

# Patterns of response to sensory stimuli encountered in daily activities: A comparison between 3–10-year-old Israeli and American children without disabilities

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**ABSTRACT:** *The purpose of this study was to examine the extent to which patterns of response of typical children aged 3 to 10 in Israel, as reported in the Sensory Profile (Dunn, 1999), were similar to typical children in the United States. The Sensory Profile is a caregiver questionnaire designed to assess sensory processing abilities. A translated Hebrew version of the Sensory Profile was completed by parents of 714 typically developing children who were recruited from across Israel. The mean scores of the Israeli children were compared to the published mean scores of the American children at the section and factor level to determine whether the scoring system of the Sensory Profile would be applicable for Israeli children. The findings revealed that, in some sections and factor clusters, the scores of Israeli children were lower than the scores of the American children across all ages. Although the Israeli children scored lower, overall, their scores were within the established range of typical performance. Initial support for the application of the scoring system of the Sensory Profile in Israel is suggested. Due to the nature of the sample of Israeli children, future studies are recommended with a national representative sample and with specific disability groups to further validate the clinical use of the Sensory Profile in Israel. Copyright © 2006 John Wiley & Sons, Ltd*

**Key words:** Sensory Profile, sensory processing, cross-cultural adaptation

## Introduction

Occupational therapists in Israel and around the world have long been interested in observing how children respond to sensory experiences encountered in everyday activities and the extent to which such responses affect performance

and engagement in daily life occupations (Dunn, 1994, 1997, 2001; Hahn-Markowitz, 1993; Roley, 2002; Stagnitti et al., 1999). In fact, a survey on the standard of care in private paediatric occupational therapy practices in Israel (Zingerevitz and Sachs, 1998) reveals that a majority of Israeli occupational therapists in private practices treat children with dysfunction in sensory integration (including dysfunction in sensory processing and dyspraxia), and that the sensory integrative frame of reference is one of the predominating treatment approaches used for intervention. Yet, Israeli occupational therapists in paediatric private practices do not use standardized assessments to meet the recommended standards related to formal evaluations, mainly because of a shortage of standardized occupational therapy assessments in Israel, which not only is a concern in private practices, but also in paediatric practice in general (Josman and Gofer, 1998; Parush et al., 1999).

A central component in the effective application of the sensory integrative treatment approach is the accurate identification and interpretation of behaviours that indicate sensory integrative deficits (Dunn, 1994). The complexity of such deficits requires a multifaceted evaluation to understand the presenting behaviours more clearly. This evaluation process often includes parent interview, observations of the child in various contexts, clinical observations, and standardized testing (Parham and Maillox, 1996). Due to the lack of standardized assessments in Israel, however, paediatric occupational therapists rely on subjective data obtained through observations and informal parent/teacher interview (Hahn-Markowitz, 1993), or they use assessments that have not been standardized for the Israeli children (Parush et al., 1999).

While there are various assessments to evaluate sensory processing abilities in children, the Sensory Profile (Dunn, 1999), developed and standardized in the United States, has several advantages. First, the Sensory Profile is quick and simple to administer, score, and interpret (Dunn, 1999). The reforms in the health care system in Israel and the implementation of the Health Insurance Law of 1994 have shifted the focus of the delivery of health care services from being socially oriented to being governed by the need to reduce costs (Abramovitch, 1995). Thus, in making a decision to adopt an assessment, cost-effectiveness is a paramount consideration. Second, the focus of the Sensory Profile is on assessing the child's responses to sensory stimuli encountered in a natural context during daily activities (Dunn, 1999). As occupational therapy services in Israel are, for the most part, centre-based (as opposed to home-based), the Sensory Profile may provide information about the child that cannot be obtained in a clinical setting. Such information would enable therapists to identify factors and conditions in the environment that may support the child's ability to perform successfully at home or in school (Dunn and Westman, 1997). Third, as a parent questionnaire, the Sensory Profile provides the means for involving parents in the evaluation process and communicating the child's difficulties in terms understandable to most parents (Case-Smith, 1997; Dunn, 1999). As in the United States, the Sensory Profile supports the intent of the

Israeli Special Education Law of 1988, a law that encourages parents' participation in the process of formulating their children's individualized education plan (Goldgraber, 2000; Gumpel, 1996).

