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SOME CLINICAL INTERPRETATIONS OF THE HAPTIC INTELLIGENCE SCALE FOR ADULT BLIND

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Summary.—The structure of the over-all test and subtest designs of the Haptic Intelligence Scale for Adult Blind fosters inferences that what is being measured is the same, or similar to, the Performance subscales of the WAIS. The implied assumption that, while the task is similar, performance without seeing may not be interpreted differently is questioned. Theoretical notions, in part, derived from the Dutch psychologist, Révész, are employed to interpret what is being assessed in terms of non-visual sensory input, resultant differences in modes of recognition and structuring of the stimulus, and tasks involved. Analysis is done on two levels: (a) The over-all test results as a measure of non-verbal cognitive adaptation to and ability to employ touch and movement in a variety of tasks; and (b) the subtests as to mental functions involved, the clinical cues that can be derived from performance of the tasks, and instances of marked differences in scores earned on one subtest relative to other subtests.

In developing a test for a specifically disabled group such as the blind, there appears to be an inverse relationship between the number of subjects for whom the test is applicable and the number of variables not usually considered in the developing and standardizing of a test to be administered to a "general" population. In dealing with blind persons or other groups having a disability, variables which can influence the use and interpretation of a test appear to take clustered forms such as: (a) the degree of disability, i.e., absolute blindness, no sight perception, light perception and projection only, motion perception, and form perception up to but not including 5/200, from 5/200 up to but not including 10/200 (so-called "travel vision"), and restricted fields; (b) the age of the loss of vision and the cause of blindness (i.e., congenital, loss during different possibly conflictual periods in personality development, slow onset or traumatically developed, e.g., auto accident or suicide attempt); (c) whether the subject has been to a special school for the blind or sight-saving classes where Braille for reading or writing and the use of the abacus for arithmetic are taught, or if the subject has learned to employ haptic cues and skills in a vicarious fashion without "formal training." These variables indicate that a disability is a pivot around which other contributing factors influence how the person is perceived, is reacted to, and perceives and responds socially as well as psychologically (Jordan, 1963).

In developing the Haptic Intelligence Scale for Adult Blind Shurrager and Shurrager (1964) refer to a number of these variables but do not deal with their influence on test results. For instance, in selecting their sample (399

subjects) they noted the level of vision, the age of onset of the loss of vision, and the cause of blindness. While they note that there is a relationship between the earlier the onset of blindness and the speed on performance tasks, the authors' emphasis was to develop a test that would enable the subject to earn a haptic IQ. Focusing almost totally on the quantifiable level leads them to the following statement about their test:

Although a great deal has already been done with the [Haptic Intelligence Test], it is not represented as a perfected test in its present form. While the reliability on the full scale is good, the tests which comprise it show relatively high intercorrelations and relatively large standard deviations which, in combination with moderate reliability coefficients, result in high standard errors of measurement. It should be administered and interpreted with caution, with much of its current value being in the clinical cues it provides the trained psychologist using it (pp. 25-26).

While indicating that psychological cues can be derived, the test authors avoid questions concerning the inferential and theoretical base to be employed if the Haptic test is to serve heuristic and "clinical" purposes. What is meant by intelligence is not defined. One generalized statement is made that "the intercorrelations among the HIS tests suggest that all six tests, while unique to some extent, contain a relatively large common factor" (p. 22). The test authors conclude:

Any implication that HIS tests measure in the blind the same factors that WAIS Performance tests measure in the sighted is not intended. They may or they may not. It seems reasonable to suppose that the two scales do assess to some extent the same abilities, but to what extent can never be determined with precision, for the blind cannot take the WAIS Performance Scale (p. 24).

Is it reasonable, therefore, to suppose that the two scales do assess to some extent the same abilities? If logic by analogy is employed, this should be the case, for four of these subtests used WAIS Performance subtests as models, i.e., Digit Symbol, Block Design, Object Assembly, and Object Completion. Another factor that may suggest this analogy is that the haptic subtests appear to correlate comparatively well with the Verbal subtests of the WAIS as a perusal of the intercorrelation table for the 399 subjects (p. 12 of the authors' manual) indicates. But the question remains whether the perception and orientation involved when employing sight is the same as when the haptic senses of touch and kinesthesia are employed.

The Dutch psychologist, Révész (1950), whose analysis of haptic characteristics and function as found in the blind led to his questioning many of the premises of Gestalt psychology notes that "each sense has its own sensory material, out of which its very own world of experience is built up" (p. 27) and that "these sensory worlds have their very own boundaries; they do not show any transition. There is no visual experience which from a phenomenological point of view has anything in common with an acoustic or a haptic experience"

(p. 29). This does not preclude a reciprocal relationship wherein certain haptic or visual perceptible qualities of objects are not so much correlated with each other but take the form of what Révész calls "associative concatenations" (p. 30). He says further: "In such a case we do not all perceive the haptic criterion visually, but we draw inferences as to the haptical contents of perceptions on the ground of associations, which we have previously established between the two impressions" (p. 30).

In the statement by Shurrager and Shurrager in which reference is made to the clinical cues which the haptic test provides for the trained psychologist using it, two implications should be examined. First, how many psychologists are trained to make a "clinical" evaluation of a blind subject? Rehabilitation counselors undergo a practicum in work with the disabled. Clinical psychologists undergo internships in mental hospitals or health clinics where the orientation is not likely to be adaptation and, if possible, compensation and rehabilitation but maladaptation and the forms that it takes. The psychological implications of a disability, however, are found in an awareness of the multiple variables which affect the subject population but are of no significance when evaluating other normative groups. For example, results on the haptic test with blindfolded subjects who have better than 5/200 vision can indicate adaptation or the rigid reliance upon their limited sight instead of learning to employ other, in this case haptic, senses to compensate. The age of loss of sight, as indicated earlier, influences the scores on the haptic test as a whole, or on some of the subtests. How the sight was lost, i.e., slow degeneration, etc., can influence the degree and type of adaptation that the scores on the test may reflect.

The authors also imply in their previous statement that the haptic test can be a source of qualitative as well as quantitative information. Two approaches can be employed to derive these cues. First, what each subtest may be measuring can be hypothesized so that inferences or as yet suppositions can be derived when the subject earns markedly higher or lower scores on a given subtest relative to the mean of the other haptic subtests. Second, cues gleaned from the subject's behavior during the performance of tests can lead to inferences as to personality characteristics, possible sources of conflict that, while not quantifiable, can later be assessed by other means.

