INTELLECTUAL STRENGTHS IN CULTURALLY DIFFERENT GROUPS: AN ESKIMO ILLUSTRATION

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The furor unleashed by Jensen's (1969) suggestion of a genetic explanation for the lower performance of Blacks on intelligence tests has led to substantial doubt about the social value of research on racial differences in cognitive abilities. Using the Eskimo as an illustration, this paper argues that such research, if based on a multi-ability model of intelligence such as the structure of intellect (Guilford, 1967), could have substantial social value. First, it might identify cognitive strengths of culturally different groups. Second, it might suggest occupational and educational areas where such strengths could be used to advantage.

Culturally Different Groups and Models of Intelligence

The finding that culturally different groups tend to do poorly on cognitive tests developed to measure western middle class intellectual functioning has become commonplace. If the gene pool rather than the environment or the tests themselves becomes the popularly accepted explanation for this performance difference, it takes little research sophistication to predict the effects on teachers, employers, and voters, who are oblivious to researchers' pious cautions about judging individuals on the basis of group norms. Thus, substantial political and economic pressures have been placed on researchers to select other areas of inquiry and, in some instances, to refrain from publishing findings concerning racial differences in cognitive functioning.

Studies on racial differences in intellectual abilities, however, may not necessarily bring "bad news" from the viewpoint of those committed to equalitarian social goals. Indeed, research based on a multi-ability model of intelligence, which is both theoretically and empirically justifiable, might well identify cognitive strengths in culturally different groups, intellectual areas where they excel.

It is the concept of intelligence as a single general ability that is in large part responsible for the consistent findings of "intellectual inferiority" among most culturally different groups. This result occurs because general intelligence tests were developed historically not on the basis of any theory about the nature and structure of human abilities but rather for a very specific practical purpose—to predict success, that is, success given the educational and occupational methods and selection traditions of Western society. It should hardly be surprising, therefore, that members of Western society tend to be better adapted—perhaps through heredity, perhaps through socialization—to the peculiar demands of Western culture than those who are members of other cultural groups. What other result could one reasonably expect? The western concept of *general* intelligence is highly western culture bound.

Other models of intelligence, in contrast, such as Guilford's (1967) structure of intellect, were developed not to predict to any established order but rather to organize in a theoretically fruitful manner a broad range of empirically identified abilities and to suggest others. When a multi-ability model of intelligence is used, culturally different groups might be found to excel in a number of these intellectual skills. Moreover, since the model itself gives equal status to different abilities, it invites the question not merely of what these abilities predict, given things the way they are, but also the question of how things could be changed in order to take advantage of the range of human talents. Equalitarian goals may better be served by recognizing that different cultural groups may have different areas of strength and weakness and that their areas of strength may be of special value to society than by continuing the fruitless attempt to "prove" that the intellectual abilities of different groups are identical or would be if the environment or the tests or something else were only different.

So much controversy, prejudice, and emotion in this country surround the case of Negroes and their abilities that it may be more illuminating to consider the social and theoretical fruitfulness of this perspective with an entirely different cultural group, such as the Eskimo. The Eskimo eminently qualify as "disadvantaged." Indeed, their employment, income, and educational levels are substantially lower than those of ghetto Blacks (Federal Field Committee, 1968). The majority of Alaskan Eskimo adults live in remote shanty town villages and support themselves by subsistence hunting and fishing, occasional unskilled jobs, and various welfare programs. Alaskan Eskimo children usually have attended school for the same number of years as their western age-mates but their performance on western intelligence and achievement tests is far lower (Alaska Department of Education, 1967-1971). Yet, in certain cognitive abilities it is possible that Eskimos surpass Caucasians. These abilities concern the domain of intellectual functioning that Guilford (1967) conceptualizes as the figural area, the processing of visual information.

This paper first reviews the theoretical basis for entertaining the notion that Eskimos may have high figural abilities. Available anecdotal reports and empirical studies are then organized through Guilford's model of intelligence into a set of hypotheses concerning the types of figural abilities which may be relatively high among Eskimos. Occupational and educational implications of Eskimos' possible cognitive strengths are explored.

This discussion relates primarily to the Eskimo and perhaps to other Mongolian groups where similarly high figural abilities have been reported, for example, Orientals (Lesser, Fifer, & Clark, 1965) and American Indians (King, 1967; Levensky, 1970). The general point, however, is that different cultures may foster different types of intelligence, that is, particular abilities which are adaptive in coping with the demands of a particular environment. Indeed, the Eskimos' arctic hunting culture may provide a nice illustration of the alternative

world Bereiter (1969) speculates upon, where the tables would be turned and it would be perceptual rather than abstract verbal abilities that would constitute "intelligence."

