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Celebrating a Century on Form Boards with Special Reference to Seguin Form Board as Measure of Intelligence in Children

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ABSTRACT

This theme paper seeks to trace the historical roots of form boards with special reference to Seguin Form Board as a measure of general intelligence in typical as well as children with developmental disabilities. Despite lapse of about a century since the design and development of form boards in the context of testing and training senses in children with intellectual disabilities, the humble device continues to remain one of the most popular, easy-to-use, and simplest tools being used by rehabilitation professionals. The initial form board era of early 19th century witnessed a spurt of several research studies which has been intermittently tried, retried, tested and retested across ages, nations, cultures and backgrounds. This tribute recommends innovative research even today as the befitting commemoration rather than a requiem for the genius in this apparatus.

Key Words: Developmental Disabilities – Intellectual Disability – Shape Perception.

INTRODUCTION

Despite several disagreement and debates on its nature, content, measurement and characteristics, the construct of intelligence has sustained over a century in the field of western psychology. Francis Galton is credited as the starting point for history of intelligence testing (Galton, 1865). Inspired by his cousin, Charles Darwin's perspectives on evolution and adaptation, Galton wrote his first famous article on hereditary nature of genius and talent. He established a laboratory in England in 1882 for measurement of individual differences. A few years earlier, in 1879, Wilhelm Wundt established his laboratory for experimental psychology in Leipzig, Germany. James Mc Keen Cattell, an American student of Wundt, established the first testing centre in the United States. He also coined the term "mental test" to describe measures of sensory perception and reaction time (Boake, 2002).

Charles Spearman developed a theory of general intelligence that would inform the methods of its assessment. His 2-factor theory was based on observed correlations between sensory discrimination and academic performance. He proposed that performance on ability tasks comprise two elements: general intellectual ability (*g*) and components of ability specific to the task(*s*)(Spearman, 1927; 1904). In contrast, Binet (1905) scorned the development of tests based on theory. Along with Theodore Simon, he was commissioned by Ministry of Public Instruction, Paris, France, to develop an educational assessment that could determine whether a child would or would not benefit from mainstream schooling. The Binet-Simon Scales was developed for these requirements. However, by 1908, the Scale was criticized for its reliance on verbal content and its single-user administration.

Henry H. Goddard, who translated the Binet scales into English, was one such critic. Goddard is best known for his work at Vineland Training School for Feeble-Minded Girls and Boys. He introduced the classification system for IQ score (like *moron, imbecile,* and *idiot*)(Goddard, 1915). The first group-administered test of ability was developed by William Pyle in 1913. In the same year, Seguin, Goddard and Sylvester developed the non-verbal test of intelligence called Seguin Form Board (SFB). In 1916, Lewis Terman of Stanford University adapted and standardized Binet-Simon Scales into Stanford-Binet Scale for use in the United States (Lohman, 2003).

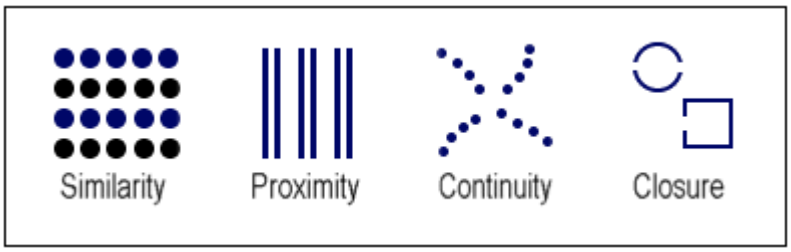
During World War I, other group tests of intelligence appeared, such as, Army Alpha and Beta by Robert Yerkes and Arthur Otis. John C. Raven furthered non-verbal assessment with development of Progressive Matrices (Raven, 1939). David Wechsler published Wechsler-Bellevue Intelligence Scales (Wechsler, 1939). He used deviation IQ scale (mean of 100, SD of 15) instead of mental age calculations by awarding credit for all items in each scale, not just for passing a specific number of tasks. He was the first to combine verbal and performance scale with different versions for adults and children, memory and achievement. Some minor changes in assessment of cognitive ability came several years after RPM and Wechsler scales were published. The assessment of separate abilities, such as, verbal, numerical and abstract reasoning emerged from Raymond Cattell and John Horn's work on fluid and crystallized intelligence in 1960's. Theories of multiple intelligence resulted in a plethora of assessments that tap into the specific abilities portion of intelligence measurement (Brody, 2000; Gardner, 1985). Nowadays, we have measures of cognitive or intellectual styles with varying levels of complexity. The concept of emotional intelligence and other types of intelligence are turning popular. However, none of them has anyway completely revolutionized our perspective on the actual definition of intelligence. It will be interesting to await the impact of new technologies on this tricky concept of intelligence in future.

