
Sensory Sensitivities of Gifted Children

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KEY WORDS

- gifted, child
- environment
- sensation
- sensation disorders
- sensory gating

Gifted children often display sensitivities to their environment that vary from those of the general population. Data were gathered on 6- to 11-year-old gifted children attending a public elementary school gifted program. Parents completed Dunn's (1999) Sensory Profile questionnaire regarding their child. Two primary analyses were conducted: (1) a comparison of the gifted children's sensory sensitivity with Sensory Profile norms and (2) an examination of the internal consistency of the Sensory Profile for the gifted sample. Gifted children were more sensitive to their environment and reacted with heightened emotional and behavioral responses than did children of average intelligence. Internal consistencies for the 14 Sensory Profile sections and the Sensory Profile factors for the gifted sample were found to be equal to the reported norms of the Sensory Profile. These findings further support that gifted children may have important sensory modulation differences and add to our understanding of gifted children.

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Gifted children's unique challenges and skills are likely embedded in a neurological system that perceives and responds to the environment differently from children of typical intelligence (Roedell, 1984). Sir Francis Galton, who hypothesized that sensory channels are a means of information input, speculated that gifted people may have superior sensory sensitivities (Galton, 1883). Although Galton's sensory and motor tasks were not accurate measures of intelligence, there appear to be links among sensory speed, discrimination, acuity, and intelligence level (Deary, 1994; Li, Jordanova, & Lindenberger, 1998). For example, one study by Li et al. (1998) found that performance on three tactile tasks accounted for approximately 20% of the variance in intellectual ability of tested participants. Similarly, the combination of performance on temporal discrimination and pitch discrimination tasks accounted for 24% of the variance in performance on measures of intelligence (Helmbold, Troche, & Rammsayer, 2006). Using the Farnsworth–Munsell 100-Hue Test, Deary, Bell, Bell, Campbell, and Fazal (2004) also noted a strong correlation between levels of cognitive functioning and sensory sensitivities.

Since Galton's early research on human intelligence, children with above-average intelligence have been found to use select cognitive skills (e.g., strategy use, metacognitive knowledge, abstract reasoning) significantly more than do children of typical intelligence (Cheng, 1993; Kitano, 1990; Sternberg & Davidson, 1985). Despite these children's cognitive skills, however, researchers have also documented that approximately 20% to 25% of gifted children have psychosocial difficulties and may isolate themselves from rewarding social contact (Gallagher, 1990; Janos & Robinson, 1985). These psychosocial difficulties may result from several factors, including atypical sensory processing.

Ayres (1963) theorized that atypical sensory processing, regardless of over- or undersensitivity, may result in functional problems, including emotional issues.

Miller, Anzalone, Lane, Cermak, and Osten (2007) postulated that people with sensory overresponsivity may experience a range of behaviors such as impulsivity, aggression, withdrawal, or avoidance of sensation. If it is, in fact, true that people with above-average intelligence have superior sensory sensitivities, then gifted children may be vulnerable to a variety of physical, psychological, and psychosocial issues.

Giftedness

Attempts to accurately define *giftedness* have proven to be as elusive as attempts to define *intelligence* itself. Significant efforts have been used to measure and identify intelligence on the basis of criteria that test developers and researchers consider to be typical manifestations of intelligence in behaviors (Russell, Hayes, & Dockery, 1988). Former U.S. Commissioner of Education Sidney P. Marland Jr. (1972) defined *gifted children* as those who, because of their outstanding abilities, are capable of elevated performance, as identified by professionally qualified assessors. Russell et al. (1988) suggested that these abilities may be manifested in one or more of the following areas: general intellectual ability, academic aptitude, creative thinking, leadership ability, visual or performing arts, and psychomotor ability.

Although *intelligence* may be defined in multiple ways, in the current study, we define it as a score achieved by a child on a standardized test of intelligence such as the Wechsler Intelligence Scales for Children—Third Edition (Wechsler, 1991) or the Stanford–Binet Intelligence Scale—Fourth Edition (Thorndike, Hagen, & Sattler, 1986), because those tests are the most widely used and accepted by professionals in the United States. Standardized intelligence tests allow comparisons with peers on intellectual functioning. Thus, the label of *gifted* is given to children who score higher than average on an intelligence test (e.g., a test score >130, or 2 standard deviations above the mean, compared with the normed test score of 100).

