity and interruption (=1) vs. non-interruption (=0) of education on the Combined score (r=.14; $p<$.05) was significant in the direction predicted.

CHAPTER V

DISCUSSION

The results of the present study tend to confirm
the general findings of Bower (1969), Bower & Anderson
(1970) and Stewin (1969), that current measures of
complexity tend to be domain specific, to the point of
virtual orthogonality in the case of the SANT vs the CST.
A comparison of the scores on these two instruments and
their respective predictive validities indicates that a
pure structural approach, without content loading, such
as is used on the SANT, is of less value in the problem
at hand than is the CST approach of heavy content loading
on dominant cultural values. That the CST is directly
based on the variables held to be important by Harvey et al.
in the original 1961 formulation of the conceptual
complexity construct also tends to make this instrument a
better predictor in the case of the hypotheses of the
present study, as these were based on the same formulation.

It is of some interest that the only significant
correlations between complexity as measured by the SANT
and the independent variables in the present study were
in national origin and living at home vs. away from home.
The former variable is the only one on which the content
of the SANT may be said to be heavily weighed; the latter
correlation admits to no simple explanation, although it
seems apparent that the SANT content is more probably
related to this area than is the content of the CST.

Results obtained vis-a-vis the remaining hypotheses
also support this view: Correlations between professed
faith (1=high dogmatism; 9=low dogmatism) and complexity
on the CST are 0.18 and 0.27 ($p \ll .01$ Combined; $p \ll .001$,
Systems) vs. a correlation of 0.017 ($p > .25$) for the SANT.
For interruption (=1) vs. non-interruption (=0) of
education, the use of the CST Combined score yields a
correlation of 0.14 ($p < .05$) against a negligible
correlation with SANT. Living at home (=0) vs. away
from home (=1) correlates with complexity on the SANT at
$r=.10$ ($p < .01$) against $r=.04$ ($p > .25$) on the CST (Systems).
Sex correlates highly with both instruments, with highly
significant results on the Combined CST score in the
direction predicted, but in the opposite direction to
the prediction on the SANT. The remaining hypotheses
are not supported to any significant extent by either
instrument.

An examination of the instruments reveals a number
of social expectancy items on the CST. These items,
which are more-or-less evenly distributed among the
sub-tests which comprise the System score, would not be
expected to show a sex differentiation on this score.
In the Combined score, which is the sum of all sub-test
scores, the effect of these items accumulates, with the
result that this scale becomes sensitive to the fact
that social expectancy has a greater governance over

female than male behaviour in this society.

That no significant correlations were found between cognitive complexity and return (=1) vs. non-return (=0) to Education and home address (1=rural; 4=large urban) may be assumed to be because the content of the items on these instruments bears little, if any, relation to the content implicit in these two variables.

That religion (1=high dogmatism; 9=low) correlated highly with complexity on both the Combined and Systems scores of the CST may be viewed in the same light: the many items dealing with religion on this instrument apparently tap the same content area as do professions of faith.

Neither SANT nor CST contains items dealing with social status, and this is perhaps the reason that neither instrument differentiates between levels of fathers' occupations or SES. It is, however, somewhat surprising that the various value systems operating in the strata of this society were not detected by the CST; possibly such sensitivity is attainable only through a greater specificity within the test items than that instrument provides.

Interruption vs. non-interruption of education was significantly correlated with complexity on the CST Combined, but not on Systems, probably for much the same reasons given for the similar effect on the correlation with sex, while

the significant correlation obtained between living at
home vs. away from home and complexity on the SANT is
again probably due to the fact that the content of the
SANT permits the detection of changes in one's world outlook
while the content of the CST is such that it does not.

In general, the results of the present study may be
held to have been useful in the attainment of the original
ends, although this usefulness is unfortunately in a
negative sense, that is, in the barring out of approaches.
We find that the instruments used in this study are not
capable of making useful discriminations between differences
in the population which are predicted in theory, and to
which they should be sensitive. Given that the views of
complexity upon which these instruments are based are not
without foundation in reality, we would be hard put to
explain why both SANT and CST do divide the population
into those segments predicted by theory. Under these
circumstances, the conclusion that the models used do, in
fact, have some correspondence to reality appears to be
inescapable, which observation leads in turn to an
examination of the instruments themselves. As has been
noted, both instruments do in fact partition the population
into those segments predicted by theory. But this division
lacks generality: the borders of the segments appear to
follow the outlines of theory, but the division is specific
to the content domain of the instrument. The CST provides

a measure of social complexity specific to Ss' views on such subjects as religion, morality and orderliness, while the SANT is specific to Ss' world outlook within the rather limited domain of inter- and intra-national affairs. Scores for the latter instrument are also affected to a considerable extent by interests and information on the area of content, as has been shown by Scott's (1965 and subsequent) work with the Groups of Nations Test.