The application of an assessment tool in another country and culture implies that such assessment is intended to be used with a population other than the one for whom the assessment was standardized and validated (Reid, 1995). As cultural and environmental factors might influence human behaviour and performance (Dunn et al., 1994; Marsella and Kameoka, 1989), it is expected that individuals from different cultural groups would differ in their response or performance on a particular assessment (Anastasi and Urbina, 1996; Valencia and Suzuki, 2000). Thus, when applying an assessment tool in another culture, it would be inappropriate to assume that the norms from the original instrument can be readily transferred. Developing new norms, however, is a major undertaking. Therefore, some suggest that if the target population is found in a preliminary investigation not to differ substantially from the source population, the use of the original norms may be justified (Butcher, 1996; Geisinger, 1994).

The purpose of this study was to examine the extent to which the patterns of response of typical Israeli children, as reported in the Sensory Profile, were similar to typical children in the United States so that the utility of the scoring system, established for the American children, can be determined for Israeli children aged 3–10 years. These scoring systems are used to determine the child's sensory processing abilities and detect potential problems (Dunn, 1999).

## Method

### *Participants*

The sample, as shown in Table 1, consisted of 714 children of which 56% ( $n = 398$ ) were girls and 44% ( $n = 315$ ) were boys (the gender was not indicated for one child). These children, who were attending Hebrew preschools and schools in Israel, were reportedly not receiving special intervention services, and had no known diagnosis of hearing impairment, visual impairment (i.e. blindness), physical disability, autism, attention deficit disorder/attention deficit hyperactivity disorder (ADD/ADHD), learning disabilities, mental retardation, or seizure disorders (which were the criteria of inclusion).

Most of the children in the sample were born in Israel (95%) while a small percentage of them was born in the former Soviet Union, Europe, North/South America, Asia, and Africa. The majority of the sample was from the district of Haifa (50%), which was the primary area from which the preschool/school data were collected. However, the sample also included children from all other geographic regions in Israel (i.e. Jerusalem, Tel Aviv, the Northern, Central, and Southern districts as well as Judea, Samaria, and Gaza district). Fifty-nine

TABLE 1: Characteristics of the sample of Israeli children		
	N	%
Gender (N = 713)		
Girls	398	55.8
Boys	315	44.2
Distribution by age (N = 714)		
Age 3	69	9.7
Age 4	110	15.4
Age 5	93	13.0
Age 6	70	9.8
Age 7	76	10.6
Age 8	112	15.7
Age 9	107	15.0
Age 10	77	10.8
Country of birth (N = 712)		
Israel	674	94.7
North America	18	2.5
Former Soviet Union	11	1.5
Europe	5	0.7
South America	2	0.3
Asia	1	0.1
Africa	1	0.1
Place of residence (N = 694)		
Haifa District	346	49.9
Central District	133	19.2
Northern District	112	16.1
Jerusalem District	48	6.9
Tel Aviv District	24	3.5
Southern District	18	2.6
Judea, Sameria and Gaza District	13	1.9
Type of residence (N = 711)		
Urban	418	58.8
Suburban	118	16.6
Kibbutz	79	11.1
Rural	68	9.6
Co-operative Village (Moshav)	28	3.9

percent of the Israeli children were living in urban areas, while a smaller percentage of the children were living in suburban areas (17%), Kibbutz (11%), rural areas (10%), or moshav/co-operative moshav (4%).

In examining the extent to which the proportion of the sample reflected the proportion in the population (as published by the Central Bureau of Statistics, 2001), it was found that although there were differences between the sample and the population for gender, country of birth, place of residency, and type of residency, those differences were not statistically significant.