Although intelligence tests are the standard tool for identifying giftedness, parents often identify such children well before formal assessment has been completed. Silverman (1997) stated that parents and teachers often recognize gifted children on the basis of their wide-ranging fund of general information, elevated vocabulary, memory, abstract knowledge, and reasoning skills. In addition, she pointed out that parents and others often observe giftedness in the first 3 years of the child's life by recognizing rapid progression through developmental milestones. These precocious children may impress and amaze their parents and teachers, but they often struggle to fit in, and many find socialization difficult. Gifted children are often as misunderstood by their peers as they are by adults (Silverman, 1990). Generally, educators and

other adults have high educational and social expectations of the gifted child that may go unmet. Silverman (1990) suggested that gifted children likely face just as many challenges in educational and social functioning as children of below-average intelligence.

Sensitivity of Gifted Children

Several theorists have posited that the gifted person may be more sensitive and responsive to external stimuli in his or her environment. Silverman (1997) asserted that the personality traits of sensitivity, intensity, and perfectionism are often associated with giftedness. Additionally, Roedell (1984) indicated that one area of vulnerability in the gifted population is intense sensitivity. Bachtold (1980) described such sensory sensitivities as a vast array of unorganized incoming sensory data that create stress in gifted children. If the gifted child is more emotionally or physically sensitive to his or her environment, responds with increased intensity, and attempts to be perfectionistic, then he or she will likely experience challenges in social adjustment (Silverman, 1997).

Although some theorists have suggested that the gifted population shows increased or even hypersensitivity, little research has empirically quantified those characteristics and compared them with those of the general population. Moreover, the literature that does exist on this issue has typically focused primarily on emotional sensitivity. However, research examining sensory stimulation in specific populations has found that certain groups are more sensitive to sensory stimulation than others. For example, studies have compared sensory sensitivities of children with autism and children with attention deficit hyperactivity disorder (ADHD) with those of the general population (Kientz & Dunn, 1997). Both children with autism and children with ADHD reported greater sensitivity to their environment. In response to the limited information available about gifted children, in this study, we focused specifically on the sensory sensitivity of gifted children and the contribution of sensory sensitivity to their daily patterns and routines. To better understand the relationship between sensory sensitivity and the functioning of gifted children, we examined the physiological process of sensory integration.

Sensory Integration

The sensory functions of the human body depend on the operations of the central nervous system (CNS), which is responsible for controlling the regulation and sequencing of responses for all organs of the body (Reeves, 2001). The neural system operates through an interplay of excitation and inhibition. The brain processes information from multiple

sources to establish internal balance and to formulate adaptive responses to stimuli through a process of neural modulation. Wilbarger and Stackhouse (2002) defined *sensory modulation* as the intake of sensation by means of sensory-processing mechanisms such that the intensity, degree, and quality of response are processed so as to match environmental demand, facilitating the maintenance of a range of optimal performance and adaptation. In other words, sensory modulation is the process of the brain's regulating itself (Ayres, 1979). Thus, modulation allows a person to adjust to changing external conditions. The brain and body must modulate both new and ongoing stimuli to maintain homeostasis. Noback, Strominger, and Demarest (1996) described modulation as a process that allows the CNS to alter the excitability and responsiveness of neuronal circuits. Sensory modulation is the process responsible for producing a composite picture of what is happening in the child's environment at any given moment, and it is important because it provides a crucial foundation for later, more complex learning and behavior. Therefore, if people such as gifted children have difficulty with sensory modulation, they may be interpreting their environment uniquely, possibly resulting in nontraditional responses or behaviors.

