COGNITIVE STRENGTHS OF ESKIMOS AND IMPLICATIONS FOR EDUCATION

by

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Eskimos may have unusual cognitive strengths that are rarely recognized, used to advantage, or rewarded in our society. While Eskimos' talents in such areas as map-making, drawing, and mechanics are frequently remarked upon, the basis of these aptitudes has not been examined. This paper suggests that these talents may reflect unusually high intellectual abilities in such areas as perceptual analysis and image memory. Eskimos' performance on measures of these cognitive abilities approximates and in some instances exceeds national norms. In an exploratory study reported in this paper, village Eskimo students surpassed urban Caucasian students in their ability to recall complexly structured images. Since the cultural biases of conventional psychological tests may result in a test score that is lower than the person's level of ability, it is not unreasonable to suggest that Eskimos' actual abilities in these areas may be even higher than such studies indicate.

The suggestion that Eskimos tend to have unusual ability in an area does not mean that every Eskimo possesses such talents. It means rather that, in a group of Eskimos selected at random, more individuals who have high ability in this area will probably be found than in some other randomly selected group. In any group, some persons will have talent in one field, and other persons will have talent in another. Information about talents likely to be found in a group may be useful in alerting educators and employers to strengths that they might otherwise overlook. Eskimos, for example, may often do very well in occupational areas that use such abilities to advantage, such as scientific and technical fields. Educational methods that build on Eskimo students' cognitive strengths may substantially increase their academic progress. This paper explores instructional strategies that, by making use of students' skills in perceptual analysis and image memory, may increase learning in such areas of difficulty as understanding of conceptual relationships and English abstractions.

The cognitive skills of Eskimos and other Native groups may enable them to make unique contributions in many fields. Such abilities should be recognized as a valuable resource of our society.

Anecdotal Reports of Eskimos' Perceptual Skills

Early explorers and contemporary observers both have remarked upon Eskimos' skill in tasks that possibly require the ability to analyze spatial relationships or to recall complex patterns through clearly structured mental images. While anecdotes cannot be considered trustworthy evidence, their consistency and frequency strongly raise the possibility that Eskimos indeed possess such abilities. As a later section of this paper points out, the results of studies comparing the performance of Eskimos and other groups tend to confirm these anecdotal observations.

Making accurate maps requires precise observation and recall of the form and spatial relationships of an area. Carpenter (1955) remarks upon the unusual map-making skills of the Aivilik Eskimo of Southampton Island. When Sutton visited in 1929 no good maps were available, so he asked two Eskimos to draw a map of the island. Comparing the Eskimos' maps with a modern map made years later from an aerial photograph reveals their extraordinary accuracy (see Figure 1). The major discrepancy of the Eskimos' maps was their enlargement of the southeastern peninsula, which was a favorite hunting ground. Carpenter also asked several contemporary Aivilik to draw a map of the world and found their placement of familiar towns and estimates of their distance to be remarkably accurate.

Carpenter also discusses the Aivilik Eskimos' unusual ability to comprehend figures no matter what their spatial orientation. Eskimos, he notes, frequently carve figures oriented in different directions without bothering to rotate the tusk they are working on. In an impromptu experiment, Carpenter drew on a paper twenty figures oriented in different directions and asked a number of the Aivilik 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 the figures.

Mechanical tasks may also require certain types of perceptual skills. Stories of Eskimos' mechanical talents have become part of Alaskan folklore (Foster, 1969; Hall, 1967). Carpenter (1955)

Figure 1.

Maps of the Aivilik Eskimo (a & b) and Aerial Map (c)

SOURCE: Carpenter, E.S., Space Concepts of the Aivilik Eskimo. *Explorations*, 1955, 131-145.

reports, for example, that Eskimos were able in several instances to repair complicated pieces of machinery, which white mechanics, called in for the purpose, could not fix. Crisler (1958) mentions that Eskimos succeeded in repairing a radio that his wildlife party had been forced to abandon. Recently, the oil companies have made such comments on Eskimos' mechanical skills as, "We have found that the Eskimo has more innate ability to work around equipment than anyone else around the world" (Democrats talk . . ., 1970). While Eskimos' mechanical aptitude may result in part from their higher level of manual dexterity (Alaska Manpower Resources, 1969), two additional skills are likely to be involved—ability in analyzing spatial relationships and ingenuity in using unconventional materials as substitutes for missing parts. Interestingly, among Caucasians as well, ability in perceptual analysis appears to go together with an ability to solve problems that require insight into unconventional methods (Harris, 1962).