FORM PERCEPTION

Objects in space are 3-dimensional. They are perceived by the human eye as 2-dimensional images. Form perception allows the perception of a 2-dimensional retinal image as a coherent 3-dimensional form and entity. The way adults perceive the world is totally different from the child. A child initially views the world in a state of flux. From that state, emerges a sense of permanence for self, objects and the surroundings. The child realizes that shape or form of

objects do not change despite apparent changes in color, location, size, movement or color. This is perceptual constancy. Soon, the child understands that there is a cause-effect for things or events in environment. With rudimentary development of imagery, along with traces of memory, the child grasps that there is a past and present. This will be later added with the notion of a future. At this stage, there may be still frequent confusions between imaginary and actual, past and present, fact and fiction, self and world, part and whole (May, 2007; Wrightson, 1918).

Beginning a stage of sensory fixation, by five months, through localization and tracking, infants like adults, are capable of using various cues to perceive 3-dimensional images including depth and shape. They may be yet unable to discriminate motion and color of two or more objects. Adult like form perception (also called contour perception) involves sensory discrimination of a pattern, shape or outline. Gestalt psychologists have long recognized certain ground principles based on which human beings are believed to negotiate or accomplish the task of day-to-day form perception. They are: similarity, continuity, proximity, symmetry, closure and pragnanz or figure-ground.



These rules of perceptual organization work across all senses although the diagram above depicts examples for visual field. The teacher's voice in the background of several other environmental sounds in a classroom or silence against background noise are as much examples of figure-ground as is the printed words on this page against the white backdrop of this sheet of paper. If two or more elements move together, they tend to be perceived as grouped together as per the principle of common fate. The same is true for even for two or more coincidental events or incidental happening in one's life. The individual tends to believe that they are inter connected. The broken circle and square given above is perceived as complete owing to closure effect just like a fault is followed by an apology or a crime is meted with punishment to be deemed as settled. Camouflage is another strategic phenomenon in which objects are hidden from the view but not being occluded. Instead, they are perceptually subdivided or broken up internally and repartitioned in such a manner that their parts are grouped with parts of the surrounding environment. By doing so, animals or defense forces in warfare, for example, survive undetected by their adversaries. Similar examples can be generated for application of the laws of perceptual organization even to tactile and haptic sense modalities (Warren, 1982).

CLASSIFICATION OF FORMS

Forms or shapes are of many kinds and they can be classified in many ways. A useful classification for understanding form perception of children in a developmental perspective is divided as primary, secondary and tertiary shapes. Primary shapes are simple forms like circle, square and triangle. Secondary shapes are derived or extended from primary shapes, such as, rectangle, oval, ellipse, semi-circle, rhombus, diamond, simple quadrilaterals and parallelogram. Tertiary shapes are combination of primary and secondary shapes, such as, hexagon, pentagon, heptagon, oxagon, nonagon, decagon, dodecagon, hospital plus, simple or Christmas star. From a developmental perspective, children first acquire primary shapes at kindergarten level followed by attainment of secondary shapes by primary school and later master tertiary shapes during middle and high school years. In other words, children below five appreciate primary shapes, those between five and eight or nine can handle secondary shapes as the older children are proficient with tertiary shapes. Thus, the development of form perception appears to be linked to developmental age levels (Krogh & Slentz, 2001). This observation is the basis for development and standardization of tests of intelligence such as Gesell Drawing Test, Draw a Person Tests, House Tree Person Drawing Test, Cow Personality Test, Rorschach Inkblot Test, Furham Shape and Color Test, etc.