Sensory integration theory provides a scientific basis for investigations that examine people's arousal, affect, and motivation and further provides insight into their engagement and mastery of tasks via their responses to their environmental stimuli (Spitzer & Roley, 2001). According to Ayres (1979), adaptive sensory processing enables meaningful and purposeful involvement in a full range of daily activities. In addition, sensory modulation is a dynamic process that allows a person to function well when interacting with and adapting to his or her environment (Spitzer, 1999). Therefore, on the basis of the concept of sensory integration theory, we hypothesized that an interactive relationship exists between neurological thresholds and behavioral responses. This relationship may be evidenced in, for example, a child who is overly sensitive to the seams in his or her socks and who will respond with agitation to putting on shoes. The child may throw a tantrum at the prospect of wearing certain shoes (Dunn, 1997). According to Miller et al. (2007), however, these atypical responses are not willful disobedience; rather, they are automatic and unconscious physiologic reactions to sensations.

Neurological thresholds are the amount of stimuli required for a neuron or neuron system to respond (Dunn, 1991). The neurological threshold is established by a continuum from habituation to sensitization. Habituation occurs when the nervous system recognizes that something familiar or repetitive has happened to the point of neuron inhibition (Dunn, 1997). Without habituation, children

would be continually distracted by each new stimulus they experience. Habituation is necessary to mediate incoming stimuli so one can focus on specific tasks. Habituation allows children to attend to their surroundings while engaged in other activities. *Excitatory sensitization* is the process that facilitates heightened attention and an immediate response to stimuli. Through modulation, energy from the environment transduced into neuronal signals can be made more meaningful, permitting children to generate appropriate responses to their environment. Thresholds range from those that facilitate adaptive behavioral responses to stimuli to those that are beyond the acceptable range for functional reaction (Dunn, 1999). Children whose thresholds are too low are likely to be overly responsive to stimuli or, in other words, hypersensitive to their world. Therefore, minimal stimuli may generate a reaction. Moreover, when children receive imprecise or unreliable sensory input because of sensory integration impairment, the ability to process information and generate responses is disrupted (Dunn, 1991). Sensory integration impairment results from unconventional processing of information from the sense organs. This processing occurs in the CNS, where the flow between sensory intake and motor output is altered. The result is the unconventional integration and organization of sensory input received by the nervous system, thus creating an interruption in the ability to assimilate the senses into adaptive responses (Kranowitz, 1998).

To summarize, in the late 1800s, Sir Francis Galton proposed that people of higher intellect may have superior sensory sensitivities; more recent researchers have provided some support for this postulation by suggesting that those who gifted are vulnerable to intense sensitivity and are more emotionally or physically sensitive to the environment, possibly resulting in social adjustment problems (Roedell, 1984; Silverman, 1997). Sensory modulation abilities and intelligence level appear to be moderately related (Deary, 1994). Heightened sensitivity may be a double-edged sword; it is both a highly tuned means of obtaining sensory information and a distracter when the ability to integrate this information is not functioning optimally. Although sensory integration has been studied in diverse populations of children, such as those with autism or ADHD, a paucity of research exists on whether sensory sensitivities exist among gifted children. Therefore, the purpose of this study was twofold: (1) to determine whether gifted children are different from a population of average intelligence with regard to responses to stimulation assessed via the Sensory Profile (Dunn, 1999) and (2) to examine and compare the internal consistency of the Sensory Profile sections and factors for gifted children with Sensory Profile norms as established by Dunn (1999).

Method

Participants

The participants were 80 children, ages 6 to 11 years, enrolled in a public school district's gifted program and their parents, who completed the information regarding their children. The children had all been administered a standardized intelligence test (Wechsler Intelligence Scales for Children, Third Edition) by the school system, and each had scored ≥ 138 on the Full Scale IQ (a minimum score of 138 was established by the school district as the cutoff for enrollment in the program). We used a systematic random selection process to select 200 students from a master list of students enrolled in the gifted program. All participants whose parents consented to and completed the survey were included in the study, which was processed through the standard university institutional review board policies and procedures and approved by the public school board.