Theoretical Basis

Demands of Arctic Hunting

The ecological demands made by a particular environment together with a group's cultural adaptations to these demands may stimulate the development of particular types of cognitive abilities (Berry, 1971). For thousands of years the Eskimos' economy has been based on hunting in the Arctic. The Arctic, in contrast to urban areas or farmland, is an environment of extreme visual uniformity. As Laughlin (1970) describes it:

> The horizon is commonly flat with minor relief. There are no trees or forest canopy. The visual cues are often small, consisting of subtle changes in the colour of the ice, of small patches of snow which reveal wind direction and intensity, of water texture and slight indications of tidal changes and currents. The available cues are obscured and diminished by fog, snow, wind, rain glare, darkness, ice, and low level contrasts that camouflage the animals as well [p. 9].

That Eskimos have made a highly successful adaptation to the demands of arctic hunting is evidenced by their ability not only to maintain the group but also to expand geographically. The Eskimos together with the closely related Aleuts inhabit the longest distance of any people in the world (Laughlin, 1970).

To hunt successfully in the visually uniform Arctic requires particular types of cognitive skills. The Eskimo hunter, for example, must be extremely sensitive to visual detail (Berry, 1971). In his ethnography of Eskimo hunting, Nelson (1969) emphasizes that the hunter must be able to detect slight cracks in the ice because a breaking icepack could set him adrift in the ocean. To find his way back to a few houses in the tundra, the hunter must attend to the angle and shape of small drifts of snow. If he is to survive should he venture out, the hunter must judge weather conditions by carefully observing subtle patterns of dark and light on clouds made by reflected water, ice, and land. For an urbanite, in contrast, attention to such visual detail may even be nonadaptive. The driver of a car, for example, needs to code a reddish hexagonal figure as a stop sign despite any individual peculiarities of color or shape. On the other hand, functional adaption for the Eskimo hunter requires that he code visual information on the basis of its uniqueness not that he categorize in terms of general form.

Not only awareness of figural detail but also the ability to memorize

this detail and especially its spatial arrangement is crucial to successful navigation through the Arctic. As Nelson (1969) observes:

> On the flat and monotonous tundra or the jumbled piles of sea ice, the smallest unique features become important landmarks—an upturned rock, a cut in the river bank, an unusually large or strangely shaped ice pile. The Eskimos are extraordinarily skillful at observing such landmarks and remembering their spatial relationships [p. 102].

Caucasians who have traveled with the Eskimo frequently remark upon their apparently extraordinary ability to find their way through what appears to be a featureless terrain by remembering visual configurations (Nelson, 1969; Carpenter, 1955). According to some reports, such memories persist for long periods of time. Elderly hunters have succeeded in guiding parties through terrain seen only in their youth (Carpenter, Varley, & Flaherty, 1959).

A number of other figural abilities may be critical to the Eskimo hunter. For example, he must be able to recognize rotated visual patterns since he may return to an area from a different direction. Spatial scanning is important in selecting a clear path for sled and dogs through terrain broken with rough ice piles. The hunter must be able to analyze or break down complex visual configurations, for example, determining if an ice boulder is composed of the rounded ice pieces on which it is safe to camp or the sharp pieces which may break apart under him. In short, to survive in the Arctic, the hunter must continually be aware of, be able to recall, and be able to evaluate figural information. Such environmental demands are rarely made of urban Caucasians and for them attention to figural detail could even be dysfunctional.

Language as a Cultural Adaptation

In its adaptation to the demands of arctic hunting, the grammatical character of the Eskimo language appears to be a powerful intellectual tool for the processing of figural information (Berry, 1966). In Eskimo, localizers consisting of prefixes and suffixes specifying shape and location may be grammatically integral to the word that represents an object. As Gagné (1968) points out, the English sentence, "Please put this thing over there," could be translated into four different three word sentences in Eskimo because both the shape of the object and also the shape of the surface on which it is to be placed must be specified through localizers. Moreover, contrasts between certain localizers used in such a three word Eskimo sentence might also specify the directional position of the object on the surface. The English language, in contrast, would require several additional words to code the same amount of figural information. Since the use of such localizers is grammatically obligatory, the Eskimo language speaker may be more likely to attend to shape and location. Moreover, because such localizers permit economical coding of spatial information, the speaker of the Eskimo

language may also find such information easier to remember than speakers of English.