### *Instrument*

The Sensory Profile (Dunn, 1999), standardized in the United States for children aged 3–10 years, is a caregiver questionnaire intended to assess the way in which the child responds to sensory stimuli (i.e. over/under-responsive) and to identify the sensory system(s) responsible for causing difficulties in performing daily activities (Dunn, 1994, 1999). The parent reports the frequency with which the behaviour occurs on a 5-point Likert scale whereby 1 = always, 2 = frequently, 3 = occasionally, 4 = seldom, and 5 = never. The Sensory Profile consists of 125 items divided into 14 sections. The child's sum of scores for each section can fall into one of the three performance categories: Typical Performance, Probable Difference, or Definite Difference, indicating typical response, a potential problem, or a problem in sensory processing, respectively. The process of translating the Sensory Profile into Hebrew and validating its accuracy is described in detail elsewhere (Neuman et al., 2004). Briefly, the Hebrew translation of the Sensory Profile was first reviewed by Israeli occupational therapists and was then filled out by Israeli parents. Questionable items were revised based on their comments. A back-translation and a bilingual method were both employed (Brislin, 1980, 1986; Brislin et al., 1973) to examine the accuracy of the Hebrew translation. The findings suggested that the Hebrew translation conveyed the intended meaning of the original English version of the Sensory Profile.

The internal consistency, estimated with coefficient alpha, ranged from 0.64 to 0.96 in the various sections of the Hebrew version (Neuman et al., 2004). These coefficients were comparable to those reported for the original English version of the Sensory Profile, i.e. 0.47 to 0.91 (Dunn, 1999). An initial report on the construct validity of the Hebrew version of the Sensory Profile (Tal-Saban et al., 2002) showed that children with ADHD and children with dysfunction in sensory integration differed significantly from children without disabilities in all sections and factor clusters of the Sensory Profile. These initial findings are congruent with findings reported by Dunn and colleagues (Dunn, 1999; Ermer and Dunn, 1998).

### *Procedure*

Recruitment of participants was accomplished in three ways. Occupational therapists (OTs) practising in a variety of paediatric settings across Israel were asked to recruit parents of typically developing children aged 3–10 years within their community. They were also asked to refer other OTs who might be willing to assist with data collection. In addition, parents were approached via schools and preschools. An approval was granted by the Office of the General Scientist (a sub-division of the Israeli Department of Education), which permitted access to public preschools and elementary schools in Haifa. Additional approval was granted by the Committee on Activities Involving Human Subjects. Parents

from across Israel were also approached directly for referrals through their personal contacts. The parents who agreed to participate received the research materials, which included a letter explaining the study, a parent/child demographic questionnaire, the Hebrew version of the Sensory Profile, and a stamped self-addressed envelope. A total of 778 questionnaires were completed of which 64 were excluded because the parent indicated that the child was receiving special intervention services, attending a special education programme, or had an identified diagnosis of autism, ADD/ADHD, learning disabilities, motor impairment, or seizure disorders.

### *Data analysis*

Dunn (1999) published data on a national sample of typical American children as mean raw scores by age group. Thus, in order to conduct any meaningful comparisons, the mean raw scores and standard deviations were computed for the Israeli sample (by age). A one-sample *t*-test was conducted for each age group to examine whether the behaviours of the Israeli children were significantly different from the American children. This test is ordinarily employed to compare a single set of data, in this study, the sample of Israeli children, to a known population value, in this study, the published mean scores of the American children (Norusis, 2000). Because the published scores vary from section to section, the test value, against which the mean raw scores of the Israeli sample were compared, was adjusted when computing each test.

The analysis of the data focused on examining the extent to which the sample of Israeli children aged 3–10 years was similar in their performance on the Sensory Profile to the American children. This was done to determine whether the scoring system, established for the American children, would be applicable for the Israeli children. Because of its clinical utility, the comparisons between the Israeli and the American children were on two levels: section and factor-level comparisons. In the section-level comparisons, the performance of the Israeli children was compared to the American children on each of the 14 sections of the Sensory Profile (i.e. sections A to N). In the factor-level comparisons, the Israeli children were compared to the American children in relation to their performance on the nine factor clusters that were derived from the exploratory factor analysis (Dunn and Brown, 1997).