Instrument

To assess sensory processing, we used the Sensory Profile (Dunn, 1999), a standard method for measuring a child's sensory processing abilities and profiling the effects of sensory processing on the functional routine in the child's daily life. The Sensory Profile consists of 125 items grouped into 14 categories, or sections. The children's parents responded to each behavioral statement using a 5-point Likert scale ranging from 1 (*always: when presented with the opportunity, the child responds in the manner described every time, or 100% of the time*) to 5 (*never: when presented with the opportunity, the child never responds in this fashion, or 0% of the time*). On the basis of this system, the lower the score on an item was, the greater the sensitivity reported was. The 14 sections consist of the following components:

- Auditory Processing (8 items describing the child's responses to things heard);
- Visual Processing (9 items describing the child's responses to things seen);
- Vestibular Processing (11 items describing the child's responses to movement);
- Touch/Tactile Processing (18 items describing the child's responses to stimuli that touch the skin);
- Multisensory Processing (7 items describing the child's responses to activities that contain a combined sensory experience);
- Oral Sensory Processing (12 items describing the child's responses to touch and taste stimuli to the mouth);
- Sensory Processing Related to Endurance/Tone (9 items describing the child's ability to sustain performance);

- Modulation Related to Body Position and Movement (10 items describing the child's ability to move effectively);
- Modulation of Movement Affecting Activity Level (7 items describing the child's demonstration of activeness);
- Modulation of Sensory Input Affecting Emotional Responses (4 items describing the child's ability to use body senses to generate emotional responses);
- Modulation of Visual Input Affecting Emotional Responses and Activity Level (4 items describing the child's ability to use visual cues to establish contact with others);
- Emotional/Social Responses (17 items describing the child's psychosocial coping strategies),
- Behavioral Outcomes of Sensory Processing (6 items describing the child's ability to meet performance demands); and
- Threshold for Response (3 items describing the child's level of modulation; Dunn, 1999).

The instrument manual provided a normed sample of 1,037 3- to 10-year-old children without disabilities, which we used as a comparison group. The reliability for the categories on the Sensory Profile reveals a slight range in variability, which is explained by the variability in children and the likelihood of change in a child over a short period in time (Dunn, 1999). Dunn (1999) obtained convergent and discriminant validity by comparing Sensory Profile categories with categories for similar behaviors on the School Function Assessment (Coster, Deeney, Haltiwanger, & Haley, 1998). The data supported the hypothesized correlations, demonstrating a valid instrument according to its purpose (Dunn, 1999).

Procedures and Measures

Participation materials were mailed to each student's parents. Parents were asked to complete an informed consent form, a demographics survey, and a Sensory Profile (Dunn, 1999) regarding their child.

Results

Preliminary Analysis

Children were between 6 and 11 years old ($n_s = 5, 11, 21, 18, 10, \text{ and } 9$, respectively; mean age = 8.7 years; 50 boys, 29 girls [1 child had a missing gender code]). The children were predominantly from middle to higher socioeconomic status families, with 38 (48%) having a total income between \$31,000 and \$75,999 annually, 31 (39%) having a total income of $> \$76,000$ annually, and 11 (13%) having a total income of $< \$30,999$ annually. Finally, the sample consisted solely of White children, and no minority participants took part in the study.

Individual IQ scores were not available as requested by the school administration; however, IQ ranges were provided by the school. The IQ score distribution of the children was distributed evenly across three subgroups: 28 (35%) scored ≥ 146 , 27 (34%) scored 141–145, and 25 (31%) scored 138–140. Comparisons of the three IQ groups using a multivariate analysis of variance across the 14 sections of the Sensory Profile yielded no significant differences. In addition, subsequent multivariate analyses of variance revealed no significant main effects for gender or across age in the gifted children. In summary, given the homogeneity of the data, we assumed that the sample of gifted children could be interpreted as a group, free of notable differences on the basis of demographic variables.

Primary Analysis

We conducted two primary analyses: (1) mean comparisons of the gifted sample versus Dunn's (1999) normed sample of the Sensory Profile's 14 sensory sections and nine sensory factors and (2) a comparison of the gifted sample versus Dunn's normed sample of the Sensory Profile's internal consistency for the 14 sensory sections and nine sensory factors. We discuss each of these analyses in turn.