This paper explores some of the multiple levels found in the haptic test and the possible clinical inferences that may be derived from it. A factor limiting this discussion to the inferential level is that little research has been done with the test instrument or the areas of behavior that act as the basis for the inferences to be made. Such inferences are the responsibility of the author and are based on experience in testing blind subjects as a consultant to several agencies serving the blind. It is hoped that the discussion may serve heuristic pur-

poses as well as increase the sensitivity of the psychologist using the test to the multiple levels of interpretation that are intrinsic to the instrument.

HAPTIC SENSES: SOME IMPLICATIONS

In developing the haptic test, Shurrager and Shurrager employed the common sense notion that, if Performance subtests from the Wechsler-Bellevue were modified so that the subject could perform the test by relying on the sense of touch alone, they would then serve a similar purpose for the blind in measuring a Performance IQ. When one of the Wechsler Performance subtests could not be modified, e.g., Picture Arrangement, two subtests were added. These are the Bead Arithmetic and Pattern Board subtests that require "less fine tactile discrimination" (Shurrager & Shurrager, 1964, p. 3). By taking a common sense approach the developers were able to avoid a number of questions regarding the sense of touch and its implications on complex mental functioning. By assuming the subtests were emotionally neutral,² they avoided the affective connotations of touch with sighted as well as blind subjects. While it would be far easier to avoid considering these implications when dealing with the haptic subtests on a "clinical," i.e., interpretive level, such skirting is not desirable. The haptic senses, defined here as tactile or touch, and kinesthetic, or perception of movement, involve a number of psychological characteristics not particularly associated with sight or other sources of perception. The haptic senses can transmit primitive symbols of thought, speech, and motoric behavior and provide a source for learning early notions of what is tangible, i.e., reality, and notions of "self," as well as areas possibly associated with taboos. However, there are generalized characteristics of haptic perception that are not clinical or idiosyncratic and that would limit the type of logic by analogy employed in developing a test. It is recognized that "strictly speaking, the recog-

²The term "neutral" is used because the simplistic connotation of the task or the objects involved is not prone to produce associational disturbance. Putting together, or "conceptualizing," the shape of a ball or counting the number of dots in the top of a triangle are perceptive experiences that foster a sense of presentational immediacy, to use notions derived from Whitehead (1959). Reality is objectified because of the characteristics of the stimuli or the end product. "The knowledge provided by pure presentational immediacy is vivid, precise and barren" (p. 23). The direct recognition involved in the test item does not produce readily noticeable cues as to subjective emotional conflict. But a task or test item appears to have what Whitehead calls "causal efficacy" when a subject has difficulty with it when, based upon his previous responses and scores, he would be expected to apprehend readily what the shapes might produce; but, due to the "emotional interference" triggered by the symbolic references of the stimuli, has difficulty doing the task. Whitehead notes: "The result of symbolic reference is what the actual world is for us, as that datum in our experience (is) productive of feelings, emotions, satisfactions, actions, and finally as the topic for conscious recognition . . ." (p. 18). But, as Whitehead states: "One part of our experience is handy, and definite in our consciousness; also it is easy to reproduce at will. The other type of experience, however insistent, is vague, haunting, unmanageable" (p. 43). It is held that when a task involves either or both aspects of causal efficacy, psychological cues are fostered as to subjective difficulties in the subject being tested and, therefore, the stimuli are not psychologically neutral.

nition of material by means of vision cannot be compared with haptic recognition, as normally both co-operate continuously and reciprocally with one another" (Révész, 1950, p. 65). In haptics only a small part of the total form of an object is employed in the recognition of objects, i.e., material, form (partial and total), position, and their combinations.

In haptic perception one of the most important facets is described by Révész as "the intention towards a total recognition and the focusing on the general aspects" (p. 67). He continues: "The integrative comprehension of the individual reality presupposes vivid observation of the indivisible thing and its many sided unity. The haptic sense, however, is not endowed with the faculty of clearly integrating that complexity" (p. 68). Révész notes: "Two fundamental tendencies are operative in the mode of perceiving objects. The result of one of these represents the figure-image (i.e., the form), the other one the organization of the whole in its geometrical connections (i.e., the structure)" (p. 77). What is meant by form is "the unity of its parts as emerging out of the process of being perceived, a unity leading to complete fusion of its elements in the total impression" (p. 77). But the blind do not pay attention to the form of objects. "In the field of Haptics—and that is what we are here concerned with—one usually does not start from the whole, one rather tries to construct a structural entity out of the analytically perceived partial structures" (p. 80). Révész concludes that "*the intention of structural recognition is an expression of the mainly cognitive nature of the haptic sense*, as opposed to the largely spontaneous nature of visual perception" (p. 83). The "form-structure relation" prevails in Optics but the "structure-form relation" governs the field of Haptics (p. 85). Therefore, "the notion that Optics and Haptics of space are governed by the same rules must therefore be abandoned. Visual and haptic perceptions cannot be compared in respect of the specific impression of form; they are phenomenologically different" (p. 128).

On the applied level, the characteristics of the haptic senses are to be considered as they influence the subject's performance on the haptic subtests. Some implications can be derived when testing subjects with different degrees of loss of vision and with different perceptual orientations (optics vs haptic). This is particularly to be noted when the reactions of the totally blind and partially sighted are dealt with. For example, it is the author's impression that legally blind persons with good partial vision or individuals with monocular vision appear to earn lower scores on the Haptic Object Completion subtest than do persons who are almost, or are, totally blind. This implication, if accurate, ties in with the "need" to rely on visual perception, no matter how little sight the person may have, rather than on haptic perception.

Quantitative and Qualitative Approaches

The issue of "clinical" or psychological cues that can be derived is the

focus of this paper. In accepting this approach it is held that the haptic test is more than a measure of intelligence but is a subtle and highly sophisticated method of assessing individual differences. Aspects of this subtlety and how cues can be derived take three forms: (a) the total score (external norms); (b) subtest scores when they are either markedly higher or lower than the mean of the other subtest scores (internal numerical norms); and (c) qualitative inferences derived from the observation of the subject's behavior. In this paper (b) and (c) will be combined.

Total score.—When the standardized scores on each of the subtests of the haptic test are added and applied to the tables given in the manual, they yield a Haptic Intelligence Scale IQ. A perusal of the intercorrelation table for the 399 subjects that form the normative group indicates that each of the subtest scores has a sufficiently high correlation with the other subtests and the WAIS Verbal subtests to suggest that they are measuring the same general factor. This factor and its influence on efficiency has a generalized significance beyond what each of the subtests appears to measure. Having these normative data enables the tester to infer what may be the "generalized" factor leading to markedly or significantly higher or lower Haptic scores than those earned on the WAIS Verbal subtests. When these differences occur, it is possible to draw inferences as to the subject's adaption to loss of sight, areas of capability, and his reactions—be these reactions due to psychological or cultural factors. This requires: (a) a closer analysis of the subject's scores and behaviors on each of the subtests; (b) a comparison of these impressions with data from the subject's case history, i.e., educational and social background, when the loss of sight occurred, occupational interests and activities, etc.; and (c) a comparison of the Haptic data with other psychological tests results (such as personality inventories, projective tests) that are not the focus of this paper.