Socialization Practices

Eskimo socialization practices also seem likely to foster a high level of figural abilities. Eskimo children are treated with great indulgence and child-rearing practices for both sexes emphasize independence and exploration (Briggs, 1970). A number of studies suggest that this type of child-rearing orientation leads to highly developed figural abilities. Within Western culture, development of such spatial skills as a high level of field independence appears to be related to parental encouragement of independence as opposed to parental strictness and pressure toward conformity (Witkin, 1967). Within African groups, greater experience in exploring the environment also has been found to relate to a higher level of spatial ability (Munroe & Munroe, 1971; Nerlove, Munroe, & Munroe, 1971). Comparisons between cultures also suggest that members of cultures with more severe socialization tend to have a lower level of spatial skills (Berry, 1966).

Other aspects of Eskimo socialization may contribute to highly developed figural abilities. Traditionally, children learn more by carefully watching adults than by receiving verbal instruction. In addition, Eskimos tend to place great emphasis on observable information. Marshall (1933) compared the conversational topics of Eskimos versus whites living and hunting in the same area, and found that Eskimos' conversation centered much more frequently on geography. An Eskimo hunter, for example, might entertain the group by a detailed description of the forks of a minor river and his audience would interrupt to ask even more specific questions. Severe social sanctions as well as natural disasters befall Eskimos who fail to learn such figural information. Nelson (1969) observes that hunters who become lost are mercilessly ridiculed upon their return.

Genetic Influences

It seems possible that genetic factors also may help account for the high level of figural abilities noted among Eskimos. Comparisons of identical and fraternal twins suggest that spatial ability, at least among western groups, has a high degree of heritability (Thurstone, 1951; Osborne & Gregor, 1966). Moreover, sophisticated studies attempting to relate specific environmental factors to different mental abilities have found that the learning environment of the home accounts for a very small percentage of the variance in spatial skills in contrast to other abilities (Marjoribanks, 1972).

Since the penalty for navigational errors in the Arctic could easily be rapid death through freezing, natural selection may have resulted in a high level of figural skills in the Eskimo group. Those hunters who possessed a high level of figural abilities may have been more likely to survive and to have many offspring. The offspring of successful hunters

could also have been better fed and thus more resistant to disease. Such natural selection processes may be of great importance in determining characteristics of a population such as the Eskimo, who have lived in the same environment for long periods of time, who have been sexually isolated for many generations, and who passed through winter periods of food scarcity which reduced population (Witkin, 1967; Laughlin, 1970).

Compensatory Influences

Compensation for difficulties in receiving information through verbal channels may also contribute to the development of Eskimos' figural abilities. Otitis media, an ear infection, has resulted in prevalent hearing loss among Eskimos. Moreover, many Eskimos have difficulty understanding information presented in English and may attempt to compensate by reliance on figural skills. An Eskimo student employed in our research institute, for example, was found to be memorizing the visual arrangement of folders in the files since he did not understand the filing system.

No studies have been done which attempt to determine to what extent language, socialization, genetic or other factors are related to the development of figural abilities in Eskimos. In contrast to the male superiority characteristic of Western groups (Berry, 1966; Kunce & Sturman, 1966; MacArthur, 1967; Feldman & Bock, 1970), the intriguing lack of sex differences in spatial abilities commonly found among Eskimos suggests that the high level of spatial abilities among Eskimos probably depends on general factors rather than on specific hunting experience. Clearly, Eskimo males would have more hunting experience than females.

Anecdotal Accounts

Anecdotal reports of high level performance on specific tasks are not generally considered strong evidence of the possession of a high level of a specific ability. However, frequent and consistent reports of high performance are at least suggestive. For example, the relationship between certain spatial abilities and mechanical aptitude is generally accepted, and descriptions of Eskimos' mechanical abilities have become folklore of the Arctic (Foster, 1969; Hall, 1967). Carpenter (1955) reports that in several instances Eskimos were able to repair complicated pieces of machinery which trained white mechanics had failed to fix. Crisler (1958) remarks that Eskimos succeeded in repairing a radio that their party had been forced to abandon. Oil companies who have hired Eskimos to work in the Prudhoe Bay oil fields recently have reported, "we have found that the Eskimo has more innate ability to work around equipment than anyone else around the world (Democrats talk on oil, 1970)." While Eskimos' apparently high mechanical aptitude may result in part from their higher level finger dexterity

(Alaska Department of Labor, 1969), skill in analyzing spatial relationships may also be involved.