Mean Comparisons. We conducted a series of one-sample t tests on each of the 14 sensory sections to identify differences between the group of gifted children and the population norms (see Table 1). We should note that the alpha was adjusted (a Bonferroni correction) to control for Type I error. The analyses yielded significant differences between the gifted sample and the norms on all sensory sections with the exception of Visual Processing and Threshold for Response.

Table 2 displays the t -test results, which compare the gifted sample's mean scores on the nine sensory factors with those of the normed group. Here, too, the alpha was adjusted via a Bonferroni correction to control for Type I error. The results of this series of one-sample t tests revealed significant differences between the gifted and the normed groups on all sensory factors but Oral Sensory Sensitivity, Poor Registration, Sensory Sensitivity, and Fine Motor/Perceptual. Note that the difference on the factors was in the predicted direction; the gifted sample had lower mean scores. In addition, we performed the analysis using the quadrant cut scores in Dunn's (2006) Sensory Profile Supplement. These analyses yielded probable differences in two quadrants: Seeking (mean [M] = 99.74, standard deviation [SD] = 15.64) and Avoiding (M = 109.28, SD = 17.61). The other two quadrants provided scores at the cutoff between typical performance and probable difference: Low Registration (M = 64.12, SD = 7.79) and Sensitivity (M = 81.02, SD = 12.02).

Internal Consistency Comparisons. We calculated coefficient alphas for the gifted sample as Dunn (1999) described and reported for the normed sample. The coefficient alphas for the normed and gifted samples are presented in Table 3. For the 14 sensory sections, the coefficient alphas for the gifted sample were of the same magnitude as that of Dunn's normed group. Table 4 displays the coefficient alphas for the nine sensory factors. Here, too, all coefficient alphas were of similar magnitude to those of the normed sample with the exception of the Fine Motor/Perceptual factor. Thus, the findings of this study showed that the Sensory Profile's item and factor structure is valid for gifted children and adds further support to the Sensory Profile's validity.

Table 1. One-Sample t Tests for Gifted vs. Normed Mean Raw Scores Across the 14 Sensory Profile Sections

Section	Gifted		Normed M	t ($df = 52$)
	M	SD		
Auditory Processing	28.63	6.06	33.69	-7.476*
Visual Processing	36.95	5.54	37.30	-0.565
Vestibular Processing	48.08	5.23	51.60	-6.025*
Touch/Tactile Processing	73.22	10.37	81.06	-6.756*
Multisensory Processing	28.84	3.78	30.58	-4.127*
Oral Sensory Processing	49.55	9.88	52.93	-3.059*
Sensory Processing Related to Endurance/Tone	40.25	5.89	42.60	-3.567*
Modulation Related to Body Position and Movement	43.51	5.23	45.62	-3.607*
Modulation of Movement Affecting Activity Level	22.29	3.83	26.82	-10.596*
Modulation of Sensory Input Affecting Emotional Responses	16.50	2.79	18.12	-5.189*
Modulation of Visual Input Affecting Emotional Responses and Activity Level	15.75	2.66	17.03	4.304*
Emotional/Social Responses	61.25	12.52	70.81	-6.829*
Behavioral Outcomes of Sensory Processing	21.86	4.49	25.38	-6.992*
Threshold for Response	13.29	1.66	13.33	-0.229

Note. Minimum alpha required after a Bonferroni adjustment for the 14 one-sample t -test comparisons is $p < .0036$. M = mean; SD = standard deviation.

*Statistically significant difference.

Table 2. One-Sample *t* Tests for Gifted vs. Normed Mean Raw Scores for the Nine Sensory Profile Factors

Factor	Gifted		Normed <i>M</i>	<i>t</i> (<i>df</i> = 23)
	<i>M</i>	<i>SD</i>		
Sensory Seeking	65.17	11.86	73.54	-6.297*
Emotional Reactive	65.48	-7.74*	54.51	12.670
Low Endurance/Tone	40.25	5.89	42.60	-3.567*
Oral Sensory Sensitivity	36.76	8.23	39.10	-2.541
Inattentional/Distractibility	24.34	5.59	28.47	-6.610*
Poor Registration	35.63	3.38	36.67	-2.768
Sensory Sensitivity	17.66	2.92	18.54	-2.691
Sedentary	11.39	4.01	14.91	-7.861*
Fine Motor/Perceptual	12.83	2.07	13.32	-2.136

Note. Minimum alpha required after a Bonferroni adjustment for the nine one-sample *t*-test comparisons is $p < .0055$. However, all Sensory Profile factors were statistically significant in the predicted direction when the alpha was not adjusted and the traditional $p < .05$, two-tailed, test was used. *M* = mean; *SD* = standard deviation.