## **Results**

### *Section-level comparisons*

For the most part, the mean scores of the Israeli sample, across all ages, were lower than the scores of the American children (the exceptions were section B: visual processing; section K: modulation of visual input affecting emotional responses and activity level; and section N: items indicating threshold for

response, in which the Israeli children generally scored higher or similar to the American children). A low score suggested that the Israeli children, as observed by their parents, tended to display the behaviour more frequently. That is, behaviours that were uncommon, i.e. occurred rarely or seldom in typical American children, were more common, i.e. occurred frequently in typical Israeli children (this will be further explored in the item-level comparisons).

As shown in Table 2, the mean scores of the Israeli children were significantly different (at  $p < 0.05$ ) in the sections related to sensory processing (sections A–F), modulation (sections G–K), and behaviour and emotional responses (sections L–N), however, age groups inconsistently varied from section to section. For example, in section D (Touch Processing) and section M (Behavioural Outcomes of Sensory Processing), the Israeli children in the younger age groups (i.e. 3 and 4) and the older age groups (i.e. 9 and 10) scored significantly lower than the American children. On the other hand, in section I (Modulation of Movement Affecting Activity Level) and section J (Modulation of Sensory Input Affecting Emotional Responses), the Israeli children scored significantly lower than the American children only in the older age groups (i.e. 7 and 8 in section I; 8 and 10 in section J). Yet, in section F (Oral Sensory Processing) and section H (Modulation Related to Body Position and Movement), the Israeli children in all age groups scored significantly lower than the American children. Conversely, in section B (Visual Processing), and section K (Modulation of Visual Input Affecting Emotional Responses), the Israeli children scored significantly higher than the American children in the younger age groups (i.e. 3 and 5).

#### *Factor-level comparisons*

As seen in Table 3, with the exception of factor 6, the mean scores of the Israeli children were significantly different ( $p < 0.05$ ) from the mean scores of the American children across all ages, although the age groups, again, varied from factor to factor. For example, in factor 5 (Inattention/Distractibility), the Israeli children in the younger and the older age groups (i.e. 3, 4, and 10) scored significantly lower than the American children. On the other hand, in factor 3 (Low Endurance/Tone), the scores of the Israeli children were significantly lower than the scores of the American children in mixed age groups (i.e., 3, 4, 6, 7, and 8). Yet, in factor 4 (Oral Sensory Sensitivity), factor 7 (Sensory Sensitivity), and factor 8 (Sedentary), the Israeli children in all age groups scored significantly lower than the American children. Conversely, in factor 6 (Poor Registration), there was no significant difference in scores between the Israeli and the American children across all age groups.

#### *Is the performance of the Israeli children typical?*

Given that the scores of the Israeli children were generally lower than the scores of the American children, it was important to examine the extent to which