In a clinical context, the Gesell Developmental Schedules records that children can match three primary forms by 18 months. They match secondary forms by two years and all the forms by 2 ½ to 3 years (Skeels & Stoddard, 1933; Skeels, 1932). When combined with grapho-motor abilities, penmanship and fine motor palm-finger grasp and eye-hand coordination, form perception is manifested in children through activities like copying simple to complex geometric shapes (Bayley, 1926; Wallin, 1912). The age graded copying tests testify such developments in a child. For example, typical child can copy vertical strokes by 18 months, horizontal strokes by 20 months, imitate a cross by 22 months and so on.

It is also important to understand the developmental sequence in acquiring mastery over form perception through 5-tier sequential stages where they initially learn to *match and sort* identical shapes, followed by *identification and naming* the shapes before eventually *generalizing* their acquired notion of the shapes across things or materials in their environment. Children who are still in the stage of matching and sorting are likely to find it difficult to conceptually grasp activities involving identification, naming and/or generalization of shapes (Charlesworth & Lind, 2013). This developmental sequence of matching-sorting-identification-naming-generalization holds good even for acquisition of allied concepts like color, size, weights, texture, etc. Apart from age, gender differences have also been reported with advantage for men over women in tasks involving visuo-spatial as against verbal intelligence. This claim is being increasingly disputed and explained as stereotype threat effect.

TESTS INVOLVING FORM PERCEPTION

The measurement of spatial visualization or visual spatial ability involving manipulation of 2-dimensionl and 3-dimensional objects or figures may involve use of form boards, paper folding tasks, manipulation of cubes, reversal of

needles on clocks, maze route finding tasks, etc. Among all of them, the form board tests are the most popular. Based on single factor theory of intelligence, form board tests measure speed and accuracy apart from a child's eye-hand co-ordination, visuo-motor skills, shape-concept, visual perception and cognitive ability.

There are several variants of form board test. The simplest is three to five, six and/or complex form board tests. Form boards have been in use of several years. Clinical psychologists continue to use them as one of the easiest, quickest and best measures of general intelligence especially in children. It appeals to the interest of children, and eases rapport building during testing. Seguin constructed a number of form boards. Some smaller ones made of soft wood without being painted had just three forms. Other larger ones made of hard wood had a dozen variously shaped symmetrical shapes. A few boards had light colored wood on one side and dark colored wood on the reverse. An early variant is Knox's Imbecile Form Board (Knox, 1914) and Witmer Form Board (Young, 1916). Maria Montessori was the first to apply form board device for training normal children. The form board was first used as testing device by Naomi Norsworthy in her study of mental defectives (Norsworthy, 1906). The board had a haphazard mix of primary, secondary and tertiary forms even with handles to place or retrieve them. Goddard brought the board to its present size, removed the handles and complex forms which used to be preset in its earlier version (Goddard, 1917). Edwin B. Twittmyer adopted Goddard's arrangement and size of forms, but revised their order, made the recesses shallow, used hard wood, and gave the overall attractive appearance that it has today (Mittler, 2008).

TYPES OF FORM BOARDS

Apart from 3-dimensional wooden form boards, investigators have designed, developed and standardized paper form boards too. The **Minnesota Paper Form Board Test** contains 64 multiple choice items arranged in order of difficulty. It contains five figures and one of the figures is displayed in disarranged parts. The subject has to decide which of the figures display the pieces joined together. The test is ordinarily given with time limit of 20 minutes and the score on this test is derived from the total number of subject's right responses. The nature of items suggests that, both, speed of response and level to which a subject is capable of reach is expressed as the obtained score in the given standard time limit. There are two versions available for this test as AA and BB with equal in difficulty and having adequate internal consistency (Range of r: 0.75-0.94). This test measures spatial orientation, spatial visualization, mental visualization, part-whole relationship skill, ability to manipulate objects in space and imagery capacity (Likert & Quasha, 1948; Stephens, 1945; Tinker, 1944; Quasha & Likert, 1937; Newell, 1931).

