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Normalizing the Bender Visual-Motor Gestalt Test Among 6-10 Year-Old Children

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Abstract: This research is aimed at normalizing the visual-motor Bender Gestalt Test among 1014 students (693 boys and 321 girls) that focused on Koppit'z system for administration and scoring. Findings indicated a test-retest reliability coefficient (after 4 weeks) of 0.81 ($p \leq 0.001$). There was a significant negative correlation between BGT scores, Good enough-Harris Drawing Test ($r = -0.36$; $N = 80$) and Colored Progressive Matrices Children Test ($r = -0.41$; $N = 117$). However, gender-related differences were found to be significant ($p \leq 0.0001$); and males attained higher error mean scores than their female counterparts. Also, age-related differences were significant that is older children attained lower error mean scores than younger children (8 and 7 year-old age-groups children). The results showed perceptual performance improvement with students' increasing age, especially for 9 and 10 years-old ones, which is consistent with Koppit'z maturational hypothesis.

Key words: Bender Visual-Motor Gestalt Test, normalizing

INTRODUCTION

Developmentally, The Bender-Gestalt or Bender Visual-Motor Gestalt Test is a popular research and pencil-drawing test that, historically, has been widely used in the screening and assessment of neuropsychological impairment. The test aims at identifying defects in an individual's visio-constructive ability, which is considered a Gestalt function composed of biological imprints of sensory reception, perception and motor action (Ghassemzadeh, 1988). For more than six decades, this psychometric measure, developed by Bender (1938) to identify brain-injured adults and to detect signs of emotional disturbance, has been included as an integral part of psychological assessment of cognitive functioning (Lacks, 1984).

The Bender-Gestalt Test (BGT) consists of nine cards each displaying an abstract design. Bender (1938) adapted these stimulus designs from those originally used by Wertheimer (1923) for his research on visual perception (Koppitz, 1975). Bender (1938) saw her test as being particularly relevant to the assessment of cognitive maturation and the diagnosis of organically based pathologic. When administering the test, the examiner presents the cards one at a time to the test-taker who is required to copy each design as accurately as possible. No time limits are imposed. Standard administration requires the designs to be copied on a blank unlined sheet of paper with an HB pencil (Bender, 1938). The individual's designs are then rated on their relative degree of accuracy and overall integration. The final product is a reflection of the original stimuli as modified by the test-takers, unique visual-motor ability.

For many years, the BGT has been an integral part of most neuropsychological assessment batteries. It appears equally widely used by clinicians working with adults as well as children (Bassa and Schlebusch, 1984; Less-Haley *et al*., 1996; Rabin *et al*., 2005). Surveys in the United States of America indicate that the BGT continues to be ranked among the top ten assessment instruments of choice among psychologists (Less-Haley *et al*., 1996).

The popularity of the BGT has historically been associated with its reputation as an instrument with a wide variety of applications amongst diverse clinical groups. However, for the first two decades following its inception, the BGT was applied almost exclusively to adult population groups to diagnose a variety of clinical disorders such as schizophrenia, aphasia and other neurological syndromes (Bender, 1938; Koppitz, 1975; Lacks, 1984). Increased awareness of learning disabilities among school-going children's the 1960s and 1970s increased the need for an inexpensive, brief, easy-to-administer screening tool. The BGT appeared particularly well suited for this task (Gilger and Kaplan, 2001). The BGT can be used in the screening of scholastic problems that may emerge during the early stages of a child's education. Its particular value resides in its ability to provide an indication of broad cognitive ability in children. The maturational relationship between age and BGT performance indicated its additional promise as a measure of cognitive development (Gilger and Kaplan, 2001; Groth-Marnat, 2003; Koppitz, 1975). The Bender

Gestalt Test, or the Bender Visual-Motor Gestalt Test (BVMG), is a psychological assessment instrument used to evaluate visual-motor functioning and visual perception skills in both children and adults. BVMG scores are used to identify possible organic brain damage and the degree of maturation of the nervous system.

Most developmental measures of function or ability that yield a performance age, like the BGT, can only be meaningfully interpreted when a child's chronological age is taken into consideration. Koppitz developed age-related norms for the BGT in 1963. These norms were based on a sample of white American middle-class children from Kindergarten to forth grade. A realization of the effects of culture on BGT performance was reflected in her 1974 revision of these norms, which included minority groups such as African-Americans and Hispanics (Koppitz, 1963, 1975).