Another often noted talent of Eskimos is, of course, artistic ability. Drawings often portray objects in precise detail (Ryan, 1965). Such realistic drawing skills, while depending in part upon manual dexterity, very likely also require the ability to experience objects and events in an analytic rather than global fashion and to recall them through clearly structured mental images.

While Eskimos' perceptual skills have been evidenced so far in such pursuits as map-making, mechanics, and drawing, these cognitive strengths may also lead to unusually high performance in other areas, especially technical and scientific fields. A high level of ability in perceptual analysis, for example, appears to be useful to engineers (Barrett and Thornton, 1967). Research scientists in the fields of biology and physics are likely to use mental images in thinking (Roe, 1951). Ability to use mental imagery may also aid in certain types of problem solving (reviewed in Richardson, 1969, 81-83). Certain spatial abilities have been found to be related to achievement in higher mathematics courses and to aptitude for becoming an aircraft pilot or navigator (reviewed in Hoffman, Guilford, Hoepfner and Doherty, 1968). When adequate instruction increases Eskimos' formal educational achievements, such unusual cognitive abilities may enable them to make important contributions to a number of fields. Research should be done to define precisely the nature of Eskimos' perceptual abilities and their relationship to aptitude for different types of occupations.

Development of Perceptual Skills

Theoretical reasons as well as anecdotal reports raise the possibility that Eskimos have unusually high levels of perceptual skills. The demands of a certain type of environment may favor the development of certain types of cognitive abilities. A cultural group may also develop cognitive amplifiers, such as forms of language, which increase their cognitive powers in areas important to survival (Bruner, Olver, and Greenfield, 1960).

The requirements of hunting in an arctic environment may lead to highly developed perceptual skills among Eskimos (Berry, 1966). Unlike an urban area with its diverse buildings and written signs, the arctic has few unique landmarks to guide travel. Yet, the Eskimos had to hunt to survive. In order to find his way through an area often of extreme visual uniformity, the Eskimo hunter had to observe and recall extremely subtle visual cues.[1] In his study of Eskimo hunting, Nelson (1969) points out:

> 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 extraordinary ability to find their way through what appears to be a featureless terrain by contructing a mental image of relational patterns (Nelson, 1969; Carpenter, 1955).[2]

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[1] A reviewer of this paper, Mr. William Hensley, pointed out that successful hunting among Eskimos also required precise observation of indicators of weather such as cloud formations. Both Nelson (1969) and Carpenter (1955) confirm this point.

[2] Stefansson (1913, pp. 150-152) registers a dissent to the many anecdotes about Eskimos' ability to find their way through the barren arctic by observing that Eskimos outside of familiar territory become as easily lost as anyone else. If the basis of Eskimos' ability to find their way, however, is their capacity to take a "mental snapshot" of area they have seen and recall this mental image for long periods of time, one would not expect them to have an advantage in unfamiliar territory. Stefansson's comments, therefore, do not contradict the proposition that Eskimos' may have unusually high ability in image memory as evidenced by navigational skills.

> Though the exposure is fleeting, details can be taken in at a glance and long retained. When a man travels by sled into unfamiliar country, he continually looks back to see how the country will appear on his return. These brief glimpses, vividly recorded and faithfully remembered, are enough so that he can find his way back with ease. An elderly hunter may efficiently guide a party through an area which he has not seen since his youth (Carpenter, Varley, and Flaherty, 1959, page unnumbered).

Such cognitive skills, of course, are rarely required of urban Caucasians.