Given that content factors have, in fact, had an effect on the measured complexity of Ss in the present study, the lack of predictive validity demonstrated by both instruments becomes unsurprising. Further, since the SANT and CST may be assumed to be representative of the two broad approaches to the measure of cognitive complexity, it may be concluded that within the range of currently-available instruments within this area, no instrument not constructed to tap the specific content domains in question will meet the objectives of the present study satisfactorily. These domains are those that operate in the classroom to provide an environment conducive to increasing the complexity of the student: empathy towards one's pupils and a concomitant understanding of means of achieving specific educational objectives with specific children; comprehension of subject matter to be taught and of the alternate means it may be imparted; understanding of the many roles played by the educator in the classroom and

of the function played by these roles in the attainment of objectives; grounding in the administrative and political mechanisms of the school system and an understanding of the use of these mechanisms in the attainment of educational objectives.

The above listing of content domains is not, of course, either exclusive or comprehensive, but may serve to indicate at least the direction of an approach that may produce an instrument useful in attaining the ends of the present study. The results of the present study have not yielded information of immediate practical applicability, but have revealed that even at the present level of development of test methods, some of the predicted relationships do, in fact, exist; further, those correlations which have been demonstrated have been found to be in areas in which the content domains of the instruments used overlap those of the hypotheses under test.

While no recommendations can be made regarding the feasibility of teacher selection through the use of external criteria from this study, it is believed that sufficient indications of the promise of this approach have been shown to warrant further study.

Should such further research be undertaken in the future, some direction to such studies may be taken from the present work.

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APPENDICES

APPENDIX 1

Instruments used to measure complexity

a. a copy of the <u>Conceptual Systems Test</u>

b. criteria for assignment to Systems on the <u>Conceptual Systems Test</u>

c. a copy of the <u>Similarities Among Nations Test</u>

NAME _____

Please indicate the extent to which you agree or disagree with each of the following statements by marking an "X" in the appropriate place on the 6 point scale. There is no time limit. Have you any questions?

	STRONGLY DISAGREE	DISAGREE	SLIGHTLY DISAGREE	SLIGHTLY AGREE	AGREE	STRONGLY AGREE
1. I believe that to attain my goals it is only necessary for me to live as God would have me live						
2. I like to have a place for everything and everything in its place						
3. Any written work that I do I like to have precise, neat, and well organized						
4. I like my friends to confide in me and to tell me their troubles						
5. I like to join clubs or social groups						
6. I like to make as many friends as I can						
7. I feel like telling other people off when I disagree with them						
8. These days a person doesn't really know whom he can count on						
9. In the final analysis events in the world will ultimately be in line with the master plan of God						
10. I like to keep my things neat and orderly on my desk and workspace						
11. I don't like for things to be uncertain and unpredictable						
12. I always like for other people to tell me their problems						
13. I enjoy very much being part of a group						

	STRONGLY DISAGREE	DISAGREE	SLIGHTLY DISAGREE	SLIGHTLY AGREE	AGREE	STRONGLY AGREE
14. I like to form new friendships						
15. I feel like getting revenge when someone has insulted me						
16. You sometimes can't help wondering whether anything's worthwhile anymore						
17. The way to peace in the world is through religion						
18. I like to have my work organized and planned before beginning it						
19. I find that a well-organized mode of life with regular hours is suitable to my personality						
20. I like to help my friends when they are in trouble						
21. I like to meet new people						
22. I am a very sociable person who gets along with nearly everyone						
23. I feel like making fun of people who do things that I regard as stupid						
24. It is safest to assume that all people have a vicious streak and it will come out when they are given a chance						
25. Guilt results of violation of God's law						
26. I like to keep my letters, bills, and other papers neatly arranged and filed according to some system						
27. I like to have my meals organized and a definite time set aside for eating ..						