*Statistically significant difference (two-tailed test).

Discussion

Children with above-average intelligence are able to use certain cognitive skill sets above and beyond their peers (Cheng, 1993; Kitano, 1990; Sternberg & Davidson, 1985). However, gifted children have also been identified as experiencing psychosocial difficulties that may result in isolation from rewarding social contact with others (Gallagher, 1990; Janos & Robinson, 1985). Those who work with gifted children have often reported that these children seem to process their surroundings differently. In addition, gifted

children tend to be more emotionally sensitive, more reactive, and more intense than their same-age peers (Silverman, 1997). The focus of this study rests primarily on the hypothesis that gifted children are not only more emotionally sensitive but also more physiologically sensitive to their surroundings than are their nongifted counterparts. The findings support the hypothesis that gifted children are more sensitive to their physical environment. The potentially heightened sensations or feelings experienced by gifted children may suggest that some of these children experience alternative interpretations of incoming external stimuli to those of nongifted children. Gifted children, therefore, may be more affected by incoming sensory stimuli, resulting in sensory discomfort and subsequent peculiarity in behavioral and emotional responses. If, in fact, these children have impaired sensory-processing abilities, this impairment may lead to functional problems, including problematic emotional issues (Ayres, 1963). Moreover, researchers investigating people with sensory overresponsivity believe they may experience a range of behaviors such as impulsivity, aggression, withdrawal, or avoidance of sensation (Miller et al., 2007).

Table 3. Internal Consistency: Normed Sample and Gifted Sample Comparisons on 14 Sensory Profile Sections

Section	Coefficient Alpha	
	Normed Sample	Gifted Sample
Sensory Processing		
Section A: Auditory Processing	.659	.831
Section B: Visual Processing	.748	.822
Section C: Vestibular Processing	.696	.775
Section D: Touch/Tactile Processing	.857	.851
Section E: Multisensory Processing	.639	.693
Section F: Oral Sensory Processing Modulation	.845	.920
Section G: Sensory Processing Related to Endurance/Tone	.838	.915
Section H: Modulation Related to Body Position and Movement	.743	.739
Section I: Modulation of Movement Affecting Activity Level	.662	.534
Section J: Modulation of Sensory Input Affecting Emotional Responses	.582	.613
Section K: Modulation of Visual Input Affecting Emotional Responses and Activity Level	.618	.651
Behavioral and Emotional Responses		
Section L: Emotional/Social Responses	.899	.926
Section M: Behavioral Outcomes of Sensory Processing	.639	.783
Section N: Threshold for Response	.472	.448

Table 4. Internal Consistency: Normed Sample and Gifted Sample Comparisons on Nine Sensory Profile Factors

Factor	Coefficient Alpha	
	Normed Sample	Gifted Sample
Sensory Seeking	.891	.911
Emotional Reactive	.915	.915
Low Endurance/Tone	.838	.915
Oral Sensory Sensitivity	.852	.915
Inattentional/Distractibility	.773	.858
Poor Registration	.767	.581
Sensory Sensitivity	.807	.814
Sedentary	.833	.950
Fine Motor/Perceptual	.725	.590

Professional educators working with gifted children may benefit from applying this information when developing classroom settings, activities, or both so as to accommodate children's particular sensory processing and maximize their learning potential. For example, if a child is overly sensitive to certain auditory or visual stimulation, adjustments may be made to accommodate his or her sensitivities. Certainly, considerable caution should be taken in this accommodation process, which could lead to minor classroom adjustments that result in a more conducive learning environment: The intent is not to overly accommodate the child and thus cater to superfluous needs; rather, the accommodations should be based on a thorough evaluation process to determine the appropriate adjustment for the child.