Socialization Practices

Child-rearing practices generally function to increase children's competence in the skills they will need as adults. Adapted to the demands of hunting in the arctic, Eskimo child-rearing methods seem likely to increase the ability to observe and recall experience accurately. Traditionally, Eskimo children learned primarily through watching adults rather than through verbal explanation. As a Savoonga villager points out in recommending that the schools use more appropriate teaching methods for Eskimo children:

> For instance, if a child is given (written) instructions of how to put the tape on the tape recorder here, the child would bog down trying to read the instructions. If a child is *shown* by the teacher doing the work, the child could do it right after the teacher removes his hands from the machine. That's the way all the Eskimos on St. Lawrence Island learn. (Mr. Timothy Gologergen, 1970, p. 113)

Where verbal instruction is used, the language of Eskimo adults generally calls attention to the observable aspects of the situation (Kroeber, 1948). One important verbal method of instruction, for example, is describing experiences on hunting trips, which may be recalled in exhaustive detail during the long winters.

Failure to observe and recall accurately appears to be severely sanctioned in the Eskimo socialization process. Nelson (1969) reports that young men who lost their way were subjected to merciless ridicule when they returned. Such a sanction system has obvious survival value.

Another Eskimo socialization practice that may lead to highly developed perceptual skills is the autonomy typically allowed children. From an early age, children are usually free to explore and

manipulate the environment. A number of studies, both cross-cultural and within the Caucasian population, suggest that child-rearing practices that permit this type of early independence foster the development of perceptual skills (reviewed in Vernon, 1966).

Genetic Factors

While I am reluctant to bring up so sensitive a subject, there is reason to wonder if highly developed perceptual skills among Eskimos result from genetic as well as socialization factors. Studies that have compared the perceptual abilities of identical and fraternal twins suggest that these types of perceptual skills are to a relatively large extent inherited (Thurstone, 1951; Osborne and Gregor, 1966).

Since hunting was essential to survival, natural selection may have led to a higher incidence of individuals with high levels of perceptual skills among Eskimos. Able hunters may have been more likely to possess highly developed perceptual skills. They may also have been more likely to survive and to produce many offspring who inherited similar abilities.

Language

Language can be viewed as a tool which amplifies cognitive abilities in areas of importance to a society (Bruner, Olver, & Greenfield, 1966). Adapted to the Eskimo hunter's need to recall and communicate precise information about spatial location, the Eskimo language probably allows more precise representation of the domain of form and space than the English language (Gagne, 1968). The Eskimo language appears to contain a richer form and space vocabulary than English. In addition, "localizers" (prefixes and suffixes which specify shape and location) may be grammatically integral to the word representing an object (Gagne, 1968; Lantis, 1965). For example, the English sentence, "Please put this thing over there" could be translated into four different three word sentences in Eskimo because the shape of the "thing" and the shape of the surface on which it is to be placed must be specified through localizers (Gagne, 1968). Contrasts between the localizers used in such a sentence also may indicate the directional position in which the object is to be placed. The English language, of course, would

require many additional words to represent the same amount of information. Since the use of localizers is grammatically obligatory and permits economical representation of spatial information, the Eskimo language speaker may be more attentive to form and space distinctions and find such information easier to learn and remember.[3]

Compensatory Factors

Highly developed perceptual skills among Eskimos may also result from compensation for hearing loss or language difficulties. Ear infections have caused a high incidence of auditory difficulties among Eskimos. Since English is often a second language, many Eskimos have difficulty receiving information through the English verbal modality. Reliance on observation for information may compensate for such problems.

Psychological Tests of Perceptual Skills

The results of psychological testing generally appear to confirm anecdotal reports and theoretical speculations about Eskimos' high level of ability in perceptual analysis and image memory. Despite test biases, a number of studies have found that Eskimos approximate or surpass test norms on measures of these skills.