Numerous studies focusing on the applicability and use of the BGT amongst children have focused on the relationship between BGT performance and socio-cultural background. The effects of demographic variables such as intelligence, education and psychological factors on BGT performance has been widely documented (Goldstein and Britt, 1994; Yousefi, 1992-1993; Koppitz, 1975; Rajabi, 1997; Rajabi *et al*., 1999; Parush *et al*., 2000). Studies conducted on American children have indicated significantly better performance by white middle-class children than by their Native American and African-American counterparts, who were all from disadvantaged backgrounds (Koppitz, 1975). Results obtained in a study on Sierra Leone children revealed poorer performance for the investigated sample when compared to Kpppitz norms (Karr, 1982). Studies conducted by Ghassemzadeh (1988), Yousefi *et al*. (1992), Rajabi (1997), Rajabi *et al*. (1999), Alilo (1993) and Poorsharifi *et al*. (1997) reveal a pattern of possible cognitive maturation reflected in Koppitz findings which suggests that visual-motor ability is a cognitive entity represented by improved BGT performance with increases in chronological age. However, copying figures requires fine motor skills, the ability to discriminate between visual stimuli, the capacity to integrate visual skills with motor skills and the ability to shift attention from the original design to what is being drawn.

Yousefi's (1992-1993) normative study among 1600 students ranging from 6 to 10 years and 11 month of age in Shiraz indicated that with increasing age their the error means decreased in BGT. Also, he found that there were no significant gender-related differences in the BGT performance among Shiraz sample. Shapiro and Simpson (1995) by Koppitz scoring system for the Bender-Gestalt Test in a sample (N = 87) of behaviorally and emotionally disturbed adolescents showed that age was modestly related to Koppitz developmental scores, an indication that visual-motor skills continue to develop beyond age 11. The current research suggested that visual-motor development is not maturational complete by age 11 years, 11 months (Bolen *et al*., 1992). Results of Decker (2008) suggest that visual-motor ability has a rapid maturation lasting into middle adolescence, steadily decreases through adulthood and rapidly declines in later age ranges. These results provide evidence against earlier research conclusions that suggested visual-motor ability development ends in late childhood and remain steady across the life span. Alilo (1993) in another normative study on 7 to 10 year-old school children in Tabriz revealed the same results. Poorsharifi *et al*. (1997) in a normative study on a sample of children (N = 1008) aged 6 years and 6 month to 11 years and 6 month showed that with age increase in children, their means of errors decreased in BGT. In another study, Rajabi (1997) compared the 6 to 8 year old students BGT performance in elementary schools (398 boys and 181 girls) in Busher city. Results of indicated that significant gender-related differences in the maturational patterns of males and females as well as students across the three age groups. Rajabi *et al*. (1999) in a normative study on 6.5 to 10.6 year-old school children in Zahedan (452 males and 417 females) demonstrated that with the student's age increase their performance in the BGT improved too. They found no significant gender-related difference in BGT performance in the Zahedan, Iran sample.

Here, the present research was designed to examine the maturation level of children going 6 to 10 upon the ability of reproduction of the Bender Gestalt Test figures and attainment of BGT norms for Iranian students. We proposed to answer two main questions: Are there significant differences between 6 to 10 year old students on reproduction of the Bender Visual-Motor Gestalt Test patterns? And are there differences between male and female students on reproduction of the Bender Visual-Motor Gestalt Test patterns?

MATERIALS AND METHODS

Participants: The participants were elementary schools students in grades 1 to 5 (N = 1014) within the age range of 6 to 10 (321 females and 693 males) and the study was conducted in 2003. They were selected randomly from 15 elementary schools in Busher city, the Busher Province, Iran.

Instrument: The Bender Gestalt Test was administrated to students individually based on Koppit'z (1963, 1975)

instructions. In this system, 30 cases are scored that it's 5 case to form A and B and the total scores range from 0 to 30 varieties. Also, there are four types of errors main including: distortion, rotation, integration and perseveration. The average time to complete the Bender Gestalt Test for children was 7 min and 41 sec. In addition, in present study the higher score suggested that child is likely to have maturational problems.