Shurrager and Shurrager's approach in developing the first four subtests and the correlations found when the haptic and WAIS Verbal subscale scores are compared lead to the assumption that the haptic test measures not only a general cognitive factor but capabilities similar to those found on the Performance subscales of the WAIS. If this assumption is accepted, marked differences in WAIS Verbal IQ and Haptic IQ can lead the examiner to question the possibility of an organic disorder in the central nervous system. Montarazzo (1972) refers to an extensive number of studies with the WAIS, summarizing their results in this fashion:

- (1) Well-defined groups of patients with a left hemisphere lesion perform less well on the verbal subtests relative to the performance subtests; (2) similarly well-defined groups of patients with lesions on the right side show a reversal of this differential pattern; and (3) there is suggestive evidence . . . that patients with bilateral (diffuse) lesions show a differential similar to the patients with a right hemisphere lesion, namely, higher verbal than performance subtest functioning (p. 391).

The possibility of an organic disorder being present requires a close analysis of test scores as well as of such qualitative aspects as figure reversals, difficulty with arithmetic problems or synthetic tasks when the background of the subject indicates this should not be the case. To test the possibility of an organic disorder, the subject's medical and social history data, when available, and data from other tests that the examiner may want to administer should be employed. This is an area where psychological cues must be looked at with great caution and confirmed by either medical means or history data.

In the case of the legally blind when the Haptic IQ is closer to the WAIS Verbal than the WAIS Performance, the question of the validity of employing the WAIS Performance, as is often done with such persons of limited vision, can readily be raised. In such instances the author is prone to accept the Haptic IQ as the better indication of the subject's psychomotor and performance-cognitive capabilities.

The Haptic Subtests: What Each Measures

The author has found that the one score approach to the haptic test is too limited when assessing individual differences. It is hypothesized that each subtest, as is true for the Wechsler scales, measures a different mode of cognitive functioning. It is held that evaluating the individual scores earned by a subject enables the use of the haptic test as a more meaningful instrument than a measure of haptically evaluated intelligence only.

Shurrager and Shurrager's (1964) limited one scale approach appears to have two merits in that (a) in accepting the summation of the scaled scores, the standardized IQ as a statistically finer basis for evaluation is reached. This broad assessment approach avoids dealing with the potential "headache" of diagnostic implications of scatter, as can be found in subtest scores when the diagnosis is based upon a psychiatric model. Matarazzo (1972) notes, in discussing the studies of pattern analysis on the WAIS: "A correlated index such as a Wechsler profile, no matter how promising, cannot produce anything but fickle, confusing, or otherwise frustrated findings" (p. 430). A second advantage (b) is that avoiding concerns with what is "normal" or "pathological" facilitates interpreting the haptic subtests as means of assessing levels of functioning in a variety of fashions without the use of sight. In making an assessment, it is suggested that a deviation subtest score approach is very useful because the subject is virtually being measured against himself for what appear to be marked increases or decreases in performance on each subtest as compared to the over-all scores on the other six subtests.

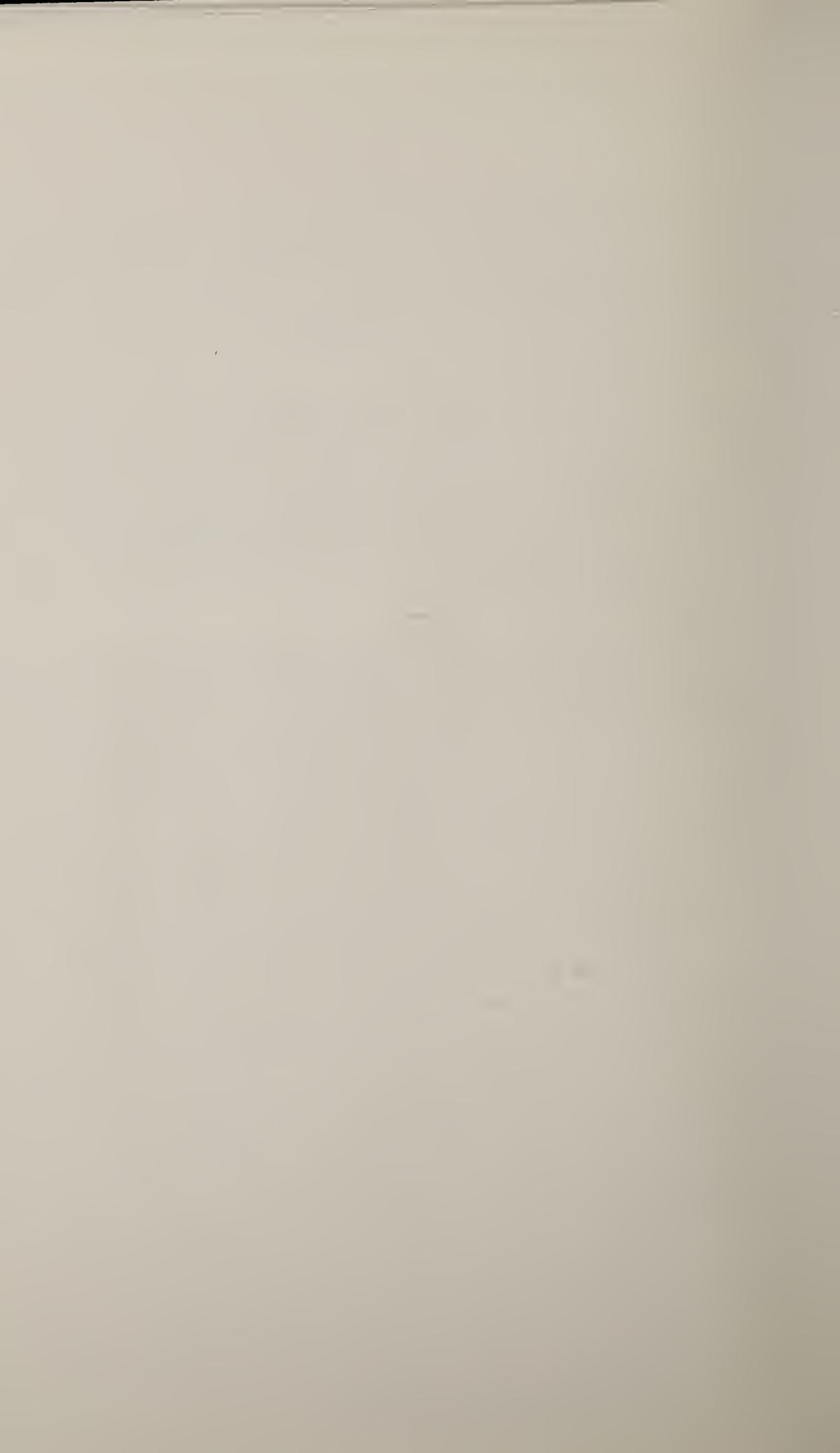
As noted earlier, the haptic subtests fall into two groups, those modeled after the Wechsler Bellevue, e.g., Digit Symbol, Block Design, Object Assembly, and Object Completion and two tests, the Pattern Board and Bead Arithmetic, which were incorporated into the haptic scale because they appeared applicable