Performance on a test of perceptual skills depends not only on the level of the individual's perceptual abilities but also on whether he possesses the required test-taking attitudes and accepts testing conventions. That the unfamiliar requirements of the testing situation may depress performance in culturally different groups is

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[3]Whether a child who grows up in an Eskimo group but who does not himself speak Eskimo is likely to have similar cognitive advantages is not clear. The extent to which language shapes patterns of thinking and the extent to which language merely reflects a group's patterns of thinking (which may continue after the language has fallen into disuse) is a question of much controversy. Possibly the Eskimo language speaker, aided by the tool of language, is better able to observe and recall information about form and space. However, the child who grows up in an Eskimo group but who does not speak the language still may have advantage over the Caucasian child because of his socialization within the cognitive style of Eskimo culture.

well-known. Is the subject prepared, for example, to view a trivial, pointless task such as copying a design or finding his way through a maze as worthy of serious attention and maximum effort? Is he sufficiently familiar with such tests or sufficiently competent in English to understand exactly what he is supposed to do? Is how fast he completes the test used as the measure of the quality of his performance when doing something as fast as possible may not be a value in his own society? Does resentment at the test lower performance, perhaps because he does not realize that the test is widely given but believes instead that people like him are being singled out? As one village Eskimo remarked after such a test:

> Why do the people do the circular maze? Will this be graded? Is it a way of finding out how much the people know? Couldn't some other kind be given to grade them? People "outside" are not graded by the way they can find their way out of a circular maze. (Rehabilitation Project, Hooper Bay Report, 1966, p. 18)

In view of the cultural biases of these tests, a small difference in favor of Eskimos raises the possibility that the actual difference in ability may be much larger.

Berry (1966) has done the most extensive comparisons of Eskimos' perceptual skills with those of other groups. Berry gave a visual discrimination test and also a number of tests that in part measured spatial ability to rural and urban groups of Canadian Eskimo, Temne of Sierra Leone, and Scots. The Temne were selected because they contrasted sharply with the Eskimo on the ecological and cultural characteristics believed to lead to highly developed perceptual skills. The Temne live in a complex rather than uniform visual environment and they farm rather than hunt. Their language has fewer spatial terms than the Eskimo language. Temne child-rearing practices emphasize obedience and conformity rather than freedom and autonomy. The Scots were probably selected as a Western comparison group for convenience, since the research was conducted from the University of Edinburgh.

In the test of visual discrimination, persons were asked to draw a series of forms such as triangles and squares which were flashed on a screen for 20 milliseconds. Each of these forms had a gap in one side, and the gaps progressively increased in size. The criterion of performance was how wide the gap had to be before it was noticed. The Eskimo far surpassed the Temne on this task, and they did

better than the Scots as well. Moreover, the rural Eskimo, who probably require such skills more in hunting, surpassed the urban Eskimo. The Eskimos may have done even better had they been wearing corrective lenses. Eskimos' performance declined in the over 40 age group (which lowered the score of the Eskimo group as a whole) where most of the Scots but few of the Eskimos were wearing glasses.

The tests measuring spatial ability were: (1) Kohs Blocks, which requires analysis of a complex design in order to reproduce it with blocks, (2) Witkin Embedded Figures, which requires identification of a geometric form hidden in a complex visual context, (3) Morrisby Shapes, which requires the identification of geometric forms when oriented in different directions, and (4) Raven Matrices, which requires completion of a series of designs by perceiving the principle relating them. The tests in this group generally require more familiarity with test-taking conventions than the first visual discrimination task, and certain tests, especially Raven Matrices, measure additional types of abilities as well. On this group of tests, Berry again found that the Eskimo far surpassed the Temne. In comparing the performance of urban and rural groups of Eskimos and Scots, Berry found that the Eskimo exceeded the Scots in one case, matched them in four, and were slightly lower in three. The test on which Eskimos surpassed the Scots was Morrisby Shapes, which measures ability to comprehend rotated figures. This result seems to confirm Carpenter's (1955) informal observations of Eskimos' ability to carve and identify figures oriented in different directions. On these tests, the urban Eskimo did better than the rural Eskimo, probably because they were more familiar with Western institutions and were more likely to have the test-taking skills required by this group of tests.