According to Yousefi (1992), for an 8 to 10 week interval and Poorsharifi *et al.* (1997), for a 4 to 6-week interval, test-retest reliabilities on the Bender-Gestalt Test on 60 and 100 students has been 0.77 and 0.89 ($p<0.001$), respectively. The Bender-Gestalt Test by test-retest reliability method during 3 to 4 months intervals among 60 and 80 students were 0.52, 0.81 ($p\leq0.01$), respectively (Rajabi *et al.*, 1999; Rajabi, 1997). Fuller and Vance (1995) the Modified of the Bender-Gestalt Test administered to 48 kindergartners and first grades by a licensed psychologist. The 48 test protocols were scored independently by two psychologists using the qualitative scoring system. The sets of scores were significantly correlated. In the present study, the test-retest reliability coefficient over an interval of 4 weeks was 0.81 ($p\leq0.001$).

The validity coefficients of BGT with the Good enough-Harris Drawing Test (80 students) and with Colored Progressive Matrices Children Test (117 students) were -0.36 and -0.41 ($p\leq0.01$), respectively in the present study. All tests coefficients were significant statistically. In addition to the above mentioned tests, we consider the age of the participants as construct validity indication, that is, the older children in the test have the fewer mistakes. However, with age increase their frequency of their errors decreases again (Fig. 1).

RESULTS

The means and standard deviations for the BGT scores are reported for the entire sample and for males and females at each age level in Table 1 separately.

As shown in Table 1, the means for the lower age groups were higher, for instance, the mean difference between the age groups of 6 and 7 was greater than that of the age groups of 7 and 8 years. The difference between the means for 8, 9 and 10 year old groups was very subtle. Also, the mean error score obtained was higher for males than females in age levels. At all ages females appeared to mature about than males in visual-motor perception. Specifically, statistically significant differences across genders were found in age groups 6 ($t = 2.05$, $p\leq0.05$), 8 ($t = 2.02$, $p\leq0.05$) and the total sample ($t = 2.76$, $p\leq0.01$). The differences in age groups 7 ($t = 1.20$, $p = 0.231$), 9 ($t = 1.78$, $p = 0.076$) and 10 ($t = 1.15$, $p = 0.249$) across genders were not significant.

Table 1: Mean and standard deviation for the BGT for 6-11 years children (n = 1014)

Age groups	Females N	Females Mean±SD	Males N	Males Mean±SD	Total N	Total Mean±SD	t-value
6	55	5.96±3.25	104	7.02±3.03	159	6.66±3.14	2.05*
7	63	4.46±2.88	152	5.02±3.24	215	4.86±3.14	1.20
8	73	3.04±1.94	142	3.79±2.86	215	3.35±2.60	2.02*
9	67	2.00±2.05	144	2.54±2.05	211	2.36±2.06	1.78
10	63	1.74±2.04	151	2.10±2.08	214	2.00±2.07	1.15
Total	321	3.34±2.84	693	3.92±3.16	1014	3.74±3.08	2.76**

N: Size of sample, M: Mean and SD: Standard Deviation. *p<0.05 **p<0.01

Table 2: Standardization scores of the bender gestalt test among 6-10 year old children

Row score	Age groups 6	7	8	9	10
0	131	123	120	117	114
1	127	118	114	110	107
2	122	113	109	103	100
3	117	109	103	103	92
4	112	104	102	88	85
5	107	102	92	81	78
6	104	102	86	74	71
7	98	90	80	66	64
8	93	85	74	59	56
9	88	80	69	52	49
10	84	75	63	45	42
11	79	71	57	37	35
12	74	66	51	30	27
13	69	61	46	23	20
14	64	56	40	15	13

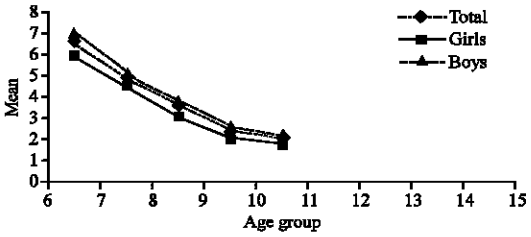

Fig. 1: Mean scores of normative sample for the developmental Bender scoring system for children

As shown in Fig. 1, the BWMG means decrease steadily between the ages of 6 to 8, thus reflecting the effect of maturation on visual-motor integration. After these age levels, the difference between the age groups diminishes. For children younger than 8 years old the BGT is useful for identification of both immature and bright youngsters.

As shown in Table 2, children with error score lower than in BGT in the five age-groups have higher IQ s than children with higher errors. Also, as the age of children increases and increase in error scores in BGT, the IQ (non-verbal intelligence) decreases. Further, children with lower ages and lower errors compared with older children benefit higher cognitive maturation.