to the over-all purpose of measuring different aspects of performance intelligence of blind subjects. In the following discussion of what each of the subtests appears to measure, the interpretation when applicable will be a synthesis of statements derived from Holt (in Rapaport, *et al.*, 1968), Matarazzo (1972), Rapaport, *et al.* (1968), Wechsler (in Matarazzo, 1972), and Zimmerman and Woo-Sam (1973).

In the shifting from tests which rely on vision as a major aspect of performance to tests that rely upon touch, modified or other interpretations of what a subtest may be measuring and what clinical cues may be derived are suggested. Such inferences are the responsibility of the author. The reason for including the Pattern Board and Bead Arithmetic subtests is derived from Shurrager and Shurrager (1964). The enlarged interpretation of the Pattern Board and Bead Arithmetic as well as the clinical cues that can be derived are the responsibility of the author.

Digit Symbol

The Digit Symbol is the only subtest on the haptic scale where the stimuli (simple geometric shapes with raised dots) and the "working materials" (raised shapes set in rows) are felt but not manipulated. Involved in performing the task is the subject's ability to maintain his attention and the psychomotor speed that he can employ in the momentary noting of what number goes with what shape. It can be assumed that what is involved is (a) the learning of relationships in an essentially rote fashion, and (b) the measure of the ability to master a new and essentially alien task. This first subtest, the Digit Symbol, may introduce the subject to relying totally upon haptic capabilities to guide his actions and to deal with a particular pattern of sensory experience that is new and possibly very anxiety-producing, particularly for partially sighted subjects. Relying upon touch and movement, this subtest offers an opportunity to draw inferences as to how the subject may cope with a "rote" learning task involving static materials and which has little ideational or associative content. In this sense cues can be gleaned as to the subject's flexibility and how he orients himself to the spatial limits and directions of the board containing the rows of randomly arranged shapes, i.e., does the subject go beyond the board or recognize when it is necessary to shift in "identifying" shapes from right to left and then left to right? Indications of motor dexterity and/or difficulty when differentiating small details can be derived and further tested by comparing this test with the other subtest reactions and scores. For example, if the subject finds it difficult to count the number of dots on the stimulus shapes, does he also find it difficult to differentiate between the textural nuances on the Block Design subtest but not indicate this difficulty when dealing with the larger, three-dimensional differences as found on the Object Assembly subtest? Because the raised dots are similar to Braille forms, cues as to the ability of the subject to learn to use Braille may be suggested.



Block Design

A test of haptic perception, tactile sensitivity and organization, the functions underlying the performance on the Block Design subtest are similar to any kind of sorting behavior in nonverbal concept formation activities. Reasoning rather than memory, as in the Digit Symbol, is a principal component and convergent skills, such as copying, are rewarded. Consisting of interchangeable but precise units, the test involves a flexibility in turning the blocks to get the design wanted. Indirectly, what is also being assessed is the individual's orientation in space. As Zimmerman and Woo-Sam (1973) indicate: "Orientation in space is one of the key elements governing the individual effectiveness of behavior in the environment" (p. 143). The Block Design and Pattern Board (to be discussed) subtests appear to be measuring two aspects of haptic structural analysis: The Block Design deals with the "inward," integrated component aspect and the Pattern Board, an "outward," free space orientation. Both tests can be considered without special bias for triggering subjective emotional implications. While the conceptualization and reproduction of the design in both subtests does not indicate a superior haptic motor coordination, a comparison of results can indicate a different aspect of the type of coordination that can be found.

Psychological cues that can be derived from the Block Design subtest are several. A high score earned on this subtest after a comparatively low score on the Digit Symbol may be related to the nature of the tests. For the Block Design is less confining, involves greater manipulation, and is not as restrictive as to time. When the increase in score is sustained throughout the rest of the scale, a resiliency when having to do varied tasks totally without sight may be indicated. A higher score on the Block Design than on the other subtests can indicate that the subject, on a non-verbal level, can find and implement logical relationships on a synthetic-abstract level. When low scores are earned only on the Digit Symbol and Block Design subtests, the possibility of impulsiveness and an easily distracted nature are suggested.

Object Assembly

This is the first of the subtests where external guides or frames of reference are not given. As Zimmerman and Woo-Sam (1973) note, concerning the Wechsler subtest of the same name, "The nature of the object to be constructed is not revealed and must be adduced without any formal help" (p. 167). While the parts are not interchangeable (with the exception of the square) and hence are inflexible, the objects to be put together are recognized with comparative ease, e.g., human figure, square, block, hand, ball. The hand, which may be more difficult to conceptualize at first, is usually identified once the thumb is fit into its comparatively large V-shaped slot. This subtest, as the Wechsler subtest, is made up of individually different pieces to be put together into a pattern

inherent in these parts. Unlike the Wechsler subtest, however, on the haptic scale the individual has to employ touch which is a sense that does not readily organize notions of a complete Gestalt to facilitate the application of mental organization. As the subject's hands move from piece to piece, juxtaposing the different parts in a necessarily critical, trial-and-error fashion, a "meaningful" object is produced. The time allowances are generous (up to 5 min.) but to earn extra points for rapidness, the subject must revert to an ideational level wherein an over-all conceptualization guides the degree and kind of motion. As a result, the haptic subtest involves more than coordination with what might appear to be a simple assembly skill, as would be true of the Wechsler subtest. The haptic test appears to measure, in its clearest form, what Révész (1950) calls the Kinematic Principle. He notes that in the visual sphere movement does not constitute a form-creating factor, but in the haptic range: "It is the *movement*, and not the succession as such, which brings form into existence. . . . Experience therefore shows us that for successively progressing impressions and their connections movement is indispensable" (p. 97).

