AN INVESTIGATION OF Hmong Students' Performance
On Four Standardized Cognitive Ability Measures

by

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A Field Study

Submitted in Partial Fulfillment of the Requirements for the Degree of Education Specialist With a Major in Guidance and Counseling

Approved: 6 Semester Credits

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ABSTRACT

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Guidance and Counseling Dr. Douglas Smith May, 99 31
(Graduate Major) (Research Adviser) (Month/Year) (No. of Pages)

Publication Manual of the American Psychological Association (Fourth Edition)
(Name of Style Manual Used in the Study)

This study investigated the parameters of a valid assessment of cognitive ability for students of Hmong origin who are referred for suspected exceptional education needs. Cognitive ability measures included: Wechsler Intelligence Test for Children-Third Edition, Kaufman Brief Intelligence Test, Comprehensive Test of Nonverbal Intelligence, and the Test of Nonverbal Intelligence-Third Edition. The sample consisted of 56 Hmong students aged 6 years 4 months to 13 years 0 months.

Mean scores on instruments that measured crystallized intelligence were in the borderline range reflecting the low verbal fluency of the students in this sample. Mean scores on instruments that measure fluid intelligence were in the average range.
Results revealed a high correlation between instruments supporting the constructs that each instrument purports to measure.

One implication from this study is the clear need to include a sound nonverbal cognitive ability measure in an assessment battery to minimize the negative effects of low verbal fluency, cultural differences and previous learning. Careful interpretation of assessment results is critical when making decisions regarding special education placement and determining appropriate academic programming for linguistically and culturally diverse students.
4. The examiner should make use of "therapeutic testing" where an educational plan is implemented on the basis of test results. The student's progress with this educational plan should be evaluated on a frequent basis with modifications made as necessary. In this approach, testing is viewed as "the beginning of the assessment process, not the end result." (Kamphaus, 1993 p. 460).

School personnel are concerned that the current assessment techniques may not be sufficient to properly identify Hmong students with disabilities. The difficulty lies in determining whether a student referred for a special education evaluation exhibits a disability, such as a Learning Disability or Mild Retardation, or if the student's academic difficulties are related to linguistic and cultural differences. Therefore, this study was designed to investigate the parameters of a valid assessment of cognitive ability for students of Hmong origin who are referred for suspected exceptional education needs.

**Methodology**

**Subjects:**

Subjects for the study included 56 Hmong students, ages 6 years 4 months to 13 years 0 months, with an average age of 9 years 3 months. The students were in Kindergarten through grade 6. Twenty-three males and thirty-three females from four of the district's seven elementary schools, in which there was a primary concentration of Hmong students, participated in this study. Hmong was the dominant language in all but one subject's home. The remaining subject's parents indicated that both Hmong and English were spoken in the home.

**Subject Selection:**

In June 1986, when this study was organized, there were 104 students of Hmong heritage, enrolled in kindergarten through grade six, in the School District of
the Menomonie Area who were eligible to participate in the study. Efforts to involve parents included two community meetings with two Bilingual Specialists to explain the intent of the study. This was followed by individual phone calls by the Bilingual Specialists as an attempt to increase subject participation rate. A participation rate of 54% was achieved. As parent permission was a requisite for participation, a random sampling was not possible.

Parents of each student completed a questionnaire that addressed the following variables:

1. Student place of birth
2. Number of years the student has been in the United States
3. Parents level of formal education
4. Language spoken in the home

Instrumentation:

All subjects were tested using the following instruments:

1. Wechsler Intelligence Scale for Children-Third Edition (WISC-III)
2. Comprehensive Test of Nonverbal Intelligence (CTONI)
3. Test of Nonverbal Intelligence-Third Edition (TONI-3)
4. Kaufman Brief Intelligence Test (K-BIT)

These tests were chosen for the following reasons:

1. All tests yield a nonverbal or non-language measure of cognitive abilities.
2. The WISC-III, as was the WISC-R, continues to be the most frequently used test for the cognitive evaluation of school aged children and is often administered LCD students (Holtzman & Wilkinson, 1991, p. 239)
3. The K-BIT was chosen to determine whether this brief measure was a valid substitute for the lengthier WISC-III.
4. The CTONI was selected because of its design as a valid language-free measure of cognitive abilities.

5. The TONI-3 was chosen as a second language-free measure. It is similar in design but shorter in length than the CTONI.