The **Arthur Point Performance Scale** (Lester, 1929; Worthington, 1926; Arthur, 1928; 1925; Dearborn, Anderson & Christensen, 1916) is a combination of color-form test, five form board tests, a triangle performance test and a chair construction test with varying degrees levels of performance difficulty. These tests are devised for arranging them in a graded series, together with other similar tests for use in the examination of immigrants, native born children and adults who speak only a foreign language, the hearing impaired, and those suffering from other speech defects. These tests may be used as supplementary to the series of intelligence tests, as alternate tests and substitution tests.

The **Mare and Foal Picture Board Test** falls under picture form board variety. The board carries the picture of a mare and foal in a field with two sheep lying down and three chickens in foreground. In the background, two houses are seen at a distance. Eleven cut out pieces of different shapes represent one or other part of the scene. The board is placed before the child with the nine pieces scattered at the top. The instructions are: "Put these pieces in the right places as quickly as you can without making any mistakes". Stop watch is used to measure start-to-end time in seconds. During the performance, the examiner counts the number of errors. An error is any attempt on the part of the child to place a piece in a wrong space. If the child holds a piece over a space hesitatingly without bringing it down to touch the board, it is not counted as error. Maximum time given for the child to perform the test task is five minutes. If s/he fails to complete the test within that time, the examiner deems the result as failure.

The **5-Figure Form Board** was devised with the idea of making the test somewhat more complicated than SFB. For this reason, each one of the cut-outs is divided into two pieces with the exception of one that is divided into three pieces. In SFB, each is a full piece. The child is instructed to put the pieces together into the board quickly and correctly. Time and errors are recorded by the examiner. Maximum time limit is five minutes. An incomplete performance is recorded as such (Rudolf & Patterson, 1917).

The **2-Figure Form Board** has only a square and cross. It was also devised by Paterson to be much more difficult than the 5-Figure Form Board and SFB. The cross consists of four pieces and the square is filled by another square with room for the remaining pieces to be put in appropriate places. Recording of time and errors, maximum time limit and the treatment given for incomplete performance is the same as in the 5-Figure Form Board Test.

Earlier called **Knox Imbecile Form Board**, the **Casuist Form Board Test** was designed by Knox (1914). The test consists of a board with three circles of varying sizes and a fourth aperture in the shape of elongated oval with the side parallel part of the way. The two larger circles are cut into three segments while the smaller circle is cut into two equal

segments. The elongated oval is cut into four pieces-two more or less circular end pieces and two middle pieces. Test administration involves scattering the pieces in a more or less definite order at the top of the board before instructing the child to insert it and complete the assembly of forms as quickly as possible. A record of time and errors is noted. The maximum time limit given to children for completing this test is five minutes. Another adult form board called **'Arrow Board'** is described and partly standardized by Dunham (1916) on 184 high school pupils aged 15-18. The number of subjects tested and the nature of selection of subjects make the test of little value in practical clinical work at the present time.

The **Triangle Test** was devised by Gwyn and **Diagonal Test** was devised by Kempf as described by Knox (1914). The triangle is cut into two pieces and the diagonal into four pieces. The subject is instructed to put the pieces together into Gwynn's triangle three times in 45 seconds. The maximum time limit given to children for completing this test is five minutes. A record of time and errors is noted. There are no norms available on these tests which are all deemed to be predecessors to the later versions of form boards made available for children.