The problems involved in relying on touch instead of sight cannot be overlooked, particularly when the subject's performance is considered a source for psychological cues. In this haptic subtest familiar objects are assembled, and each offers indications of the subject's approach to "puzzles" on a performance level. A quality of presentational immediacy appears to be involved in haptically comprehending the square and the ball. The four pieces to be put together to make the square, like the blocks of the Block Design subtest, are interchangeable. But instead of being concerned with the surface appearance, the subject has to consider how the parts fit together on an internal (peg-to-hole) basis. The subject's mode of approach can supply cues as to his ability to recognize that at times it is necessary to complete part of a task and then put parts (or in this case, the halves) together instead of putting one part on another, successively, to produce the desired product. Whether the subject's approach remains trial-and-error, or if he finally recognizes the need for dealing with parts and then wholes can be inferred. When the subject puts the ball together, it can be noted whether he differentiates between the subtle lack of surface evenness when the horizontal piece is fitted into one of the holes on the base piece, and the ball's surface smoothness when it is put into the other hole. If he impulsively accepts the irregular surface as he goes on to finish the task, he may be suggesting his over-all orientation. If he checks how "well" the fingers fit into the piece of wood carved like the palm of a hand, he may be indicating another over-all orientation.

The female figure and the hand appear to foster symbolic references, suggesting cues as to possible subjective conflict. Problems of body image and felt need for restriction in the manipulation or evaluation of body parts can be

considered. The possibility that such conflict exists can be inferred and questioned when it is found that the subject earns higher scores, be it for speed of completion or accuracy of production, on the neutral objects, in contrast to his performance when putting together the "human" objects. Other cues occur when the subject mentions what the object is but cannot put it together correctly; or, in the case of the female figure, reverses the torso so that the breasts are turned toward the back.

Interpreting a *high score* on this subtest involves: (a) a "between" subtest approach where the over-all weighted score is the highest on the haptic scale; and (b) a "within" subtest score where the high scores are found on the puzzles involving perceptual immediacy and lower scores on the puzzles that are more likely to foster symbolic referrals and to suggest sources of internal conflict.

When the total subtest score is the *highest* on the haptic scale, the suggestion is that the subject can deal with problem tasks in three-dimensional space. The ability of the subject to be field-independent and not have to rely upon external guides to cope is suggested. Higher scores on the neutral tasks can suggest a concrete mechanical orientation or interest. High scores on the "human object" puzzles appear to indicate a subjective orientation toward the world.

Low scores on this subtest can suggest, even more than the Digit Symbol, where the shapes compared are comparatively static, what Révész (1950) calls "anomalies" of the "Kinesthetic sense," which psychologists in this country would be more prone to call organicity. For neural injury or degeneration can bring about a loss of ability to distinguish tactically between objects. Another factor that may contribute to a low score can be the individual's reaction to uncertainty when no guide lines, be they visual or directly comparable, are presented.

Object Completion

While the haptic test, as its name indicates, is a test for the blind, the term blind *per se* designates a range of vision from partially sighted to totally blind. It is the author's impression that the amount of sight a person has strongly affects his score on the Object Completion subtest. It appears that the less sight the subject has, the better he performs the task. Thus, subjects with motion or form perception, or less, i.e., totally blind, appear to do better than subjects with 5/200 to 20/200, i.e., travel vision, or better, or individuals with restrictive fields, i.e., legally blind. It has been observed that subjects with more sight, i.e., travel vision or better, try to identify and differentiate nuances in the objects around them, employing whatever sight they have, instead of employing other senses such as touch in a compensatory fashion. Until re-

search can confirm or invalidate this observation, it is suggested that scores on this subtest cannot be interpreted readily as having the same implications for subjects with limited vision.

The Picture Completion subtest of the WAIS acted as the model for the development of the Object Completion. In discussing the Picture Completion subtest, Matarazzo (1972) states: "In a broad sense the test measures the ability of the individual to differentiate essential from non-essential details" (p. 211). Earlier he stated: "Ostensibly it measures the individual's basic perceptual and conceptual abilities in so far as these are involved in the visual recognition and identification of familiar objects and forms" (p. 211).

The Picture Completion and the Object Assembly subtests are similar in that a function underlying their achievement is concentration. This function is stressed by the Shurragers in their manual where the examiner is directed to say: "I'm going to hand you a number of different objects one at a time. Each object has one important part missing, and I want you to tell me what it is" (p. 35). For the first three items, if the subject names an unessential part or more than one missing part, the examiner then says: "Yes, but what is the most important thing that is missing?" (p. 35). All the material necessary for the subject's response is in the "common" object handed to him, and he does not have to organize or manipulate parts before making his decision.

The author holds that there is a marked difference between the type of concentration called for in the Object Completion and the Picture Completion subtest. In the latter, the concentration is visually oriented and takes a more passive form. Knowledge or judgment concerning what the subject observes in the drawings is not involved. For a blind subject, the necessary orientation is akin to relying upon hearing. In order that he perform this subtest, he must rely upon an active concentration that includes movement and a knowledge of, then a critical scrutinizing of what is in his hands. Then he can determine what is essential or not essential. While the objects selected are considered commonplace, the experiential world of touch is comparatively limited. In doing the subtest, thus, there is an active demand upon the subject's ability to employ information, knowledge of facts or relationships that he has experienced with things that to him may not be commonplace. The objects used in the subtest range from neutral to symbolic and subjectively conflictual. Some of the objects appear to have a sexual bias which, in this situation, is important in terms of the potential for limited experience and taboo in touching. In this sense a conflict over touching can take a very selective aspect, affecting what is perceived or not perceived. For example, recognizing that a button is missing from the attachment part of a woman's garter can be very difficult for some male subjects.

As noted earlier, it is this psychologist's impression, based upon six years

of experience with the instrument, that partially sighted subjects appear to earn lower scores on this subtest. A factor contributing to this finding could be the excessive reliance of the partially sighted upon what visual cues they can muster to try and differentiate the world around them. Thus, the need to rely upon their haptic capabilities is felt to be alien. In this sense the task involved in this subtest can be considered akin to having the subject orient himself to a transitory sensory input wherein data derived from one sense modality are translated to visual memories before a response can be given. There are times when a partially sighted subject should be able to function as if he lacked sight in order to cope, do varied tasks, or learn other modes of dealing with the world effectively. When the score on this subtest, even using the present non-differentiated norms, is lower than other subtest scores, the possibility is that adjustment training may be needed and should be considered.