Another commonly observed figural skill of Eskimos is an uncanny ability to comprehend rotated visual configurations. Carpenter (1955) notes that Eskimos often carve figures oriented in different directions without bothering to turn the tusk they are working on. Similarly, Eskimos may examine photographs in whatever direction they are received and hang pictures with little attempt to make them vertical. In an impromptu experiment, Carpenter (1955) drew twenty figures oriented in different directions on a single sheet of paper and asked a number of the Eskimos to point to the seal, walrus, and so forth. He reports that the Eskimos could identify the figures immediately while he had to turn the page around even though he himself had drawn them. Briggs (1970) similarly observes that Eskimo children had a disconcerting ability to read her private field notes as easily upside down as right side up.

Anecdotal reports also contain numerous descriptions of Eskimos' exceptional performance in tasks requiring memory for visual information. Many Caucasians have asked Eskimos to draw maps of the terrain and later found them to be extraordinarily accurate both in significant detail and in spatial arrangements (Briggs, 1970; King, 1848). Indeed, Marshall (1933) reports that an Eskimo woman "once sketched for me the first fifteen miles of the Alatna River, a stream which is nothing but bends in this lower portion, and she had them all plotted from memory almost as accurately as the instrumentally constructed Geological Survey map [p. 81]." Similarly, Carpenter (1955) found that maps of Southampton Island made by Eskimos in 1929 were almost identical to maps made years later by aerial photography.

Evidence of Eskimos' figural memory abilities is found in many other sources. Eskimos' drawings are notable for their precise detail (Ryan, 1965). Eskimos were able to describe birds in north Alaska and northeast Canada in sufficient detail for a naturalist to make a taxonomic identification of more than eighty species (Lantis, 1968). Highly developed abilities in visual memory may also underlie Eskimos' talent for mimicry, which visiting anthropologists, who are often the objects of the ridicule, have had frequent occasion to observe (Briggs, 1970, p. 129; King, 1848; Carpenter et al., 1959). In a survey of teachers in Alaskan Eskimo villages, Kleinfeld (1970) found that about 70 per cent of the responding teachers thought that their students showed unusual ability to observe and remember visual detail. These teachers mentioned that their students were quite good in tasks which required visual memory or spatial abilities such as geometry, map studies, handwriting, puzzles, repeating designs, and remembering the number and arrangements of objects.

Eskimos' inventive abilities, especially in tasks involving unconventional uses of concrete objects, have also become legendary. Lacking specialized repair shops, Eskimos have had to devise unusual solutions to practical problems (Nelson, 1969). Eskimos' divergent intellectual

skills are indicated by such ingenuity as using pieces of frozen meat to construct a sled or using dental floss to replace the cross hairs of a telescopic sight. Interestingly, among Caucasians as well, highly developed figural abilities such as field independence appears to be associated with the ability to find unconventional solutions to problems (Harris, 1962).

In many instances, alternative explanations of these anecdotal accounts can be given which do not posit unusually high figural skills among Eskimos. For example, Eskimos' indifference to the orientation of pictures or photographs can be explained as a high tolerance for disorder. Tales of Eskimos' mechanical skills can be rebutted by tales of broken machines piled in arctic villages. However, these accounts, drawn from many observers in many different periods, do point to a few fundamental intellectual abilities that might underlie and economically explain Eskimos' performance in many diverse situations. Moreover, these fundamental intellectual abilities are also consistent with theoretical expectations about the types of intellectual skills that would be adaptive in an arctic hunting economy.

Empirical Research

Cross-Cultural Testing Problems

A number of studies have compared the figural abilities of Eskimos with those of other groups through psychological tests. In reviewing this research, the familiar problems of cross-cultural testing need to be recalled. Eskimos' performance on standardized tests may be lowered because of their unfamiliarity with test-taking conventions and because of cultural biases of the tests. Eskimos, for example, may find it difficult to view a trivial, pointless task such as copying a design or running through a finger maze as worthy of serious concentration and maximum effort. Cultural biases in figural tests are still present if more subtle than on verbal tasks. On a spatial test which used directional arrows, for example, Feldman and Bock (1970) report that about a third of their Eskimo subjects did not appear to understand the directions and scored at or near chance levels.

In addition to these familiar difficulties in cross-cultural research, three special problems may occur with the Eskimo which could result in test scores lower than ability levels. First, Eskimos, especially young males, have become increasingly antagonistic to any sort of testing and research, which they view as another form of White exploitation. Co-operation, if given at all, may be perfunctory, resulting in extremely low test scores (see Feldman & Bock, 1970). Second, in many figural tests, the score depends on speed of response. Eskimos, especially males, have been socialized into extreme caution before making a judgment. The hunter is taught never to take risks, never to call out a hasty evaluation because the penalty can be swift death not only for himself but also for others who rely on his decision (Nelson, 1969).