TABLE 2: Performance of Israeli and American children on Sections A to N by age group										
Section	Mean Israeli	Test value	t	df	Effect size (d)	Mean Israeli	Test value	t	df	Effect size (d)
Age 3						Age 4				
A	31.79	33.40	-2.72*	68	0.33	31.99	33.40	-2.86*	99	0.29
B	36.85	34.60	4.48*	68	0.54			n.s.		
C			n.s.			49.42	50.50	-2.40*	98	0.24
D	75.94	78.20	-2.30*	62	0.29	77.03	79.65	-3.02*	98	0.31
F	48.75	51.20	-2.81*	55	0.38	47.18	51.40	-4.87*	95	0.50
G	41.88	42.98	-2.06*	68	0.39	41.00	42.41	-2.73*	105	0.27
H	39.92	42.83	-4.48*	64	0.56	40.67	43.61	-5.47*	100	0.55
K	16.47	15.69	2.90*	67	0.35			n.s.		
L			n.s.			68.50	70.87	-3.02*	103	0.30
M	18.12	22.36	-8.74*	57	1.16	20.23	24.11	-11.14*	96	1.14
N			n.s.			13.26	12.80	2.53*	109	0.24
Age 5						Age 6				
B	37.92	36.10	3.90*	92	0.41			n.s.		
C	50.05	51.14	-2.49*	90	0.26	48.55	51.01	-3.76*	68	0.46
D	79.36	81.27	-2.56*	84	0.28	76.36	79.35	-2.95*	66	0.36
E			n.s.			28.90	30.13	-2.41*	68	0.29
F	48.97	52.58	-4.06*	83	0.44	46.66	52.52	-4.39*	63	0.55
G			n.s.			40.97	42.92	-2.99*	67	0.37
H	42.89	44.80	-3.56*	87	0.38	41.71	44.83	-4.55*	69	0.55
K	17.39	16.63	2.76*	91	0.29			n.s.		
M	23.19	24.90	-4.44*	89	0.47			n.s.		
N	13.81	13.15	4.63*	92	0.48	13.47	13.03	2.64*	69	0.32
Age 7						Age 8				
B			n.s.			38.61	37.36	2.60*	111	0.25
C	49.98	51.69	-3.23*	72	0.38	48.76	51.70	-5.38*	104	0.53
D			n.s.			78.07	81.61	-4.23*	104	0.42
F	48.52	52.49	-4.01*	61	0.51	47.59	53.04	-5.78*	92	0.60
G	41.98	42.86	-2.05*	71	0.24	41.19	42.52	-2.56*	105	0.25
H	43.64	45.61	-3.74*	75	0.43	43.28	45.69	-4.84*	109	0.46
I	25.59	27.47	-3.97*	73	0.46	25.33	27.00	-4.07*	110	0.39
J			n.s.			17.51	18.12	-2.73*	111	0.26
L	69.05	71.41	-2.37*	72	0.28	67.90	70.59	-2.97*	106	0.29
N	13.86	13.52	2.30*	75	0.27			n.s.		
Age 9						Age 10				
C	49.25	51.50	-4.50*	103	0.44	49.07	52.07	-4.63*	70	0.55
D	79.09	81.62	-3.11*	101	0.31	78.90	82.25	-3.04*	70	0.36
E			n.s.			29.54	31.05	-3.14	72	0.37
F	49.83	53.12	-3.77*	91	0.40	47.65	53.57	-5.33*	67	0.65
H	44.20	45.89	-3.47*	105	0.39	43.32	46.12	-4.29*	72	0.51
J			n.s.			17.43	18.06	-2.03*	75	0.23
L	68.76	70.87	-2.09*	100	0.21	68.39	70.88	-2.06*	72	0.24
M	24.81	25.70	-2.26*	103	0.22	24.29	25.66	-2.67*	74	0.31
N	13.90	13.36	3.56*	106	0.35			n.s.		
Only significant results are reported. The degrees of freedom (N-1) may vary within an age group because cases with missing data were excluded. *p < 0.05; n.s. = not significant.										



TABLE 3: Performance of Israeli and American children on Factors 1 to 9 by age group