6. All tests were available, familiar and currently used in the assessment of Hmong students.

Following is a brief description of each of the tests administered in this study:

The WISC-III is a widely used instrument in the assessment of children's cognitive ability (Kramer & Conoley, 1992). The WISC-III consists of 13 subtests divided into two scales: a Verbal Scale and a Performance Scale. The Verbal Scale consists of test items that are language-based. Visual-motor items that are less language dependent comprise the Performance Scale. Ten subtest scores (five from both the Verbal and Performance scales) produce a Full Scale IQ score (Kramer & Conoley, 1992). Average reliability coefficients for the WISC-III for subjects ages 6 years to 16 years for Verbal, Performance and Full Scale I.Q. were .95, .91, and .96 respectively (Wechsler, 1991).

The CTONI is a non-language measure that tests nonverbal intellectual abilities in both pictured object and geometric design contexts. The battery consists of six subtests which yield a Pictorial Nonverbal Intelligence Composite, a Geometric Nonverbal Intelligence Composite and a Nonverbal Intelligence Composite. It was designed for use with persons ages 6-9 through 18-11 (Hamill, Pearson, & Wiederholt, 1988). The CTONI can be administered with pantomime or verbal directives. In estimating reliability (of the CTONI), coefficient alphas for subtests were calculated and range from .86-.88; for composite scores, .89-.97. Criterion-related validity evidence was presented by comparing CTONI scores with the WISC-III, the Test of Nonverbal Intelligence-Second Edition, and the Peabody Picture Vocabulary
Test-Revised (PPVT-R), in a sample of 43 "elementary level" students attending a school that exclusively serves learning disabled students. Geometric Analogies, Pictorial Sequences, and Geometric Sequences had the highest correlations with the WISC-III PIQ (r=.63); Pictorial Sequences had the highest correlation with the PPVT-R (r=.53). As expected, CTong composite quotients had higher correlations with both subtest and composite criterion IQ scores. The Pictorial Nonverbal Intelligence Quotient had a particularly low correlation with the TONI-2 Quotient (.43), in comparison to the Geometric Nonverbal Intelligence Quotient or the Nonverbal Intelligence Quotient (.84 and .82 respectively) (Conoley & Impara, 1998, p. 311).

The TONI-3 is also a language free measure of abstract/figural problem solving (Brown, Sherbenou, and Johnson, 1997). At the time of testing, the TONI-3 norming version was used as reliability and validity data were being collected. Coefficients Alpha were calculated at 20 age intervals for the entire TONI-3 normative sample. "All equal or exceed .89 and all but four are in the .90s" (Brown, Sherbenou, & Johnson, p. 80). The TONI-3 was correlated with the CTong, the WISC-III, and the Wechsler Adult Intelligence Scale-Revised (WAIS-R) (Wechsler, 1981). Correlations with the CTong Pictorial Nonverbal IQ, the Geometric Nonverbal IQ, and the Overall Nonverbal IQ were .74, .64, and .76 respectively for Form A and .72, .64, and .74 for Form B respectively. The correlations with the WISC-III Verbal, Performance and Full Scale IQ were .88, .88, and .83 respectively for Form A and .88, .82, and .69 respectively for Form B. The correlations with the WAIS-R for Verbal, Performance and Full Scale IQ were .67, .76, .73 respectively for Form A and .61, .76, and .71 for Form B (Brown, Sherbenou, and Johnson, p. 96).

The K-BIT is a brief measure of verbal (crystallized) and nonverbal (fluid) intelligence. It consists of two subtests: Vocabulary and Matrices. The K-BIT was developed specifically to be used for screening and related purposes (K-BIT manual).
Mean split-half reliability coefficients for children and adolescents (aged 4 to 18) were .91 for Vocabulary (range = .89 to .93), .86 for Matrices (range = .74 to .92), and .92 for IQ Composite (range = .89 to .95). Test-retest coefficients for 232 children, adolescents, and adults tested twice averaged .94 for Vocabulary, .85 for Matrices, and .94 for IQ Composite. (Kaufman & Wang, 1992).