Error may result in humiliating social ridicule. Especially more traditional Eskimos tend to have a slow, cautious response style which may depress their scores on speeded figural tests (Preston, 1964). Power rather than speed tests may be better indicators of Eskimos' figural abilities. Third, some evidence that Eskimos' peak performance on figural tests occurs later than that of Western groups raises the possibility of a slower rate of cognitive maturation among Eskimos which would be consistent with their somewhat slower rate of physical maturation (Feldman & Bock, 1970). If this is the case, the usual age-matched comparisons between Western and Eskimo children on figural tests may be misleading.

Although these factors may lead to reports of lower figural abilities among Eskimos than is actually the case, it is important to point out that another factor, a tendency to report interesting findings, may bias the literature in the opposite direction. The complication is that, since findings that Eskimos have lower abilities than Caucasians would be generally expected, such results may not be offered for publication.

Tests of Awareness of Figural Detail

Several tests have been given to Eskimos which require the ability to conceptualize figures in precise detail. In an exceptionally well-designed study, Berry (1966) gave a visual discrimination test involving awareness of small gaps in geometrical figures flashed on a screen to Canadian Eskimo, to the Temne of Sierra Leone, and also to Scots who served as a Western comparison group. He found that the Eskimos not only far surpassed the Temne but also the Scots as well. In another task which required accurate reproduction of simple geometrical forms which could easily be assimilated to the shape of associated objects, Berry (1969) again found that the Eskimo far surpassed both the Temne and the Scots.

The Goodenough Draw-A-Man Test which also requires detailed conceptualization of figures has been used in a number of investigations. Eskimos' performance on this test has been quite variable, however, possibly because extraneous factors appear to have substantial effects on test scores. Thus, in a very early 1930-1931 testing of isolated Eskimo children, unfamiliarity with the drawing materials was probably responsible for scores below test norms (Anderson & Eels, 1935). However, Marshall (1933) gave this test to a small group of Eskimo children living in close proximity to Westerners and found that young Eskimo children scored markedly above test norms while older children scored at appropriate norms. In a recent study of Eskimo children in a transitional town, Levensky (1970) found that young children scored slightly above test norms and that older children scored at appropriate norms. Vernon (1969) found that eleven year old Eskimo boys performed slightly below test norms, but he points out that this result may be partially attributable to an art teacher who trained students to make impressionistic rather than detailed drawings.

Harris (1963) in contrast, found consistent superiority in Eskimo children's scores on the Draw-A-Man test. However, these tests were sent to Harris by village teachers who may not have included poorer drawings.

Tests of Figural Memory

Little research has been done in the area of memory for visual information, although Berry's (1969) figural reproduction task and the Draw-A-Man Test may involve this ability to some extent. In a study of 125 village Eskimo and 501 urban Caucasian children, Kleinfeld (1971) found that village Eskimo children scored significantly higher than urban white children on a more difficult version of the Memory for Designs test. Although MacKinnon (1972) did not replicate this finding in using a modified version of the test, his sample included only 20 Eskimo and 20 white students selected by school personnel in an undetermined fashion.

Another indicator of Eskimos' visual memory abilities may be their scores on standardized spelling tests. These scores are often almost as high as the scores of white groups despite Eskimo children's lack of proficiency in other English skills (MacArthur, 1968). An intriguing possibility is that Eskimo students learn spelling words by memorizing the word's figural shape even when they do not know its meaning.

Tests of Spatial Abilities

Several types of spatial tests have been given to Eskimos. In general, where the Eskimos have had little education or little familiarity with Western institutions such as test-taking, they tend to match the performance of western groups or score slightly lower. However, where their educational level is similar to that of the Western group, Eskimos score significantly higher in a number of instances. Moreover, on those types of spatial tests where Eskimos' performance is not substantially associated with education, Eskimos with very little education may surpass the performance of western groups.

Studies of Eskimos' performance on tasks involving the reproduction of designs such as Kohs Blocks or the Block Design sub-test of the Wechsler Adult Intelligence Scale (WAIS) illustrate this pattern. Berry (1966) found that a traditional group of Eskimos scored significantly lower than the Scottish comparison group on this test while a transitional group, which averaged only three years of education, scored at the same level. Preston (1964) and Foster (1969) similarly report that Eskimos with less education than whites scored at about the same level as the test norms. Only Vernon (1969) reports a slightly lower median performance of Eskimo boys on this test, and their schooling was often delayed or irregular. However, in two studies where Eskimo children had attended village schools for the same length of time as Western age-mates, they were found to score significantly higher than test norms (Forbes, 1971; Feldman, 1971).