The **Healy Puzzle** (Bruckner & King, 1916; Healy & Fernald, 1911) contains four rectangular pieces of different dimensions which when assembled will fit into a form board. This test brings out perception of relationship of form and observations on the individual's mental procedure for giving completion of shape while performing the task. It also tells about the subject's ability to profit from experience with repeated trials. Scoring on this test involves noting the time taken, number of moves, number of impossible moves and repetitions of such obvious impossibilities made by subject in their effort to complete the test task. According to Healy, no normal person over 8-9 years should fail on this task beyond five minutes (Healy, 1915). Incidentally, the Healy's Puzzle also finds place in Indian adaptation of Binet Intelligence Scales, wherein it is located at 12 year age level for successful performance by children (Pai & Kamat, 1967; Kamat, 1934) and at 10 years in its revised norms (Venkatesan, 2002a).

The **Manikin Test** was devised by Pinter for young children. It demands the same kind of ability as in Feature Profile Test. The scattered wooden pieces of body, two arms, two legs and head are placed in a particular order before the child is instructed to be put them together as quickly as possible to derive a complete whole form of the human figure on this test. Nothing should be said that it will become the form of a human figure. The time taken and errors are noted. A complete accurate performance is awarded five points. One or both arms up or out is given four points. A reversal is given three points. Two reversals are given two points. Legs or arms interchanged gets one point. Failure receives no points. Maximum time limit for completion of this test is five minutes.

The **Feature Profile Test,** designed by Knox and Kempf, is apt for 13-year old children and above (Knox, 1914). Test administration, instructions, scoring and interpretation are similar to Manikin Test described above. Similar is another picture based form assembly test called Ship Test devised by Glick and described by Knox (1914). In all these tests, the motifs, themes and/or pictures are different although they are all falling apparently under the same category of picture completion tests.

The **Marble Board Test** (Werner, 1944) was developed and standardized on mentally retarded children between mental ages of 7-11. The test performance requires duplication of six mosaic forms on a marble board of ten rows of ten holes each. The examiner makes a pattern out of red and black marbles outside the sight of the child. The pattern is then shown to the child who copies it on his own board. The scoring involves noting the sequence of the child's moves as well as his accuracy. The number of correct performances is expected to increase with increasing mental ages. The child's performance can be subjected to a higher order analysis (what Werner called as 'configurational organization'). Deficient performances were characterized by too much attention to the whole or to the parts. Both these conditions indicated less maturity. Still more primitive was strictly a linear performance wherein the child was guided by lines and apparently did not perceive form features of the patterns at all.

SEGUIN FORM BOARD

O. Edouard Seguin (1812-1880) and J.E.D. Esquirol (1772-1840) were two French physicians who revolutionized thinking about persons with mental retardation. They lay the foundation for later development of Binet tests. In those days, mental retardation was called 'idiocy' and mental illness was referred as 'dementia'. Esquirol recognized three levels of mental retardation: those using short phrases, those using monosyllables and those with cries only, no speech. There was no classification of mental retardation as mild, moderate, severe and profound as done today. Seguin established a new humanism toward mental retardation in the late 1800s. As a student of Esquirol and fellow mate of JMG Itard (1774-1838), who is well known for his 5-year attempt to train the 'Wild Boy of Aveyron', a feral child who lived in the woods for the first ten of life, Seguin constructed a teaching aid under 'physiological method' for children with mental retardation (Itard, 1932; Seguin, 1956; 1866). In 1916, Seguin, Goddard and Sylvester developed the non-verbal test of intelligence called SFB.

The idea of using form boards began by the turn of 19th century. The first effective use of SFB to assess general intelligence covering mental functions like form perception, visual matching and discrimination, eye-hand or psycho-motor coordination and cognitive perceptual abilities in children was followed (Spearman, 1927). There are several norms available for the SFB as there are different procedures for their administration, scoring and interpretation. Some of the earliest norms were given by Pinter & Paterson, (1916), Wallin (1916a; 1916b), Whipple (1914), Sylvester (1913), Goddard (1915; 1912), etc.