Professional counselors may profit from knowing that gifted children process certain sensory stimuli differently from their general population cohorts. It may be that interpreting sensory stimuli differently from the general population affects gifted children in a variety of physical, psychological, and psychosocial ways. Recognizing that a gifted child may react or act differently from their peers to certain stimuli may be helpful in fully understanding the child. The same could be said for the parents of gifted children: If parents are aware of their gifted child's particular sensory sensitivity, they may be more apt to understand certain problems that may arise as a result and recognize that their child is not intentionally behaving inappropriately. Parents may consider modifying the home to reduce the stress associated with the child's particular sensitivity or adapting their parenting techniques on the basis of this greater understanding of their child.

Note, however, that not all gifted children may react negatively to heightened sensitivity. Increased sensory awareness may provide beneficial resources for quicker learning and more acute social awareness, which may be why many gifted children seem to be more mature or advanced socially than their same-age peers. The result of increased sensitivity, therefore, is likely to be different from child to child. Given the results of this study, future replication and investigation is needed to verify and expand on the understanding of sensory sensitivities of gifted children.

Limitations and Future Research

Several areas of this study allow for improvement in future considerations. First, the norms of any tests are not exactly the same as the norms for any given population, and errors in generalization might occur. Therefore, if in the future comparisons are made of an identified gifted sample with a nonidentified gifted sample and with a control group of the same age, results might be more conclusive. Given gifted children's high level of intellectual development, adults may

expect other domains to be on par (Roedell, 1984), leading to the labeling of age-appropriate responses as troublesome. Thus, parents of gifted children may provide different responses in reaction to their heightened expectations of their child to items such as those found on the Sensory Profile than would parents of nongifted children. To reduce the impact of such expectations in future studies, unbiased raters without prior knowledge of the child's intellectual abilities may be used to evaluate the sensory sensitivities of gifted children. Finally, all children in this study were White. It would be beneficial to further examine other gifted populations to determine the replicability of the findings presented here across samples of different socioeconomic status, race or ethnicity, or geographical location. We hope that the hypotheses raised here will stimulate interest in further experimental and clinical study and that the resultant research will improve our understanding of and interactions with gifted children. ▲

References

- Ayres, A. J. (1963). The development of perceptual-motor abilities: A theoretical basis for treatment of dysfunction (1963 Eleanor Clarke Slagle Lecture). *American Journal of Occupational Therapy*, 27, 221-225.
- Ayres, A. J. (1979). *Sensory integration and the child*. Los Angeles: Western Psychological Services.
- Bachtold, L. (1980). Speculation on a theory of creativity: A physiological basis. *Perceptual and Motor Skills*, 50, 699-702.
- Cheng, P. (1993). Metacognition and giftedness: The state of the relationship. *Gifted Child Quarterly*, 37(3), 105-112.
- Coster, W., Deeney, T., Haltiwanger, J., & Haley, S. (1998). *School Function Assessment*. San Antonio, TX: Psychological Corporation.
- Deary, I. J. (1994). Sensory discrimination and intelligence: Postmortem or resurrection? *American Journal of Psychology*, 107, 95-115.
- Deary, I. J., Bell, P. J., Bell, A. J., Campbell, M. L., & Fazal, N. D. (2004). Sensory discrimination and intelligence: Testing Spearman's other hypothesis. *American Journal of Psychology*, 117, 1-18.
- Dunn, W. (1991). The sensorimotor systems: A framework for assessment and intervention. In F. Orelove & D. Sobsey (Eds.), *Educating children with multiple disabilities: A trans-disciplinary approach* (2nd ed., pp. 35-78). Baltimore: Paul H. Brookes.
- Dunn, W. (1997). The impact of sensory processing abilities on the daily lives of young children and their families: A conceptual model. *Infants and Young Children*, 9, 23-25.
- Dunn, W. (1999). *Sensory Profile user's manual*. San Antonio, TX: Psychological Corporation.
- Dunn, W. (2006). *Sensory Profile Supplement*. San Antonio, TX: Psychological Corporation.
- Gallagher, J. (1990). Editorial: The public and professional perception of the emotional status of gifted children. *Journal for the Education of the Gifted*, 13, 202-211.