On the Object Assembly sub-test of the WAIS, which shows little

relationship to education among Alaska Natives (Foster, 1969), Eskimo or Alaska Native adults (a political rather than racial grouping which includes Indians) with little education have been found to surpass test norms (Preston, 1964; Foster, 1969). Indeed, Lantis (1968) reports that adolescent and young adult Eskimo males performed on a somewhat similar Block Assembly Test at the same level as Harvard undergraduates, whose nonverbal intelligence is probably substantially higher than that of the general population.

Eskimos' performance on maze tests also raises the possibility that Eskimos might surpass Westerners if education or familiarity with Western institutions were equalized. As a group, Eskimo adults performed slightly below test norms on Peter's Circular Mazes, but the subgroup of Eskimos with only a high school education performed substantially higher (Kunce, Rankin, & Clement, 1969). Vernon (1969), however, found that Eskimo boys' median performance on Porteus Mazes was lower than an English comparison group, but the Eskimo students frequently had delayed or irregular schooling.

On measures of field-independence, Eskimos' performance tends to be about the same as western groups. Berry (1966) found no significant difference between Scots and either traditional or transitional groups of Eskimos on the Embedded Figures Tests. Vernon (1969) and MacArthur (1968) found that Eskimo students performed slightly lower than white students on Embedded Figures, but MacKinnon (1972) found no significant difference. On the Draw-A-Man test scored for field independence, Vernon (1969) found that the Eskimo males surpassed a white comparison group.

Only one spatial test requiring comprehension of rotated figures—a skill frequently mentioned in Eskimo anecdotal reports—has been given to Eskimos. Berry (1966) found that both traditional and transitional groups of Eskimos surpassed Scots' performance on Morrisby Shapes. The difference between the transitional Eskimo group and the urbanized Scots reached statistical significance.

In sum, available empirical research, while possibly biased by a tendency to report unexpected findings, gives some support to theoretical expectations and anecdotal accounts which suggest that Eskimos could have relatively high figural abilities. Despite a number of cross-cultural testing problems which would be expected to lead to scores indicating lower than actual ability level, Eskimos frequently perform significantly higher than Western groups on psychological tests measuring ability to conceptualize or remember visual detail and sometimes perform significantly higher on tests measuring spatial abilities.

Another interesting consideration is the Western figural tests tend to be based on the dominant figural experiences of Western cultural groups. Most tests, for example, require manipulation of idealized geometrical forms such as perfect hexagons. While such forms may be very familiar to Westerners who live in highly carpentered environments, the experiential world of village Eskimos is dominated as much by natural irregularities such as ice piles and twisting rivers as by

Western importations. An intriguing possibility is that tests measuring abilities to process information concerning visual irregularities could reveal more pronounced figural strengths among Eskimos.

Relationships to Guilford's Structure of Intellect

While numerous kinds of visual and spatial tests have been given to Eskimos, no systematic attempt has been made to identify the types of figural abilities in which Eskimos may surpass western groups and the types of figural abilities which may be about the same or lower. More precise information about the nature of Eskimos' figural skills is crucial in determining how these abilities might relate to aptitude for certain occupations and also in devising instructional methods which build on them. As Bracht (1970) points out, it has generally been those studies which have defined individual characteristics with great specificity and then developed treatments narrowly based upon them that have succeeded in finding aptitude-treatment interactions.

Guilford's (1967) familiar structure of intellect provides a theoretical model of intelligence which is useful in organizing anecdotal accounts and empirical studies concerning Eskimos' figural abilities into hypotheses concerning the set of figural abilities where Eskimos may exceed Western groups. In this model of intelligence, the figural area is conceptualized as one of the four fundamental content areas of intellectual functioning. Specific abilities within the figural content area are then defined in terms of two parameters. One is the forms of information that occur—units, classes, relations, systems, transformations, and implications. The second is the types of intellectual operations that may be performed on these forms of information—cognition, memory, convergent production, divergent production, and evaluation. Thus, a specific figural ability is conceptualized as "memory for figural units" or "cognition of figural transformations." A practical task such as drawing a map and a psychological test such as Block Design may involve a number of these different figural abilities.