Since tests measuring analytic functioning in perception are frequently viewed as non-verbal intelligence tests, a number of diverse tests have been given to Eskimos or Alaska Native groups. The results are similar. Despite the cultural biases of these tests, these groups frequently approximate and sometimes exceed national test norms. Foster (1969), for example, administered the Wechsler Adult Intelligence Test to 42 Alaska Natives at the Alaska Native Medical Center. Scores on the performance tests such as Block Design almost reached national norms, and the Alaska Native group surpassed the norms on the Object Assembly Test. Lantis (1968) similarly found

that adolescent and young adult males in one large Eskimo community approached the Object Assembly Test in the same way and performed on the same level as a group of Harvard undergraduates.[4] This test, similar to a jig-saw puzzle, requires analysis of form relationships. On the Circular Pencil Maze Test, which was given to 156 Native adults in Tununak and Hooper Bay, the Eskimos scored slightly above national norms (Kunce, Rankin, and Clement, 1966). On the Goldstein-Sheerer Cube Test, the performance of a combined group of rural and urban Eskimo children equalled the performance of urban Caucasian children (Reich, 1966). On an abstract reasoning test based on graphic figures, Alaska Native ninth graders scored about as high as national student norms (Kleinfeld, 1970).

Tests of Canadian Eskimos have led to similar findings. Vernon (1966) found that a group of 25 Eskimo boys came close to test norms on several measures of perceptual abilities and exceeded test norms on one measure. With a larger sample of 167 Canadian Eskimo students, MacArthur (1968) found a similar pattern.

An Exploratory Study of Image Memory*

The tests reviewed in the previous section measure such abilities as visual discrimination, analytic functioning in perception, or reasoning from graphic figures. A perceptual skill more closely related to the demands made by hunting in an arctic environment may be image memory or the ability to recall complex patterns accurately. This study, tested the hypothesis that village Eskimo students are likely to have higher ability in image memory than urban Caucasian students.

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[4]Lantis remarks that the Eskimo did work more slowly, which suggests that perceptual tests where speed is the criterion of performance may penalize them.

*Mrs. Laurel L. Bland administered the tests discussed in this section to 1,736 Caucasian, Indian, Eskimo, and Negro students. Mrs. Bland presents the test results in a 1970 monograph, "Perception and Visual Memory of School-Age Eskimos and Athabascan Indians In Alaskan Villages," published by Human Environmental Resource Systems, Consultants in Human Resource Development, located in Anchorage. Mrs. Bland also discusses the uses of these tests in identifying perceptual impediments to learning, an issue not discussed here.

Sample

The urban Caucasian group consisted of 501 students from Anchorage and Fairbanks. The village Eskimo group consisted of 125 students primarily from Barrow and Teller. Since few high school age students attend village schools, Eskimo students from a number of other villages who had recently arrived in Fairbanks to attend high school were also tested. No significant differences in image memory appeared between the different groups of Eskimo students, so they were combined in the data analysis.

Test

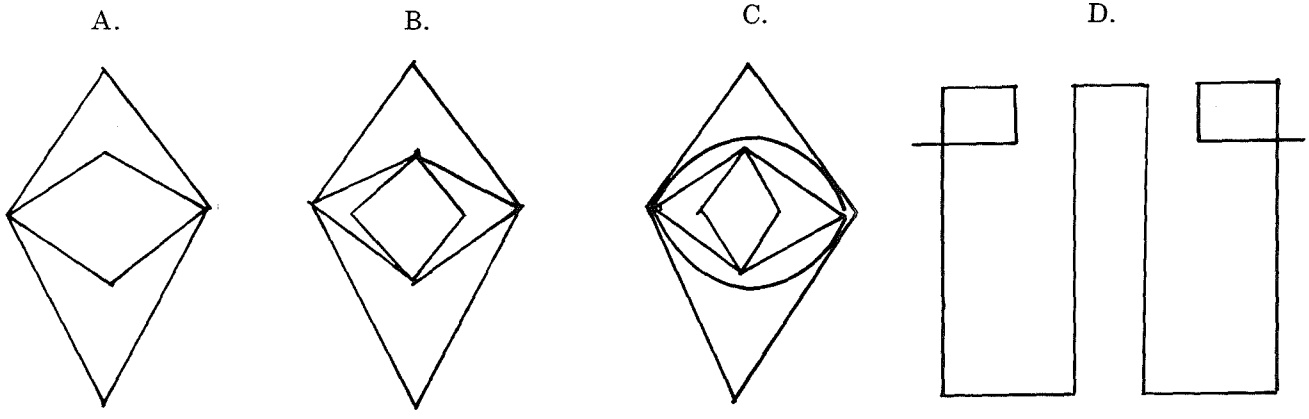
Testing methods attempted to minimize the effects of other abilities and of familiarity with test-taking conventions on image memory scores. The image memory test was adapted from a measure developed by Dr. Troy Sullivan to assess perceptual impairments (Figure 2). A design was drawn on a chalkboard, immediately erased, and the class of students was asked to draw it from memory. Drawings were scored as either right or wrong on the basis of whether the structural relationships were correct and assigned a value of five points each. A group of 100 tests were scored by both researchers and inter-rater reliability reached 86.5 per cent.