- Galton, F. (1883). *Inquiries into human faculty and its development*. London: Macmillan.
- Helmbold, N., Troche, S., & Rammsayer, T. (2006). Temporal information processing and pitch discrimination as predictors of general intelligence. *Canadian Journal of Experimental Psychology, 60*, 294–306.
- Janos, P., & Robinson, N. (1985). Psychosocial development in intellectually gifted children. In D. Horowitz & M. O'Brien (Eds.), *The gifted and talented: Developmental perspectives* (pp. 149–195). Washington, DC: American Psychological Association.
- Kientz, M., & Dunn, W. (1997). A comparison of the performance of children with and without autism on the Sensory Profile. *American Journal of Occupational Therapy, 51*, 530–537.
- Kitano, M. (1990). Intellectual abilities and psychological intensities in young children: Implications for the gifted. *Roeper Review, 13*, 5–9.
- Kranowitz, C. S. (1998). *The out-of-sync child*. New York: Skylight Press.
- Li, S., Jordanova, M., & Lindenberger, U. (1998). From good senses to good sense: A link between tactile information processing and intelligence. *Intelligence, 26*, 99–122.
- Marland, S. (1972). *Education of the gifted and talented* (Report to Congress). Washington, DC: U.S. Government Printing Office.
- Miller, L., Anzalone, M., Lane, S., Cermak, S., & Osten, E. (2007). Concept evolution in sensory integration: A proposed nosology for diagnosis. *American Journal of Occupational Therapy, 61*, 135–140.
- Noback, C., Strominger, N., & Demarest, R. (1996). *The human nervous system*. Media, PA: Williams & Wilkins.
- Reeves, G. (2001). From neuron to behavior: Regulation, arousal, and attention as important substrates for the process of sensory integration. In S. S. Roley, E. I. Blanche, & R. C. Schaaf (Eds.), *Understanding the nature of sensory integration with diverse populations* (pp. 89–108). St. Louis, MO: Therapy Skill Builders.
- Roedell, W. (1984). Vulnerabilities of highly gifted children. *Roeper Review, 6*, 127–130.
- Russell, D., Hayes, D., & Dockery, L. B. (1988). *My child is gifted! Now what do I do?* (2nd ed.). Winston-Salem: North Carolina Association for the Gifted and Talented.
- Silverman, L. (1990). Social and emotional education of the gifted: The discoveries of Leta Hollingworth. *Roeper Review, 12*, 171–178.
- Silverman, L. (1997). *What we have learned about gifted children*. Retrieved November 13, 2007, from www.gifteddevelopment.com/What_is_Gifted/learned.html
- Spitzer, S. (1999). Dynamic systems theory: Relevance to the theory of sensory integration and the study of occupation. *Sensory Integration Special Interest Section Quarterly, 22*, 1–4.
- Spitzer, S., & Roley, S. S. (2001). Sensory integration revisited: A philosophy of practice. In S. S. Roley, E. I. Blanche, & R. C. Schaaf (Eds.), *Understanding the nature of sensory integration with diverse populations* (pp. 3–28). St. Louis, MO: Therapy Skill Builders.
- Sternberg, R., & Davidson, J. (1985). Cognitive development in the gifted and talented. In D. Horowitz & M. O'Brien (Eds.), *The gifted and talented: Developmental perspectives* (pp. 37–74). Washington, DC: American Psychological Association.
- Thorndike, R. L., Hagen, E. P., & Sattler, J. M. (1986). *Stanford-Binet Intelligence Scale* (4th ed.). Chicago: Riverside.
- Wechsler, D. (1991). *The Wechsler Intelligence Scale for Children* (3rd ed.). San Antonio, TX: Psychological Corporation.
- Wilbarger, J., & Stackhouse, T. (2002). *Sensory modulation: A review of the literature*. Retrieved November 13, 2007, from www.ot-innovations.com/content/view/29/58/