Using Guilford's structure of intellect to identify figural abilities in an Eskimo population does have a serious limitation. This model has been developed and empirically tested among western populations. It is entirely possible that Eskimos' figural abilities are differently structured. However, the use of Guilford's model, especially in the initial stages of research, seems justified for several reasons. First, figural abilities appear to be highly developed among Eskimos so a more highly differentiated model of figural abilities may be appropriate. Figural abilities tend to be more generalized in groups where they are poorly developed such as Africans or women. Second, Vernon (1969), using a general plus group factor model of intelligence, did find the factor structure of intellectual abilities among Eskimo boys to be similar to that of English boys, which suggests some comparability in the factor structure of intelligence between Eskimo and Western populations. Third, even if the factor structure of figural abilities in Eskimos is

found to be different from that of westerners, one important purpose of such research is to identify figural strengths among Eskimos relative to Westerners. Thus, use of figural ability differentiations found in a Western population is a relevant perspective.

Available anecdotal accounts, empirical studies, and an analysis of the cognitive demands made by arctic hunting (not in terms of practice effects but rather in terms of abilities developed through natural selection or socialization) raise a possibility that Eskimos may surpass westerners in the following figural abilities. These abilities are defined in greater detail in publications from the Aptitudes Research Project (e.g., Bradley, Hoepfner, & Guilford, 1969; Hoffman, Guilford, Hoepfner, & Doherty, 1968).

1. *Memory for Figural Units* (*MFU*) or memory for unique visual forms as isolated units of information.
2. *Memory for Figural Systems* (*MFS*) or memory for arrangements of things, for location.
3. *Memory for Figural Implications* (*MFI*) or paired associate memory involving two figures.
4. *Cognition of Figural Systems* (*CFS*) or the comprehension of spatial arrangements with the observer as the frame of reference, similar to the frequently defined "spatial orientation" factor (French, Ekstrom & Price, 1963).
5. *Cognition of Figural Transformations* (*CFT*) or the ability to visualize how a figure undergoes change, similar to the frequently defined "visualization" factor (French et al., 1963).
6. *Evaluation of Figural Units* (*EFU*) or the ability to compare visual figures with some standard to determine agreement, more descriptively called "perceptual accuracy."
7. *Evaluation of Figural Relations* (*EFR*) or the ability to compare visual relations with some standard to determine agreement.
8. *Evaluation of Figural Implications* (*EFI*) or the ability to compare visual extensions with a standard to determine agreement, more commonly called "spatial scanning" (French et al., 1963).
9. *Convergent Production of Figural Transformations* (*NFT*) or the ability to break down one perceptual organization to form another, closely related to field independence (Witkin, 1967).
10. *Divergent Production of Figural Transformations* (*DFT*) or creative tactical shifts in solving figural problems, similar to "adaptive flexibility" (French et al., 1963).

Developing tests appropriate for measuring these abilities in an Eskimo group and studies concerning disparate Eskimo communities are necessary to determine if these figural skills are higher among Eskimos than among other cultural groups.

Occupational Implications

Eskimos' figural abilities may be of great significance in the context of an arctic hunting economy. However, the "higher mental processes" of one culture, as Vernon (1969, p. 89) so aptly puts it, "may be the relatively worthless 'stunts' of another." Are Eskimos' figural abilities nothing but interesting curiosities or might they also have value in adapting to rapidly encroaching Western culture?

Since the precise nature of Eskimos' figural abilities has not yet been clearly identified, these abilities can not yet be related to specific occupational aptitudes. Only general implications can be speculated upon. Figural skills have been found to predict success in a number of technical school subjects (reviewed in Smith, 1964). Such abilities as perceptual accuracy are known to be important in clerical occupations. Spatial and visualization abilities have been found to predict pilot aptitude (reviewed in Hoffman et al., 1968), a skill in high demand in the Arctic where settled areas are linked primarily by plane. Thus, if Eskimos have a high level of figural abilities, they may have an advantage in the technical occupations, where, for a great many, initial entry into the Western occupational structure is likely to occur.

An intriguing speculation, however, is that Eskimos' figural skills could ultimately enable them to make significant contributions to advanced fields such as higher mathematics and physics. Smith (1964) reviews a number of lines of evidence which suggest that, after a certain minimum level of verbal ability is achieved, it is spatial abilities that are related to outstanding performance in such areas as advanced mathematics and physics. One has only to recall Einstein's (1954, p. 25) description of his mental processes as "visual and motion" with words not playing a role until a secondary stage. Smith (1964) reports that many spatially talented students who eventually became famous mathematicians or scientists were considered dull in school, where talent is judged primarily by verbal facility. After prolonged contact, when Eskimos' English competence has become higher, it is possible that their figural abilities could lead to significant technical achievements.