Procedures:

The testing was completed by qualified teachers employed by the School District of the Menomonie Area and by School Psychology Graduate Students from both the University of Wisconsin-Stout and the University of Wisconsin-River Falls. These students were in their final year of preparation for certification as School Psychologists. The subjects were tested during two individual testing sessions. The CTONI, WJ-R subtests and the TONI-3 were administered by district staff in counterbalanced order during the same testing session. The order of administration of the CTONI and the TONI-3 was alternated. The WISC-III and the K-BIT were administered by the graduate students in counterbalanced order during the same testing session. The order of presentation was counterbalanced so half of the subjects received the WISC-III, K-BIT combination initially and half of the subjects received the CTONI and TONI-3 combination initially. All testing was completed during the subjects' school day in a quiet one-to-one setting. All tests were administered as outlined in each respective manual. Both the CTONI and the TONI-3 were administered using the pantomime approach to convey the test directions.

Results and Discussion

Table 1 provides descriptive statistics for the mean, range and standard deviation of scores for all tests administered. Mean scores reflecting crystallized
intelligence on the verbal reasoning ability scales (WISC-III Verbal IQ and K-BIT Vocabulary Score) are in the borderline range reflecting the low verbal fluency of Hmong students. At the same time, some students did score within the average range of performance on verbal measures. All scales designed to measure fluid intelligence on the nonverbal reasoning ability scales are in the average range. Some students however, did score in the borderline range.

For these scales the range of scores was consistent with those obtained in the standardization sample as indicated by the standard deviation. Consequently, this does not represent a sample restricted in the range of overall ability. It should be noted however that for most measures the range of scores peaks at the High Average/Superior range of ability rather than the superior range.

The data presented in Table 2 show the full scale ability correlations for all tests given. The data are supportive of the validity of each instrument. Correlations of the WISC-III Full Scale with the K-BIT composite and the CTONI composite suggest that the constructs being measured by these three instruments are similar. While still significant, the lower correlations between the WISC-III Full Scale and the CTONI composite and the TONI-3A and TONI-3B perhaps reflect the absence of verbally mediated items on the TONI-3A and TONI-3B. The CTONI utilizes abstract geometric designs, as does the TONI-3, but also has pictorial verbal items that lend themselves to verbal mediation. An example of such an item from the CTONI Pictorial Categories subtest presents a strawberry, a banana and an empty box. The subject must select the missing item that fits in the category of “fruit” from an array of cherries, an egg, a loaf of bread, an onion and a slice of pie. From the Pictorial Sequences subtest, an example of an item that lends itself to verbal mediation includes a series of pictures with a house on fire, a child yelling, a fire truck and an empty frame. The subject selects a picture to complete the sequence from an array of pictures that includes a
fireman, a doctor, a baker, a butcher and a farmer. From the Pictorial Analogies subtest, a sample analogy signifying diamonds with a diamond mine is followed by an incomplete analogy of a pearl necklace with an empty frame. The subject selects an item to complete the analogy from an array of a woman wearing a necklace, an octopus, a clam, a safe and a treasure chest.

Table 3 provides correlations between total test or subtests that purport to measure nonverbal or fluid cognitive abilities examining whether they are measuring similar constructs. The TONI-3A and TONI-3B, being presented as alternate or comparable forms correlate at a high level of .80 suggesting they are measuring similar constructs. While correlations are all significant (p<.01), ranging from .42 to .84, they are not as high as expected. Even though the CTONI and TONI-3 overlap, there are some differences in the constructs they measure.

The K-BIT Matrices subtest showed significant correlations with all other nonverbal measures. Again, this indicates a moderate overlap in constructs measured, but there are differences. The data support that K-BIT Matrices primarily measures fluid abilities while the WISC-III Performance measure is a combination of fluid and visual intelligence. The K-BIT Matrices correlations with the CTONI and TONI-3 are significant, but not as high as expected. As the TONI-3 is purely geometric, it was expected that the correlation between the K-BIT Matrices and TONI-3 would be lower than the correlation between the K-BIT Matrices and CTONI. The range of correlations (.65 to .82) between the K-BIT Matrices and WISC-III Performance, CTONI, and TONI-3 suggest moderate to strong overlap of constructs measured.

Table 4 provides correlations between subtests that are purported to measure verbal or crystallized cognitive ability. The correlation of .82 between the WISC-III Verbal IQ and the K-BIT Vocabulary is significant indicating substantial overlap in the constructs being measured. Both tests utilize items that intertwine cultural knowledge
and verbal mediation. If what is needed in a student evaluation is a score of verbal development, either would produce very similar results. The CTONI Pictorial Nonverbal IQ was included in these correlations to determine whether a subject's use of verbal mediation in responding to test stimuli adds a verbal component to this measurement. Although the CTONI is a nonverbal measure of cognitive ability, the Pictorial scale correlations of .50 and .61 with the K-BIT Vocabulary and the WISC-III Verbal IQ, respectively, suggest there are still some verbal components being measured.