The SFB is probably one of the most widely use performance tests of general intelligence for young children. The simplicity of the test, quickness and ease of administration, portability, facility to arouse attention or sustain interest, and temporal brevity are some reasons for its continued popularity (Shakow & Kent, 1925). Originally designed for use with intellectually disabled children as propaudeutic task in a sensory-motor training paradigm by the so called "physiological method" developed by Seguin, formal norms for SFB was developed (Cattell, 1953) as "g" (general) measure of intelligence (Spearman, 1927). While the test is most diagnostic as measure of mental age and/or intelligence below 7-8

years, it becomes a test of manual dexterity for older age groups. Further, the influence of practice effect on test performance has also been demonstrated (Raina, 1981).

Vance (1933) studied the effect of size of peg and form boards upon the performance scores of young children before settling down to recommend an optimum dimension which has since then become standard for such tools. Cole, Burkheimer & Steinberg (1968) studied the scores on SFB with standard scores on Wechsler Scales of Intelligence for a sample of 172 children with intellectual disabilities between 6-15 years to find that only Digit Span and Comprehension subtests showed statistically significant correlation. They concluded that the SFB is not a valid test for such children.

INDIAN STUDIES

Studies on SFB have appeared regularly in the Indian literature. The Indian adaptation of Binet-Simon Scales (Kamat, 1967; 1934) standardized on children from South India used a paper form board as one of the sub-tests at age level of four years for matching an assortment of primary, secondary and tertiary shapes. Another similar age scale was developed and standardized on children from North India (Kulshreshtha, 1971). The earliest available Indian norms on SFB as a measure of intelligence are made available on the basis of samples derived from nutritional studies on school children (N: 378) from Bombay within a limited age group (6-8 years)(Ramachandran et al., 1968). Linguistic and sub-cultural differences were reportedly significant variables in influencing performance of these children.

This was followed by norms derived from a randomized population of children attending a annual public exhibition in Mysore (Bharatraj, 1971). It was found that Mysore children were on an average 'faster' in the performance on this test notwithstanding the confession that 'testing could not be carried out in an ideal situation'. Another study explored performance speed of a sample of children of constricted age range (4-8 years) drawn from elite public schools located in Chandigarh (Verma, Pershad & Randhawa, 1979) while speculating whether the Indian samples are relatively slow as compared to their western counterparts (Verma, Pershad & Randhawa, 1980). They found differences in speeds of same aged children with better performance favoring samples from upper class schools. A decade later, Goel & Bhargava (1990) came up with norms on SFB from Delhi school children between 3-15 years which were almost identical to Mysore norms. Correlation of this test with other tests of intelligence and social maturity was seen to range between 0.31-0.50 (Desai & Kothare, 2009).

Venkatesan (1998) covered a sample of 669 typical school children in age range of 3 years 6 months to 13 years (Mean: 103.01 months; SD: 29.70), including 372 boys and 297 girls, varying in education levels from nursery to class seven. Time taken in seconds across three consecutive trials to complete the task on SFB was recorded. Further, decrement quotients as percentage index of difference between longest time versus shortest time taken against an supposed base of the individual child's own shortest timing was also computed. The rationale behind computation of decrement quotients was to discover any specific patterns of performance learning that could be determined. Results showed an inverse relationship between increasing calendar ages of sample on SFB including mean shortest time, total time and/or average time taken over trials. A comparison of norms on SFB across several investigators showed that children tested by Cattell (1953) appeared to be the quickest for comparative same age groups although the differences were not statistically significant (p: >0.05). Education was not found to influence test performance.

The calculation of decrement quotient on SFB is a new dimension. However, no discernable trends in decrement scores were reported except that there was about 40-60 percent reduction in time taken by children to complete the task across three trails against their baseline figures. The study left it for further research to address the question of an optimum number of trials that could be deemed as required to reach a plateau with respect to time taken by a child on the SFB. It was postulated that with increase in number of trials beyond three, there could be reduction in decrement rates as speed of performance work on law of diminishing returns till a plateau is reached.