The first group of designs consisted of simple figures such as circles and squares that were not scored. They served to increase test-taking confidence and to eliminate subjects whose poor eyesight or unwillingness to cooperate invalidated test scores. One village Eskimo and three urban Caucasian students were eliminated on this basis. The test was administered in a relaxed atmosphere with oral instructions and no speed stress, as Schwarz (1961) recommends in cross-cultural testing. Students were told that the test was a game and given as much time as they needed to complete the drawings.

Results

Significant sex differences in image memory did not appear in either the urban Caucasian or village Eskimo students, but image memory scores did increase with age. For this reason, comparisons were made between three age groups.

Figure 2.



SOURCE: Excerpts from a descriptive outline prepared by Dr. Troy Sullivan.

At both 9-11 and 14-16, village Eskimo children demonstrated significantly higher levels of image memory than urban Caucasian children (Table I).[5] While village Eskimo children also exceeded urban Caucasian children in image memory at age 11-13, the difference did not reach significance.[6]

In addition, at every age level, the village Eskimo children were significantly less variable in image memory than the urban Caucasian children. In other words, not only was the average score of village Eskimo children higher but also the distribution of their scores was less spread out.

This study was an exploratory effort. It must be replicated with a larger and more representative Eskimo group under more rigorously controlled conditions before conclusions can be drawn. Eskimos from different villages, for example, may differ in their perceptual skills. In a replication, standardized drawings and blind rating conditions would be used to correct such deficiencies in this experiment as the possibility that the experimenter did not completely erase a drawing or that experimenter expectations influenced test ratings. This particular experiment has many limitations. It is the consistency of these results with other studies of perceptual abilities among Eskimos that provides some basis for entertaining the hypothesis that village Eskimos may exceed urban Caucasians in image memory.

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[5]Since the samples were of different size and the variances were unequal, a correction in the degrees of freedom was made in testing the significance of the difference between means (Hays, 1963, p. 322).

[6]The drop in Eskimo children's image memory scores between age 9-10 and age 11-13 does not reach significance and may be attributable, therefore, to random sampling variation in this study. If future studies with larger samples should find a significant decline in image memory at adolescence, examining the basis of this difference would be warranted. For example, motivation to do well on academic tasks among Eskimo children may decline at adolescence as a result of increased awareness of ethnic identity problems. Bryde (1967) has reported such an academic decline among Indian students. Alternatively, such a decline may be the result of the cognitive changes at adolescence described by Piaget, specifically the change from concrete or image-based to formal or more abstract operations (see Flavell, 1963). Possibly, the Eskimo child's environment does not provide sufficient support for such a change, and the older adolescent returns to image-based thinking, although at the higher level of competence that this study suggests is characteristic of older Eskimo adolescents.

TABLE I
Image Memory Scores
of Village Eskimo and Urban Caucasian Children†

	Village Eskimo			Urban Caucasian		
	N	Mean	SD	N	Mean	SD
Age 9-10*	41	16.70	4.76	87	11.95	6.35
Age 11-13**	45	15.77	4.80	113	15.26	7.20
Age 14-16***	39	17.69	3.40	301	15.79	5.00

*$t = 4.702$ $p<.01$; $f = 1.77$ $p<.05$
**$t = .518$ n.s.; $f = 2.25$ $p<.01$
***$t = 3.084$ $p<.01$; $f = 2.16$ $p<.01$

†Mrs. Laurel L. Bland administered these tests as discussed in the previous section. More extensive tables may be found in her 1970 monograph, "Perception and Visual Memory of School-Age Eskimos and Athabascans," Human Environmental Resource Systems.