Implications

Results of this research study have numerous implications in regard to its purpose of investigating the parameters of a valid assessment of cognitive ability for students of Hmong origin who are referred for suspected special education needs. Implications apply to the area of evaluation, test interpretation and programming.

In the area of evaluation, the need to include a sound nonverbal cognitive ability measure in an assessment battery to minimize the negative effects of low verbal fluency, cultural differences and previous learning is imperative. For an initial evaluation, a nonverbal measure (CTONI or TONI-3) should be given in addition to the practitioner's usual battery, which likely includes a widely-used and more comprehensive WISC-III. However, given the high correlation between the K-BIT and the WISC-III, the K-BIT would fulfill the need for a measure of verbal development in a more time efficient manner. Reevaluations could be completed with the use of the K-BIT and the CTONI or the TONI-3.

Several factors need to be considered in interpreting test scores obtained by Hmong students. Caution should be taken to avoid placing students in special education programs when their true need is to develop the language skills necessary to allow them to function at their true level of cognitive ability. Low verbal reasoning
ability scores reflect the highly verbal nature of the WISC-III and the K-BIT. Although performance on the WISC-III and the K-BIT may be the best indicator of academic success, higher scores as obtained on the nonverbal cognitive ability measures may represent average abilities that are not clearly evidenced in the classroom. Instruments that rely heavily on verbal fluency may well lead to erroneous special education placements. Educational difficulties experienced by students who have verbal ability scores that fall in the borderline range of performance and nonverbal ability scores that fall in the average range are probably due to their cultural and linguistic differences. Diagnostically, students who present with verbal and nonverbal scores in the borderline range may indeed be exhibiting a cognitive disability. In regard to learning disabilities identification, a critical factor to be considered, beyond performance on formal testing measures, is whether the student has made academic progress when provided with appropriate regular education intervention (English as a Second Language or ESL programming). A student may be learning disabled if they exhibit advancement in English skills, but not in academic skills. When evaluating a student, practitioners may also want to examine educational success of siblings. A student who is not demonstrating academic success and who has siblings that are achieving successfully academically may be demonstrating more than the effects of being a student that is linguistically and culturally different.

The educational programming needs of the students who exhibited better developed nonverbal skills in comparison to their verbal skills are probably best met in a specialized program (ESL or a communication based classroom) targeting intensive language development. Techniques aimed at teaching to these students' stronger visual channels, in combination with verbal instruction, are probably the most effective. Addressing these needs continues to be increasingly important as these students are included in statewide assessments and may impact overall district scores.
Recommendations for Further Study

Numerous areas for additional further study exist. A limitation of this study was the restricted age range of the subjects. Additionally, as parental permission for individual subjects to participate in this study was a prerequisite, a random sample was not possible. Studies designed to investigate the variables that were limitations in this study should be conducted.

Following a group of students, such as the group in this study, longitudinally to determine how nonverbal and verbal scores change as a result of increased verbal fluency may yield valuable information, both diagnostically and educationally. A study of this nature may show which scores are predictive of academic success and which scores may be more of an indicator of true cognitive ability given appropriate intervention and language development. It may also address the issue of whether or not, with appropriate remediation, academic achievement will ever be commensurate with nonverbal ability scores.

An original goal of this study was to examine whether language spoken in the home had an impact on test performance. As Hmong was the primary language spoken in the home of all students that agreed to participate in the study, the opportunity to compare performance of subjects whose families spoke English, Hmong, or Hmong and English did not exist. It would be predicted that exposure to English in the home environment should increase performance on measures that rely on verbal fluency, particularly if English were the primary language spoken in the home. It would also be expected that with increased exposure to American culture, there would be an increase in scores on items that lend themselves to verbal
meditation to arrive at the correct answer, as it would be difficult to verbally mediate an item, either in an individual's native language or second language, if the individual had not been exposed to the item culturally.