Table 3: Results of Scheffe test for the errors of performance by the five age groups

		Age groups				
		6	7	8	9	10
Age groups	Mean	6.66	4.86	3.53	2.36	2.00
6	6.66	-	1.79*	3.12*	4.29*	4.66*
7	4.86		-	1.32*	2.49*	2.86*
8	3.53			-	1.16*	1.53*
9	2.36				-	0.36
10	2.00					-

*p = 0.0001

ANOVA ($F_{4, 1013}=97.25$, $p \leq 0.0001$) indicates that there are significant differences between the means of age groups 6 to 10 years in copying the BGT patterns (Table 3).

The Scheffe test for between group differences of the frequency errors frequency among five aged groups in the BGT is presented in Table 3 too.

Based on Table 3, significant differences were observed between the BWMG means for 6-7; 6-8; 6-9; 6-10; 7-8, 7-9; 7-10; 8-9 and 8-10 year-old groups ($p \leq 0.0001$), but no significant differences between the BWMG mean for 9 and 10 year-old groups were found. These findings indicate that copying quality among older students is better than younger partners.

DISCUSSION

The BGT was described by Bender (1938) and Koppit'z (1963, 1975) as a maturational test, which implies a close relationship between the age level and the ability to perceive, process and reproduce designs assessed for normalizing purpose in the present study. Present findings showed the BG test is a reliable and valid instrument for differentiation of perceptual-motor integration for normal children during 9 year-old which are consistent with those found by Koppit'z, Yousefi (1992), Rajabi (1997), Rajabi *et al.* (1999), Poorsharifi *et al.* (1997), Fuller and Vance (1995), Brannigan *et al.* (1995) and Rossini and Kaspar (1987).

Findings supported and confirmed answers to study objection and questions. As noted earlier, Wertheimer (1923) had used designs originally in order to demonstrate the principles of Gestalt psychology as related to perception and Bender adopted these figures as a visual-motor test. He pointed out four levels in case copying figures that included: motor skill, tactual-kinesthetic tracing, visual perception and motor-perception integration (Buros and Krisen, 1978).

However, the effect of maturation on the protocol reproduction has to be explained within a neuropsychological framework. The BGT has been an integral part of most neuropsychological assessment batteries. It appears equally widely used by clinicians working with adults as well as children (Bassa and Schlebusch, 1984; Less-Haley *et al.*, 1996; Rabin *et al.*, 2005). Gilger and Kaplan (2001) and Groth-Marnat (2003) indicated the maturational relationship between age and BGT performance. Bender (1938) argued that copying Gestalt designs reflected maturational level of visual-motor perception and this process has a close relationship with language ability, intellectual functions and intelligence in younger children. This ability involves visual perception, temporal and spatial integration, organization and reproduction. Finding of Shapiro and Simpson (1995) showed that age was modestly related to Koppitz developmental scores, an indication that visual-motor skills continue to develop beyond age 11. Bolen *et al.* (1992) indicated that visual-motor development is not maturational complete by age 11 years, 11 months. Decker (2008) suggested that visual-motor ability has a rapid maturation lasting into middle adolescence, steadily decreases through adulthood and rapidly declines in later age ranges. According to Joseph (1982), a very fundamental change happens at 7 to 10 in terms of neurodynamics of language and thought. As Evans (1973, adopted by Ghassemadeh, 1988) stated, this stage is roughly the same as that Piaget calls as the concrete operational stages. However, visual motor perception is an activity integration which consists of visual perception and motor expression. On the other hand, these two functions are immature in children. In addition, Piaget (1969) pointed out that the child needs to have time, if he is to do her motor activities and this development of motor-perceptual activities by is doing system and age role playing in this skill.

Here, we demonstrated significant gender-related differences in age groups 6, 8 and the total sample in BGT and females had lower rate of errors than males. This is inconsistent with earlier findings for gender-related differences in the BGT (Rajabi *et al.*, 1999; Rajabi, 1997; Koppit'z, 1975). Also, it can be seen that the BGT mean scores for males and females decrease between the ages 6 to 8 steadily and thus reflecting the effect of maturation on visual-motor perception (Koppit'z, 1963, 1975; Rajabi, 1997; Rajabi *et al.*, 1999; Yousefi, 1992; Alilo, 1993; Poorsharifi *et al.*, 1997).

Since, the participants in this research were only limited to groups with one-year range, we further investigation is needed to test this question for 6-month interval of age groups in our culture. Finally, Koppit'z scoring system is both replicable to Iranian normal children protocols.

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