	STRONGLY DISAGREE	DISAGREE	SLIGHTLY DISAGREE	SLIGHTLY AGREE	AGREE	STRONGLY AGREE
28. Contributing to human welfare is the most satisfying human endeavor						
29. I feel at home with almost everyone and like to participate in what they are doing						
30. I like to criticize people who are in a position of authority						
31. Anyone who completely trusts anyone else is asking for trouble						
32. Marriage is the divine institution for the glorification of God						
33. I like to have my life so arranged that it runs smoothly and without much change in my plans						
34. I like to help other people who are less fortunate than I am						
35. I like to start conversations						
36. Politicians have to bribe people						
37. No man can be fully successful in life without belief or faith in divine guidance						
38. I like to plan and organize the details of any work that I undertake ..						
39. I like to treat other people with kindness and sympathy						
40. I like to give lots of parties						
41. Most people can still be depended upon to see you through in a pinch						

	STRONGLY DISAGREE	DISAGREE	SLIGHTLY DISAGREE	SLIGHTLY AGREE	AGREE	STRONGLY AGREE
42. Sin is but a cultural concept built by man						
43. I like to sympathize with my friends when they are hurt or sick						
44. I prefer to do things alone, rather than with my friends						
45. The dictates of one's religion should be followed with trusting faith						
46. I enjoy making sacrifices for the sake of happiness of others						
47. I think I have more friends than most people I know						
48. There are some things which God will never permit man to know						
49. I like to do things with my friends rather than by myself						

Scoring the CST[1]

Each item of the CST was assigned a score from 1 for "Strongly Disagree" to 6 for "Strongly Agree" and item scores were assigned to the six subtests, below. Items 42 and 44 were scored in the reverse direction (6 to 1).

Divine Fate Control
Items 1, 9, 17, 25,
    32, 37, 42, 45,
    48

Need for Structure Order
Items 2, 3, 10, 11,
    18, 19, 26, 27,
    33, 38

Need to Help People
Items 4, 12, 20, 28,
    34, 39, 43, 46

Need for People
Items 5, 6, 13, 14,
    21, 22, 29, 35,
    40, 44, 47, 49

Interpersonal Aggression
Items 7, 15, 23, 30

General Pessimism (Anomie)
Items 8, 16, 24, 31,
    36, 41

The means for the six subtests were obtained and compared with the cutting points given below to determine the S's System Classification.

System 1 Ss were those who scored above 4.19 on the Divine Fate Control subtest.

---

1. After Bower (1969) and Stewin (1969)

System 2 $\underline{S}$s were those who scored as follows:

    less than or equal to 4.19 on Divine Fate Control;
    greater than 3.75 on Interpersonal Aggression;
    greater than 3.39 on General Pessimism

System 3 $\underline{S}$s were those whose score pattern was:

    less than or equal to 4.19 on Divine Fate Control;
    less than or equal to 3.75 on Interpersonal Aggres-
                                sion;
    greater than 4.10 on Need for People

System 4 $\underline{S}$s were those whose score pattern was:

    less than or equal to 4.19 on Divine Fate Control;
    less than or equal to 4.10 on Need for Structure-
                                Order;
    less than or equal to 4.10 on Need for People;
    less than or equal to 3.37 on Interpersonal Aggres-
                                sion

The Combined score for the $\underline{CST}$ consists simply of the summed means of the six subtests.

SIMILARITIES AMONG NATIONS

Form 1

Name _____

Instructions

On the next two pages you will find a list of
nation pairs which include all possible pairing of the
ten countries listed below.

Australia	Red China
Brazil	Egypt
France	India
Cuba	Sweden
U.S.S.R.	U.S.A.

Beside each pair is a 7 point scale which runs from
"Extremely Similar" to "Extremely Dissimilar". Place a
check mark in the position on the scale which you feel
best represents your opinion as to how similar or
dissimilar the two nations are with respect to their
basic characteristics.

For instance, if you think that the important
characteristics of the paired nations are very much
alike, place a mark under "Extremely Similar". But if
you think that the paired nations are very different,
then place a check mark under "Extremely Dissimilar" .
Where the two nations are about equal in differences and
similarities, use the center of the scale, which is
unmarked. There are 7 graduations of similarity, so try
to make use of all 7 categories in making your judgements.

Do not spend too much time on any one of the pairs.
Record your first impression. However, you may change
a rating by erasing it and marking in your new opinion.
There is no time limit.