In addition to linguistic variables, a study of the effects of educational level of parents and family socioeconomic status on Hmong students' performance on these standardized measures needs to be explored. Another possible comparison would be to examine how Hmong students who attend school in more rural areas, such as Menomonie, WI, compare with Hmong students who attend schools in a more urban area such as Wausau or Green Bay, WI. The possibility of conducting a similar battery of tests on a different minority group may indicate whether the pattern of performance of the Hmong students in this study is unique or if it is able to be generalized to other groups of LCD students.

Currently there is a thrust in test development in the area of specialized nonverbal measures. These instruments need to be studied to determine if they are more useful and efficient in identifying the needs of this population. Since this research study began, the Universal Nonverbal Intelligence Test (UNIT) (Braken & McCallum, 1988) has been developed. The tests of the UNIT, which rely on nonverbal responses, were designed to measure cognitive ability of school age children, who may have been disadvantaged by traditional verbal and language-loaded measures. The UNIT measures a broad range of complex memory and reasoning abilities, including those lending themselves to internal processes of verbal (symbolic) mediation as well as those that are less conducive to such mediation (nonsymbolic) (Braken & McCallum, 1988, p. 1). Practitioners may find the UNIT useful as an adjunct to other testing for suspected special educational needs.

The assessment of Hmong and other LCD students will continue to present a challenge to practitioners. Data presented in this study should aid practitioners in
making an informed selection of the appropriate cognitive battery to limit or neutralize the effects of bias. The results indicate it is imperative that practitioners employ assessment techniques, including nonverbal measures of ability, designed to fairly and accurately assess LCD students in order to arrive at appropriate decisions in regards to their educational programming. In addition to proper test selection, careful interpretation of assessment data is another key factor in making appropriate and accurate placement decisions. Practitioners need to be continually aware of these special considerations when evaluating students from this and other LCD populations in order to guard against erroneous special education placements.
TABLE 1
Range and Mean Scores

<table>
<thead>
<tr>
<th>Tests</th>
<th>Range of Scores</th>
<th>Mean Scores</th>
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</thead>
<tbody>
<tr>
<td>WISC-III Verbal IQ</td>
<td>46-115</td>
<td>73</td>
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<tr>
<td>WISC-III Performance IQ</td>
<td>60-123</td>
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<tr>
<td>WISC-III Full Scale IQ</td>
<td>50-118</td>
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<tr>
<td>K-BIT Vocabulary</td>
<td>40-108</td>
<td>70</td>
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<td>K-BIT Matrices</td>
<td>55-125</td>
<td>95</td>
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<tr>
<td>K-BIT Composite</td>
<td>44-117</td>
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<td>TONI-A Composite</td>
<td>70-125</td>
<td>100.3</td>
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<tr>
<td>TONI-B Composite</td>
<td>74-122</td>
<td>106.1</td>
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<tr>
<td>CTONTI Pictorial</td>
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<td>CTONTI Geometric</td>
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<td>85.8</td>
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<tr>
<td>CTONTI Composite</td>
<td>65-123</td>
<td>93</td>
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### TABLE 2
Full Scale Ability Correlations

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<tr>
<th></th>
<th>Full Scale WISC-III</th>
<th>K-BIT Composite</th>
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<th>TONI-B</th>
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<tr>
<td>K-BIT Composite</td>
<td>.63</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>TONI-A</td>
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<td>TONI-B</td>
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<tr>
<td>Composite TONI</td>
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<td>.64</td>
<td>.66</td>
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### TABLE 3
Non-Verbal Cognitive Ability Correlations

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<th>WISC-III Performance</th>
<th>K-BIT Matrices</th>
<th>TONI-A</th>
<th>TONI-B</th>
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<tr>
<td>K-BIT Matrices</td>
<td>.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TONI-A</td>
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<td>.61</td>
<td></td>
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<tr>
<td>TONI-B</td>
<td>.60</td>
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<td>.80</td>
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<tr>
<td>Composite TONI</td>
<td>.74</td>
<td>.62</td>
<td>.64</td>
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<td>TABLE 4</td>
<td>Verbal Cognitive Abilities Correlations</td>
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<tr>
<td>---------</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>WISC-III Verbal IQ</td>
<td>K-BIT Vocabulary</td>
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<td>K-BIT Vocabulary</td>
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<td>CTONI Pictoral Nonverbal IQ</td>
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<th>TABLE 5</th>
<th>Nonverbal Visual Spatial Cognitive Abilities</th>
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<tr>
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<td>WISC-III Block Design</td>
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<td>K-BIT Matrices</td>
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<td>CTONI Geometric Composite</td>
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