With the extremely limited (5/200) to totally blind, the examiner should be cognizant of how well the subject does on each of the items, the approaches employed and the reactions displayed. From these nuances the examiner can draw inferences as to how well the subject deals with the external world, how much he has been sheltered, and again, subjective conflicts he may experience and not voice.

Pattern Board

Shurrager and Shurrager developed most of their scale relying upon reasoning by analogy. Employing the Wechsler scales as models, they structured and selected the materials for the first four subtests to be somewhat similar to the original. In the attempt to extend the range of the haptic intelligence being tested, a Pattern Board, Bead Arithmetic, and Plan of Search subtests were included in the developmental stages of the scale. The authors kept the Pattern Board and Bead Arithmetic subtests but dropped the Plan of Search subtest because the Pattern Board and Bead Arithmetic required less fine tactile discrimination and skilled manipulation.

The assumption underlying the inclusion of the Pattern Board is that it investigates space perception of blind subjects. It is the only subtest involving the immediate recall of spatial and directional characteristics as if these qualities were entities in themselves. Employing a square board with five rows of holes, five to a row except the middle row with four holes and a raised "permanent peg" in the middle, the examiner fills designated holes with pegs to produce the designs wanted. These designs are to be "studied" and then reproduced by the subject. The configurations appear to deal with notions of size, shape, distance and direction. Two characteristics of the task—the reliance upon short-term memory and the test material itself, i.e., the 5- \times 5-holed board with the arrangements of pegs on it—limit the subject's opportunity to associate the

task with previous "memorized" objects in haptic space and to draw inferences as to their structure. What the subject is asked to recall has little relationship to previous experience and the only applicable "meaning" is the arrangement of pegs in controlled space. Gestalt laws of organization are not readily perceived. Because the subject has to build up his impressions from the exploration of parts in a concrete fashion wherein the focus is on how the placements of the pegs radiate from the permanent peg in the middle, or what is their location when the distance from the sides is used as the guide, the subject's orientation is basically unreflective. The task is basically psychomotor, the perception of spatial relationship basically cognitive.

In their discussion of sensory learning, Solley and Murphy (1960) note that: "(a) the way we perceive things is dependent upon the amount of experience we have had in structuring stimulation and (b) that perceptual acts become conditioned to stimulation produced by movements of the observer" (p. 215). This statement is in agreement with Révész. Involved in performing the Pattern Board subtest, probably more than any other haptic subtest, is what Révész calls the Metric Principle. First "studying" and then recalling the designs on the Pattern Board involves an orientation in respect to position and quantitative relation of the parts one to another and to the whole. Révész notes:

One is therefore compelled to make use of a method which is somewhat unusual in the visual sphere; that method is the *process of comparative measuring*. . . . The fundamental condition of measuring is realized in the haptic sense: it possesses in the width of the thumb, the length of the finger, and in the distance between the thumb and the small finger or the index finger more or less invariable spatial units, which can be laid on the objects to be measured just as with our conventional units of measure. . . . Such a comprehensive measuring activity entitles us to speak of the haptic sense as of the geometric sense (pp. 98-99).

Applying these notions, it appears that the Pattern Board subtest is attempting to measure an aspect of haptic spatial memory and the ability of the subject to employ the metric principle as aspects of haptic intelligence.

Markedly higher or lower scores, or the successful reproduction of more than four-peg designs but difficulty with later items indicate sources for psychological cues. Markedly *higher* scores may occur because the subject has learned to cope with haptic testing on the previous subtests. Coming after the Object Assembly and Object Completion subtests, both of which have a greater symbolic pull toward emotional conflict, emotional reactions due to symbolic implications of the test material are not likely to occur. The reliance upon non-reflective memory facilitates the subtest being a display of psychomotor skill. The task is basically neutral in that it does not acquire "meaning" in relation to goal activity or in reference to the external world. Even though the materials used limit the task to a confined, non-ambiguous handling of

space, higher scores can indicate the willingness to explore and handle haptic space, display the type of "haptic intelligence" indicated, and suggest a quality of field independence on the part of the subject.

Markedly *lower* scores appear to reflect any or all of the following: an inability to focus attention on synthetic tasks, an undeveloped "geometric sense," anxiety, lack of motivation, insecurity when dealing with aspects of haptic space. Indications of a field dependency and difficulty in shifting in feeling for deviations from the vertical and horizontal may limit the subject's ability to handle a task where flexibility, interwoven with a metrical reliance, is called for.

The subject may be able to reproduce the original design from memory without an appreciation of the whole of the design at any given instant yet the results may be scorable. Unreflective in approach, he may retain what was felt, particularly when dealing with the apparent simplicity of the earlier items, and mechanically reproduce them. The subject may arrange the pegs to indicate a reliance upon perception, in visual not haptic terms, wherein concerns with the Gestalt laws and not metric relationships will interfere with the memory or ability to reproduce designs.

Proximity can be a factor in the reproduction of the eight-peg items on the subtest. In one design the front peg is two holes to the left of the center peg and the grouping of the angled pegs starts parallel to the center peg. When the subject either places the front peg too close or places the "angled off" pegs back from the permanent peg, he is relying upon a Gestalt, not metric orientation. Reproductions that have the characteristics of the Gestalt principle of closure are not uncommon. This reaction, when fairly persistent, lends itself to the inference that the subject feels a need for a controlled environment, or that he will contain and not extend the self when dealing with aspects of a haptic space that might be anxiety-producing.

Difficulty with direction, which appears to be common in the blind, is found when the subject's reproductions indicate that he has trouble shifting the locus of orientation, be it, in this case, from designs with static to "moving" spatial characteristics. The inability to shift, particularly in a limited spatial context, can suggest an underlying rigidity, even when the subject may appear, on a verbal level, to extend himself or be more flexible. An "expanded" or "open" use of haptic distances, i.e., the peg placement is farther apart in reproduction than the original design, can indicate an expansiveness or field independence when dealing with the effects of spatial uncertainty. Asymmetrical reactions occur when a grouping or patterning occurs without a subject's awareness or concern with the balance imposed by the symmetrical characteristics of each item.

The random placement of the pegs or development of asymmetrical designs,

while displaying a concern that the number of pegs used on reproduction is the same as on original inspection, suggests a limited attention span interwoven with an impulsive orientation under a facade of compliance. A subject who is unable to focus his available attention in a limited spatial domain is prone to produce designs with confused or circular characteristics, suggesting the feeling of being lost in haptic space without a strategy or a fixed notion as to how to cope, even when the space is enclosed or fixed.