Adapting Instruction to Eskimos' Intellectual Strengths

In the occupational area, where roles are relatively fixed, the central question may be to discover the way in which Eskimos' intellectual strengths relate to the given order. In the educational area, however, it may be hoped that there is opportunity to modify traditional instructional practices. Moreover, for instructional purposes, the question of whether Eskimos have figural skills higher than those of other groups is immaterial. The point is that Eskimos themselves tend to evidence a pattern of high figural ability and low English verbal ability. Thus, the educational question is whether new forms of instruction can be devised which build on Eskimos' intellectual

strengths to increase their achievement, especially in their areas of academic weakness.

Considerable research is being done on the problem of adapting instruction to individual differences (reviewed in Bracht, 1970 and in Bar-Yam, 1969). These studies, however, may not be conceptualizing the problem in ways that are most socially fruitful.

Research concerned with adapting instruction to individual differences in mental abilities has identified as its general objective the development of different instructional methods for students with different ability patterns, thus permitting the assignment of students to the method which maximizes their learning. This conception of the research problem can be traced to Cronbach's (1967) famous paper on adapting instruction to individual differences. In this paper, Cronbach identified the development of differentiated instruction as the "most interesting" problem in this area of psychology. He dismissed as mere remedial instruction the alternative possibility of providing additions to traditional instruction to accommodate those students with ability patterns unconducive to learning under traditional methods.

The objective of devising different instructional methods for different students, however, is at best an intermediate goal. The ultimate objective is to enable students of varying characteristics to learn effectively—especially those students whose characteristics do not usually lead to school success. Attempting to accomplish this goal by the particular means of differentiating instruction may have a number of highly undesirable consequences. First, mental ability patterns tend to be highly associated with ethnic group and social class membership (Lesser, Fifer, & Clark, 1965) so the result may be segregated instruction. Second, when instruction is differentiated, the specific informational content taught may be the same but the intellectual operations taught may be quite different (Carroll, 1967). In the long run, it is the learning of the more powerful intellectual operations that makes the greatest difference to intellectual attainment so, in the long run, differentiated instruction may magnify group differences in intellectual attainment.

Both of these dangers are well illustrated by Jensen's (1969) implied proposal that those students who have relatively high associative memory ability (who happen to be predominantly lower class Black) be taught by rote methods while those students who have relatively high conceptual learning ability (who happen to be predominantly middle class white) be taught by conceptual methods. In the case of the Eskimo, such an approach would be even more blatantly absurd since it would suggest that white students be taught by verbal methods and Eskimo students by visual methods, a course likely to leave Eskimos even further verbally behind.

An alternative approach to adapting instruction to individual differences is to supplement traditional instruction with other methods which take advantage of different types of intellectual abilities. Where the supplement is not more of the same standard instruction, it need

not be dismissed as mere remediation. Thus, in the Jensen example, the conceptual approach to certain informational content could be supplemented with an associative approach in the same lesson or lesson sequence. This strategy would provide alternative ways to acquire the informational content, and experiencing parallel conceptual and associative approaches might help lower class Black children to acquire the more powerful conceptual tools.

Such a "supplementary approach" to the problem of adapting instruction to individual differences may be illustrated by my own attempts to devise instruction adapted to Eskimos' figural strengths. For example, since Eskimo students tend to have great difficulty in learning superordinate and subordinate class relationships, figural methods of teaching such as Venn diagrams are being devised to supplement the traditional verbal approach. While such a supplementary approach may not be the most interesting conceptualization of the problem leading to the most elegant findings, it might be a more useful conceptualization leading to more applicable findings.

Conclusion

Recognizing that there are many different types of intellectual abilities and that many factors, genetic and environmental, may lead to disparate areas of intellectual strength and weakness in particular cultural groups may help create a broader conception of social worth than performance on a general intelligence test. My own research on Eskimos' figural abilities appears to have had some effect in changing Alaskan teachers' concepts of Eskimo students' potential, and Eskimos themselves tend to interpret it as rebutting the "dumb Eskimo" stereotype.

As Bloom (1963) has pointed out, if we defined as gifted any child in the highest ten percent on any one of Thurstone's five primary mental ability tests, as many as sixty percent would fall into this category. With Guilford's model of 120 intellectual abilities, it seems not improbable that the majority of children would be gifted in some way (Guilford, 1967, p. 28). Moreover, as could be the case with Eskimos' figural abilities, reaching a certain minimum of achievement in areas of present weakness may be necessary before a cultural group's special strengths make a difference to their achievement in highly valued fields. Given this concept of the distribution of human abilities and the conditions under which a group's particular strengths may lead to significant social contributions, the eugenic proposals advanced by Shockley (1972) and others may be seen not only as ethically indefensible but, ironically, as diseugenic. Such a course could destroy forms of human talent which might later be found to have substantial value.

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