This postulation was explored in another study (Venkatesan, Basavarajappa & Divya, 2007) wherein, a modified procedure of test administration for SFB was tried out. Results indicated that an optimum of three trials is insufficient to determine the mental age equivalence of children on this test. The optimum speed of performance on SFB appears to occur around sixth trial. The study also reiterated the value and use of calculation of a 'decrement score and quotient'. A comparison of norms for shortest timings as indicator of mental ages across various investigators did not reveal any statistically significant difference in this sample (p: >0.05). Yet another recent study confirmed SFB as a reliable and valid speed test of intelligence at lower age-levels, although there were indications that it would be appropriate, superior and effective to evolve separate norms for this test in relation of area of residence (rural-urban) and socioeconomic status groups to be used along with the modified procedure of test performance (Basavarajappa, Venkatesan & Vidya, 2009). Meanwhile another study has indicated the possibility of gender differences in the performance of children on this test (Thangavel, 1986).

ADMINISTRATION & SCORING

Ten shapes need to be negotiated by children on the SFB. The test task involves matching and placing them on an achromatic wooden board following an instruction to 'Start! Do it as quickly as you can' by the examiner, who times each trial of performance in seconds without knowledge of the child. The recommended arrangement of blocks in three piles is on right side of the child adjacent to the board placed at a reachable height as per the following acronym: SCD-OTR-PHS^2. This is expanded as 'star-circle-diamond; oval- triangle-rectangle; and plus-hexagon-semi circle-square'. Note that the top layer in one of the piles is a primary form (square) and the second layer contains two primary forms (circle and triangle). This arrangement is to ease the child to begin with a primary form before proceeding to next higher forms (Arya, 1980).

It is important to acknowledge that no definite conclusions can be drawn on the speed of test performance by children from various populations on this test since there is likelihood of different investigators having used various procedures of test administration, scoring and interpretation. There is *no uniformity in the procedure of piling the blocks* by different examiners. Although the scheme of arranging the ten blocks into three piles is largely approved, there is no

agreement on which blocks get into each of these three piles. Without citing cross reference, a manual for psychologists prepared by National Institute for the Mentally Handicapped (Madhavan et al. 1989) recommends another scheme for piling the blocks. One scheme insists that there should not be any complex form on the top of any pile. Others insist that the complex forms should be evenly distributed across all the three piles. Ideally, the child must have an advantage of seeing at least one primary form on the top of any one of the three piles to start the test task. There are also *disagreements on positioning the blocks* on right or left side of the board, and/or on top or bottom of the board. Further, there are variations on the height of the table in front of the child wherein the SFB is to be placed by the examiner.

Serious *questions have been raised on the test instructions*. Should the start-up timing for the test coincide with the moment a child picks up a block, or when the child places a block into one of the slots, or along with a perfunctory instruction to 'Start!' by the examiner. Despite clear instructions to complete the test task 'as quickly as you can', sometimes, children are observed to keep the first block in their hand to ponder where the piece and other pieces should go into the board. Thus, precious time is inadvertently lost. Further, it is difficult to convey 'speed' to children with hearing impairments and/or those with receptive/expressive speech delays. There are also issues related to the *justification for using speed tests involving competition in a culture which fosters cooperation* and mutual sharing as the virtue for every child to emulate (Verma, 1971; Venkatesan, 2010; 1991). Of course, there are indications that no other in between cues or assistance that is to be given for any wanting child-although some examiners are noticed to flout such rules.

Of course, the SFB can be innovatively used as a power test. Instead of stressing on speed, children can be observed whether they are able to place the primary, secondary or tertiary forms quickly. When a child uses trial-error method, it could be observed which forms are handled by insight method. There have been discussions about children being permitted or not permitted initial sessions to get the hang on or about the apparatus. Ideally, the subject should not see the examiner remove or pile the blocks. Therefore, some examiners recommend the use of a screen before the child is instructed to start performance on this test. There are different opinions on whether the subject should know that his efforts are being timed. The knowledge may induce test anxiety, retard speed or hinder performance for some children. Another argument wonders if children could be given the results on timings at the end of each trial to improve their performance. Arguably, the immediate feedback and knowledge of results may facilitate faster performance to get the best out of the child's potential on the form board.