Bead Arithmetic

In discussing the Bead Arithmetic subtest, Shurrager and Shurrager (1964) indicate their own uncertainty about the subtest:

So far as we know, the abacus has not been previously used as a device for testing intelligence in either blind or sighted subjects. Learning to use and understand the principles of an abacus seem to be problem-solving processes. Its validity as a testing device would be vitiated by previous training in its use (p. 5).

This statement fosters inquiry on two levels: Should the score on this subtest be included as an integral part of the developed IQ or should it be considered as an alternative subtest? Is the understanding and use of the abacus a problem-solving process or is it a measure of the subject's ability to concentrate? Rapaport (1968) notes that:

Concentration is a voluntary effort to insure intake of outside stimulation. . . . A person takes in not the stimulus but its meaning. Frequently when a stimulus pattern becomes complicated, the meaning does not reveal itself automatically to effortless attention. In such cases concentration focused upon the discovery of the meaning of the stimulus pattern becomes necessary (pp. 118-119).

The over-all process involves scrutinizing, selecting, and organizing and can be described as occurring when attention turns into effortful pursuits.

The applicability of Rapaport's description is apparent when the Bead Arithmetic subtest as a task is analyzed. There are four parts or phases involved in doing this subtest.

During Phase I the examiner employs oral description while demonstrating the manipulation of the beads on their spokes, with the subject haptically "studying" the design and operation of the device. The subject's role is to focus his attention so that he can employ a haptic means to apply his previous knowledge of the unidimensional characteristic of numbers. In so doing, there is a development of "meaning" in abacus manipulation.

During Phase II the examiner puts a number on the board and the subject is to tell him what it is. Beginning with relatively simple examples, the numbers become progressively longer or more complex. To count the numbers placed on the board, the subject has to follow the complex instructions given and demonstrate that he can apply what has been described and demon-

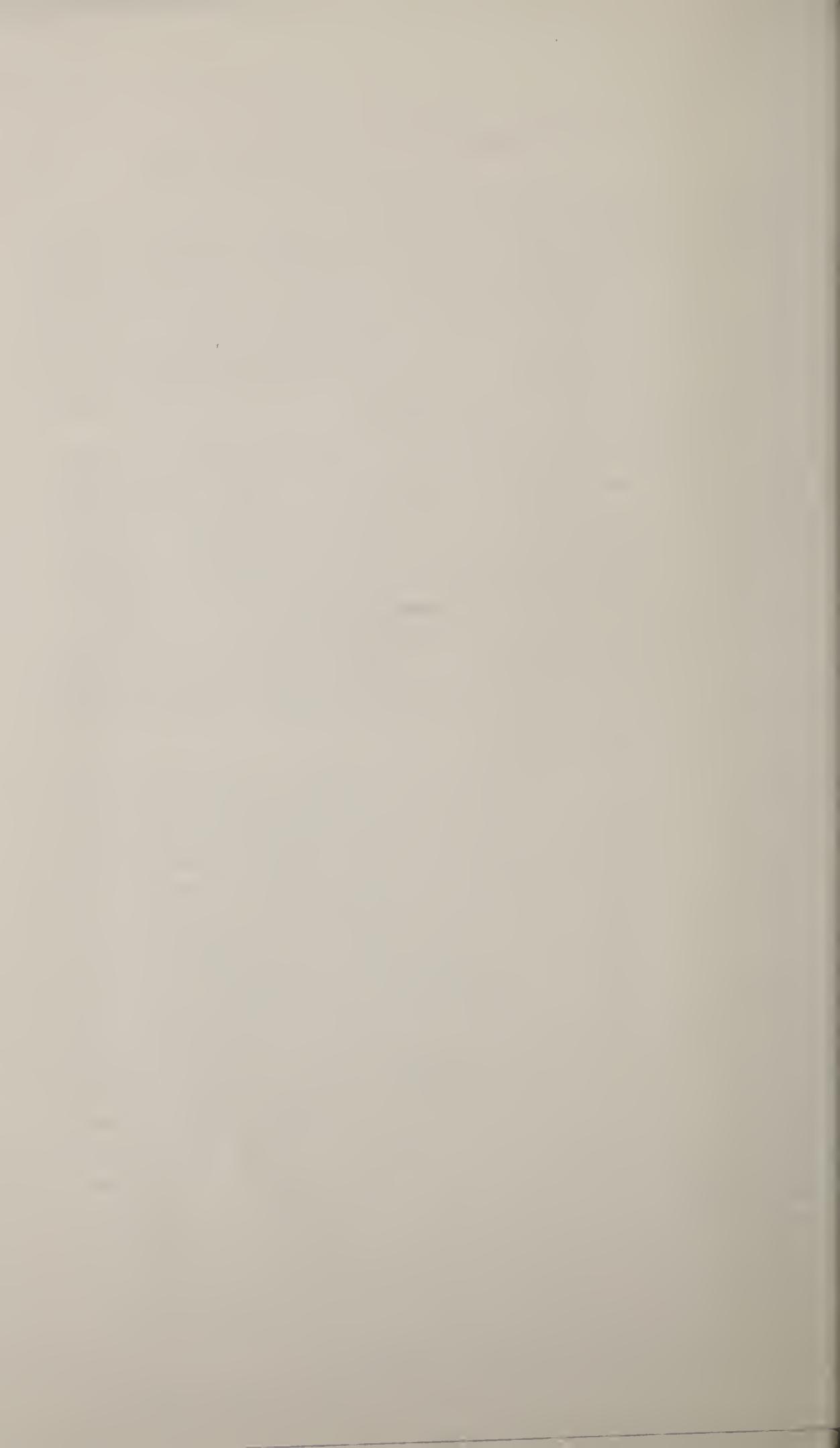
strated. The subject's performance reflects the attention he applies to a meaningful pursuit. With each new number placed on the board there is further practice in scrutinizing the pattern of bead placement and the opportunity to learn number values and their location, i.e., ones, tens, hundreds, fives, fifties, etc. Active concentration is indicated by the subject's comprehension of the differences found in the ways the beads are manipulated to form numerical patterns or "complex" numbers. In the process of applied concentration, memory traces become ingrained, if only temporarily.

During Phase III active concentration is interwoven with active manipulation. The subject has to demonstrate that he can employ his haptic senses to demonstrate that he has learned the mechanics of a comparatively complex device to produce requested numbers that are not very complex. To do so involved the application of the "memory traces" just instilled to perform a function that underlies the performance of any kind of sorting behavior.

The fourth phase calls for the addition of numbers. The examiner reads a number and the subject puts it on the board. A second number is called that is to be put on the first number. The subject then reads the sum of the two numbers from the beads. This task does not appear to involve problem solving *per se* but is an extension of Phase III.