Educational Implications

In order to see if village teachers had noticed these cognitive strengths and whether these skills might lead to better performance on certain types of academic tasks, a questionnaire was sent to teachers in Alaskan village schools. Teachers of all Native groups were included in order to obtain some preliminary indication of whether other groups might also possess such skills. The questionnaire contained the items:

1. Have you noticed any special abilities which your students tend to possess or subject areas where they learn especially quickly?

2. Do your students show particular ability to observe and remember visual detail? If so, how do they show this ability?

Teachers' Observations

Of the 102 village teachers who generously responded to this inquiry (school response rate = 64 per cent), about 69 per cent believed that their students did demonstrate an unusual ability to recall visual detail. Moreover, teachers of different Native groups expressed similar opinions.

	PERCENTAGE OF TEACHERS
Eskimo	69%
Athabascan	65%
Aleut	86%
Tsimpsian	68%
Mixed Alaska Native Group	55%

These percentages may underestimate the degree to which village teachers have observed these cognitive strengths because a number of teachers who answered "no" to the question concerning students' unusual ability to recall visual detail then stated that their students showed high ability in areas which may evidence it. Teachers frequently remarked, for example, that their students

found it quite easy to learn unfamiliar spelling words. The relatively high spelling performance of Native students evident in achievement testing programs (Thomas, 1969) may be due to students' ability to learn words by taking a mental snapshot of the figural pattern or image whether or not they know the word's meaning. A number of teachers pointed out the accuracy and realism of students' drawings. Several teachers mentioned that their students were quite good in geometry, map studies, handwriting, repeating designs, putting together puzzles, and remembering the number and arrangements of objects. A few teachers mentioned children's exceptional abilities at mimicry.[7] Teachers also mentioned that students often referred to subtle visual details in class discussions and that their writing was often of high quality because of reference to vivid details.

Almost invariably the village teachers emphasized that students' perceptual skills made image-based instruction such as charts, diagrams, and films[8] highly effective teaching strategies. As one teacher summed up:

> They do have an unusual ability to observe and remember even the smallest details of what they have seen. I believe that this may be the reason I have had so much success with educational films in correlation with subject matter.

Several teachers remarked that their students were able to remember information presented through images which the teachers themselves had not noticed and that students were able to recall such information for long periods of time. One teacher commented, for example:

> They will remember minute details from a movie or their readers which I never even noticed. They remember movies from two or three years ago and can mimic the action or draw it.

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[7]Carpenter, Varley, and Flaherty (1959) also point out that Eskimo children's observational skills make them "superb mimics, wonderfully imitating someone to the delight of all...children especially seem gifted in this line—I know because I was their favorite subject. A hunter's imitation of a seal is sometimes good enough to fool the hunted seal." (page unnumbered.)

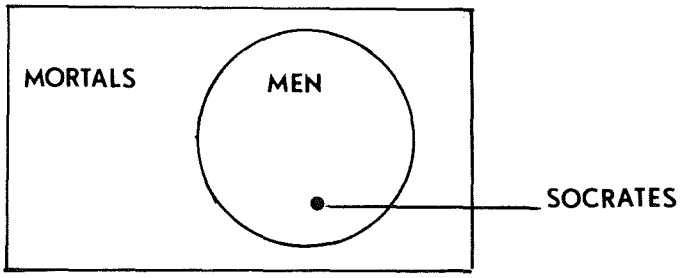
[8]Of course, interest in movies and cultural incentives may also be responsible for Native children's ease in learning from films. In his visit to Angoon, for example, Slim Randles (1970) reported that the movies were so crowded he couldn't even get in until he made an advance reservation. He observes that, "one of this tiny Tlingit village's greatest status symbols is to be able to memorize every detail of movies that have been here over the past few months."