There are three options for interpretation of test scores. It may be the shortest time taken by the subject across three trials, or the total score over the three trials, and/or the average score of the three trials. In doing so, there have been instances wherein children are bound to get different mental ages for the different yardsticks. Although, the shortest time taken across three trials is the often recommended procedure for test scoring, in view of the findings on the efficacy of having increased trials, this area requires closer research.

The *phenomenon of test scatter* is also reported. Also called dispersion, this involves children showing inconsistencies in their time taken across trials to complete the test task. Expectedly, the time taken by a child to complete one trial must decrease in the next trail. This may be due to the effect of familiarity as well as practice. However, in some cases, when a child takes more time and commits more errors in later trials than in the initial ones, it implies that certain extraneous factors are at work that is impeding the optimum performance of the child. Obviously, there must be some mechanism to discount such nuisance factors while calculating the final score or interpreting the test results. Scatter can also occur owing to temporary lack of attention, motivation, disinterest, boredom, monotony, etc.

FUTURE DIRECTIONS

The SFB is not to be reckoned as a closed chapter. It is neither to be deemed as a departed test deserving a requiem. On the other hand, it holds potential for becoming a revived or rejuvenated tool if only contemporary researchers awaken to view the humble device from innovative perspectives. It is possible to explore avenues of using the SFB as modified tactile board, wherein blindfolded or blind subjects may be instructed to identify and match the forms on the apparatus using haptic or touch modalities. Comparisons can be undertaken on the speed, accuracy and manner of performance on typical and/or sensory impaired subjects on this test. A three tier approach of classifying the shapes into primary, secondary and tertiary forms before attempting an age stratified exploration of the performances in young children along these lines might throw light on developmental acquisition of form perception from a different perspective. The availability of modern computers with possibilities for 3-dimensional onscreen portrayals provides another platform for contemporary researchers to compare performances of subjects between the actual vis-à-vis virtual modes of testing.

While product oriented testing on SFB has always focused on performance outcomes, such as, speed and number of trials; rather, less focus has actually gone into objectively studying the processes involved in solving the form board problem by young children. With the availability of video-taping equipments, studies can be undertaken on how the children go about completing the form board activity rather than merely how quickly. Especially, when children use trial-error to attack the problem in place of insight method, the investigator gets an opportunity track the sequences of the trials across various forms for different age levels.

With the growing premium on reading, writing, spelling and arithmetic, the mastery of form perception has become immanent for children. Contemporary research can seek to discover linkages if any, between visuo-motor coordination, manual speed and dexterity on the form boards as against penmanship, tripod hold, hand-writing, board-to-book copying activities, cursive writing, and/or allied academic activities in young children. Of course, it is appreciated that tests need to be validated and re-validated periodically. Norms need to be regularly updated. Even though, the SFB is floated as culture free and culture fair test, in view of the evidence that children from rural-urban areas and/or different SES average different performance speeds, there is scope for further research along these lines. The delineation on the various types of form boards hold opportunity and occasion for more research on how best they can be adapted for contemporary times. The SFB is no exception to this dictum.

SUMMARY

In sum, this paper has attempted to trace the historical backdrop of SFB-which happens to be close to celebrating its hundred years of existence. Even as this device for intelligence testing continues to be used by psychologists and rehabilitation professions all over the world, very less is made available on its hoary past. Despite its age, and even after having weathered several storms owing to the much assailed concept of intelligence upon which it rests, the humble device continues to find its place upon the table of almost all examiners working towards diagnosis, program planning and remediation of children with special needs both inside as well as outside the country. It continues to hold promise for new avenues of research-albeit differently, which is also an invitation and innovation being put forth in this paper.

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