If the Bead Arithmetic subtest is a test of concentration as well as application of complex instructions, what would happen if the instructions were modified? This was done for some subjects who were slow to assimilate but kept trying to comprehend the instructions as given in the manual by questioning the examiner or rechecking if they were doing the task correctly. The modification employed was suggested by a student who was a native of China and often used the abacus as an "adding machine." He described how he learned its use, and the author paraphrased this and interwove it with the statement in the manual. This approach has not been formalized as yet but is presented as follows: The beads on the first spoke below the divider can be thought of as the five fingers we have on each hand. To show the fingers, we raise them, one at a time, just as the beads on the first spoke are raised, one at a time. (This is haptically demonstrated to the subject.) Man has two hands. Like man, the two beads above the divider can be considered two hands, each of which has five fingers. If man has to use more fingers than he has on one hand (five), he pulls down a bead from above the divider which stands for a "whole hand") and then pushes up the number of fingers beads he needs to complete the number from the spoke below the divider to complete the number. (Making the number eight is used as an example.) The second spoke is then described as standing for 10s, the third for 100s, etc., compliance with the instructions in the manual.

This simplified form of reasoning by analogy appears to save time and proves the subject's comprehension, as well as ability to apply himself to



the task. It also may account for the author's as yet untested impression that increases in score are found when this analogy is incorporated in the instructions. If this is the case, it further reinforces the author's opinion that what is being tested on this subtest is not problem solving but memory, concentration, and sorting skill.

As noted earlier, the validity of the Bead Arithmetic subtest as a measure of intelligence with subjects who have had a previous training was questioned by Shurrager and Shurrager. Nonetheless, they structured the test so that the score earned on the subtest is included in the calculation of the Haptic IQ for all groups. Considering the Bead Arithmetic an alternative subtest is not mentioned, nor are IQs based upon the sum of scaled scores for the other five subtests given. The apparent reason for not doing so is that the scores on the Bead Arithmetic for the Research sample correlate quite highly with the overall, other subtest scores, and the subtest and Verbal IQ scores on the WAIS, i.e., the range of correlations, after correction for contamination, is .42 with the Digit Span on the WAIS to .65 with the Pattern Board on the haptic test (Shurrager & Shurrager, 1964, p. 23).

In order to resolve whether to keep or not keep the subtest as an integral part of the total haptic test, possibly different sets of standardized scores might be developed for: (a) those who have had experience with the abacus in the past; (b) those with extremely limited vision, i.e., from total blindness to subjects with motion and form perception, up to, but not including 5/200 (the tables presently employed are applicable to this group); and (c) those partially sighted subjects.

In interpreting the scores earned for the subjects who have not had previous experience with an abacus or have not followed occupational interests or pursuits involving the use of numbers, the subtest can be considered a means of measuring the subject's ability to comprehend readily the mechanics of a new instrument in order to perform an exacting haptic task. Put differently, the subject's score and behavioral response to the test may indicate how readily he can comprehend and employ a new principle of approach and apply it cognitively. Psychological cues can be derived as to the subject's capacity to sensitize himself to the demands of the instrument and how well he learns to select and manipulate what is desired. How readily the subject learns the task (Phases I and II) can be considered a sign of mental or haptic alertness. How well he does on Phases III and IV enables the assessment of how well the subject is able to memorize, retain, recall and apply complex instructions to attain a goal. How well or how readily the subject responds when the examiner is putting the numbers on the abacus or when the subject does the task himself can give cues as to whether the subject functions best when he has to cope in a dependent or independent fashion.

CONCLUSION

This discussion of the haptic test is not meant to be, nor can it be, complete. The Haptic Intelligence Scale for Adult Blind, like the WAIS, is more than just a measure of "intelligence." It is a subtle and highly sophisticated method of assessing individual differences and capabilities. Like the Performance subscale of the WAIS, the subject's responses to the test can be assessed on three levels: (a) the total score wherein the numerical end product enables a comparison of the subject's level of functioning with a normally distributed external population; (b) the individual subtest scores wherein scores on individual subtests are compared with scores on the other subtests with implied assumptions as to what the difference in score may indicate; and (c) qualitative inferences derived from the observation of nuances in the subject's cognitive and behavioral reaction to parts of, or all of, a given subtest. Throughout this discussion there is the implicit assumption that on an individually administered test instrument such as this haptic one, the qualitative and quantitative aspects of assessment occur concurrently.

Shurrager and Shurrager imply, but do not state, a theoretical basis for subtest inclusion and interpretation of results. The basis appears to be statistical in that the subtest scores earned by the normative population yielded positive correlations with each other; and secondly, since four of the haptic subtests are "similar" in appearance and the tasks involved to the WAIS subtests after which they are modeled, they must be measuring similar capabilities or aspects of intelligence. But when familiar notions, such as what the much researched subtests on the WAIS measure, are extended to novel subject matters, such as cognition through haptic means, on the basis of unanalyzed similarities, then errors can easily be committed and the clinical inferences derived may be of little applicable value. If Shurrager and Shurrager's reasoning by analogy is accepted, inferences as to the type of increased or lessened capability can be drawn based upon the subject's scores. However, if this probable inference is questioned, then the examiner may wind up with norms in the form of standardized scores but no theoretical structure to guide him in drawing implications as to what is being measured.

In this discussion a number of Révész's modified Gestalt notions have been employed because it is held that there is a marked difference in orientation when problem-solving situations are approached visually and haptically. Put differently and in agreement with Révész, it is held that to function haptically is to employ a method of coping that involves comparatively autonomous functions involving differences in attention and comprehension than the analogy with the Wechsler Performance subtests would engender. What the haptic test appears to measure is: (a) the ability to use touch and kinesis without visual cues to indicate how a subject has compensated for the loss of sight;

and (b) the ability and flexibility in dealing with non-visual materials—a capability necessary in the totally blind or necessary but possibly rejected in the case of the partially sighted. If this assumption is valid, then the psychologist doing the assessment should include the haptic scale in test batteries not only for the totally or nearly totally blind but for the legally blind and monocular subjects as well. Testing the latter can contribute inferences as to how the subject will respond to new sensory experiences and his ability to increase sensory responsiveness when not relying upon limited sight. In this sense the subject's performance can indicate not only learning, cognitive styles, or adaptive sensitization but the modes of coping or adjustment to new emotionally laden situations. When marked difficulty in any of these areas is indicated, remedial training may be necessary to facilitate the subject's learning and ability to adapt not only with haptic space and handling but in other psychological areas.

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