TURN THE PAGE

Now rate each pair of nations as to their similarity on the 7-point scale.

| Nation Pairs | SIMILAR | | | | DISSIMILAR | | |
	EXTREMELY	QUITE	SLIGHTLY		SLIGHTLY	QUITE	EXTREMELY
1. Cuba – U.S.A.							
2. Australia – U.S.S.R.							
3. Australia – Sweden							
4. Red China – France							
5. U.S.S.R. – U.S.A.							
6. Australia – Brazil							
7. France – India							
8. U.S.A. – Red China							
9. India – Australia							
10. India – U.S.A.							
11. Egypt – U.S.A.							
12. U.S.S.R. – Egypt							
13. Cuba – Sweden							
14. Sweden – U.S.A.							
15. Australia – Red China							
16. Egypt – India							
17. Brazil – Cuba							
18. India – Brazil							
19. India – U.S.S.R.							
20. Brazil – Sweden							
21. Egypt – Sweden							

TURN THE PAGE

	SIMILAR				DISSIMILAR		
	EXTREMELY	QUITE	SLIGHTLY		SLIGHTLY	QUITE	EXTREMELY
22. Red China – U.S.S.R.							
23. Brazil – Red China							
24. Sweden – India							
25. Egypt – France							
26. Australia – Egypt							
27. Cuba – Red China							
28. U.S.A. – Australia							
29. France – U.S.A.							
30. Australia – Cuba							
31. France – Australia							
32. Brazil – U.S.S.R.							
33. Cuba – U.S.S.R.							
34. Red China – Egypt							
35. Brazil – France							
36. India – Cuba							
37. Sweden – Red China							
38. France – U.S.S.R.							
39. Egypt – Cuba							
40. Sweden – France							
41. Brazil – Egypt							
42. France – Cuba							
43. U.S.A. – Brazil							
44. Sweden – U.S.S.R.							
45. Red China – India							

END

APPENDIX 2

Scales used in coding data

(1) <u>Sex</u>

0=F
1=M

(2) <u>Faculty of Re-registration</u>

0=dropped out or transferred to another faculty
1=returned to Faculty of Education for at least one term
   following that in which tests were administered

(3) <u>Home Address</u>

1=farm, rural, hamlet, village
2=towns to 5,000 population
3=small cities to 50,000 population
4=cities over 50,000 population

(4) <u>Religion</u>

1=fundamentalist (Adventist, Church of God, Full Gospel,
2=Islamic   etc.)
3=established fundamental faiths (Presbyterian, Lutheran)
4=Jewish*
5=old established faiths (Catholic, Orthodox)
6=established Protestant faiths (Anglican, United, etc.)
7=non-specified "Protestant"
8=non-specified "Christian," Unitarian
9=agnostic, atheist, none

Faiths were rated by a panel of judges from 1=high to
9=low insistence upon adherence to dogma by a given
religion.

* The panel reported some difficulty in placing the
  Jewish faith on the continuum, and this writer does
  not agree with the rating finally arrived upon.
  Since there were only 4 persons of Jewish faith in
  the total sample, the correctness of this particular
  rating is probably of little importance.

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(5) <u>Birth</u>

0=Canadian born
1=foreign born

(6) <u>Continuity of Education</u>

0=continuous attendance
1=education interrupted for at least one year

(7) <u>Live</u> <u>home?</u>

0=lives at home while attending university
1=lives away from home while attending university

(8) <u>Father's</u> <u>Occupation</u>

00=unemployed
01=housewife
02=menial labour
03=semi-skilled
04=skilled labour

05=menial white collar
06=clerical
07=retired
08=business
09=professional

<u>multipliers</u>

00=lowest rank
10=independent of supervision
20=foreman/supervisor
30=administrator (at least two subordinate foremen)
40=manager of business
50=owner/manager of large concern
60=independently wealthy

This scale was composed by a panel of judges consisting
of graduate students from this Department. In use, each
occupation is rated using a two digit number made up of
the first digit of the multiplier and the second digit
of the occupation list. Thus, farmers, for example,
would be rated 13.

(9) <u>Blishen</u> <u>Revised</u> <u>Socio-Economic</u> <u>Index</u> (<u>SES</u>)

This the standard Canadian scale of occupational ranking
by occupation. The version used here (1967 revision)
uses a decile division, but for the purposes of this
study, because of the low number of respondents in the
uppermost listings, it was decided to combine the two
top deciles to yield a nine-point scale. Values assigned
were from 1=membership in lowest decile through 9=
membership in ninth and tenth deciles.

It would be tedious to reproduce the entire Index here,
but a list of representative occupations within the
nine categories used follows (After Blishen, 1968).

1=labourer, weaver, guide
2=tanner, knitter, cook
3=postman, tailor, miner
4=barbers, molders, boiler-
               maker
5=sales-clerk, plumber

6=millwright, postmaster,
               foreman
7=mechanic, clerical, other
               foreman
8=photographer, stenographer,
               social worker
9=owners/managers, professors,
    physicians, chemical eng.