Development of Appropriate Instruction

Additional research must be done to substantiate this suggestive evidence concerning Alaska Natives' unusually high perceptual abilities and the effectiveness of image-based instructional strategies before implications for educational practice can be drawn. Such studies should compare learning under image-based instruction with learning under solely verbal instruction. Such studies should examine the effects of image-based instruction on students with different patterns of cognitive abilities. The use of images to supplement solely verbal teaching, for example, might increase achievement substantially primarily for students with a high perceptual-low verbal ability pattern. While this type of ability pattern is characteristic of Native students (for whom English is often a second language), it is frequently found in Caucasian students as well.

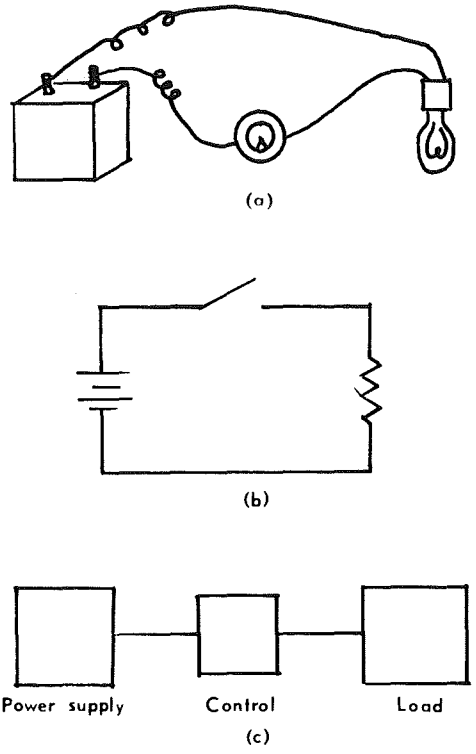
If future research should demonstrate the potential of image-based instruction for Native students, educational methods might be developed which build upon Native students' strengths in perceptual analysis and image memory to increase achievement in areas of difficulty such as learning conceptual relationships and English language abstractions. Venn diagrams might be used, for example, to teach principles of logic and category inclusion.

All men are mortal.
Socrates is a man.
Therefore, Socrates is mortal.



Since the image structure emphasizes logical structures, the student remembers conceptual relationships when he recalls the image.

Figure 3.



Three degrees of pictorial literalness: (a) the "blueprint" type of diagram; (b) the "circuit diagram" type; (c) the "block diagram" type.

SOURCE: Yours, J.Z., *Model of the Brain*, Oxford: Clarendon Press, 1964.

Images might also be used effectively to teach English language abstractions since they allow movement from the concrete to the abstract in much smaller and clearer stages than is possible through words alone. Images differ widely in the degree to which they are literal representations of reality. They can range from photographs, which present a phenomenon in realistic detail, to abstract line drawings, which represent only essential elements of a phenomenon, to symbolic diagrams, which bear little relationship to reality (see Figure 3). A lesson designed to teach a verbal abstraction such as "pressure," for example, might first present diverse realistic illustrations of it, both in the village and elsewhere. The abstract concepts might then be represented both in words and in progressively more abstract images which evoke the concrete associations. Images, in short, permit great continuity in progressing from the concrete to the abstract.

Many village teachers use image-based instructional materials extensively in the classrooms, for example, films from the very fine film library of State-Operated Schools. These materials should be expanded. Films and other image-based materials might be most effective when integrated with textbooks in curriculum units adapted to rural students' experience. An Instructional Materials Development Center which constructs such curriculum units might substantially increase village students' academic progress. The Rural School Project of the University of Alaska has developed this type of curriculum and demonstrated its effectiveness for the elementary grades. Appropriate materials for upper elementary and secondary school rural students are still badly needed.

Conclusion

Eskimos and other Native groups may have cognitive strengths which will enable them to make significant contributions in many areas. While these abilities have been evidenced in the past in such areas as map-making, spelling, or mechanics, advanced education may enable Natives to use such skills in many other fields. Improving instruction, perhaps by developing educational methods that build on these cognitive strengths, is essential in enabling Native students to fulfill their academic potential.

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