Factor	Mean Israeli	Test value	t	df	Effect size (d)	Mean Israeli	Test value <sup>a</sup>	t	df	Effect size (d)
Age 3						Age 4				
1	65.13	67.80	-2.08*	61	0.27			n.s.		
2	62.97	65.00	-2.10*	60	0.27	62.29	65.26	-3.59*	104	0.35
3	41.81	42.98	-2.15*	66	0.26	40.88	42.41	-2.91*	103	0.27
4	34.39	37.79	-3.55*	60	0.46	33.52	37.77	-5.21*	95	0.53
5	27.87	29.03	-2.40*	67	0.29	28.06	29.25	-2.60*	99	0.26
7	16.81	17.87	-3.46*	67	0.42	16.55	17.95	-4.68*	106	0.45
8	14.26	14.87	-2.12*	68	0.26	13.75	14.48	-2.59*	107	0.25
9	6.34	8.24	-7.30*	55	0.98	8.44	11.36	-10.50*	100	1.05
Age 5						Age 6				
1			n.s.			67.36	71.25	-3.04*	66	0.37
3			n.s.			40.87	42.92	-3.15*	68	0.38
4	34.78	38.97	-4.83*	82	0.53	32.39	38.79	-5.25*	61	0.67
7	17.35	18.36	-3.62*	92	0.38	17.07	18.56	-4.12*	68	0.50
8	13.95	14.59	-1.99*	91	0.21	14.09	14.79	-2.14*	69	0.26
9	10.79	12.20	-4.43*	80	0.50	12.15	12.84	-2.13*	66	0.26
Age 7						Age 8				
1			n.s.			70.83	74.10	-3.86*	106	0.38
2	62.90	66.24	-3.20*	72	0.38	61.87	65.22	-3.54*	105	0.35
3	41.62	42.86	-2.42*	72	0.29	40.55	42.52	-3.49*	109	0.33
4	32.45	38.74	-5.26*	64	0.66	33.52	39.23	-6.84*	98	0.69
7	17.63	18.58	-3.34*	75	0.39	17.06	18.37	-3.94*	106	0.38
8	13.24	15.47	-6.44*	74	0.75	13.48	14.95	-4.67*	110	0.45
Age 9						Age 10				
1			n.s.			71.52	75.39	-3.65*	71	0.43
2	62.94	65.70	-2.61*	100	0.26	62.33	65.43	-2.41*	72	0.28
4	36.12	39.10	-3.67*	89	0.39	33.42	39.68	-5.97*	71	0.71
5			n.s.			27.40	28.54	-2.15*	73	0.25
7	17.38	18.76	-4.78*	105	0.47	17.26	18.47	-3.10*	72	0.37
8	13.58	14.43	-2.23*	106	0.22	14.01	14.78	-2.33*	74	0.27
9	12.93	13.49	-2.51*	106	0.24	12.72	13.68	-3.47*	75	0.40
Note. Only significant results are reported. The degrees of freedom (N-1) may vary within an age group because cases with missing data were excluded.										
*p < 0.05; n.s. = not significant.										

their performance would still be considered typical based on the scoring system established for the American children. To this end, one-sample t-tests were conducted for age groups 3, 4, and 5–10, respectively, to determine whether the mean scores of the Israeli children were significantly different from the established minimum cutoff score for Typical Performance. It was expected that the mean scores of the Israeli children would be higher than the minimum

cutoff score, thus implying that such scores fall within a typical range of performance.

Overall, in all sections of the Sensory Profile, the mean scores of the Israeli children were significantly higher than the minimum cutoff score for Typical Performance. The exceptions were Section H (Modulation Related to Body Position and Movement) and Section M (Behavioral Outcomes of Sensory Processing). In Section H, age group 3, the mean score of the 3-year-old Israeli children ( $M = 39.92$ ) was not significantly different from the minimum cutoff score of 39 [ $t(64) = 1.4$ ,  $p = 0.160$ ,  $d = 0.18$ ]. In Section M, age groups 3 and 4, the mean scores of the 3-year-old ( $M = 18.12$ ) and the 4-year-old ( $M = 20.23$ ) Israeli children were significantly lower than the minimum cutoff score of 20 (for age 3) and 21 (for age 4),  $t$  age 3(57) =  $-3.9$ ,  $p = 0.000$ ,  $d = 0.51$ ,  $t$  age 4(96) =  $-2.2$ ,  $p = 0.029$ ,  $d = 0.23$ .

In all factors of the Sensory Profile, the mean scores of the Israeli children were significantly higher than the established minimum cutoff score for Typical Performance. The exception was factor 7 (Sensory Sensitivity) in which the mean score of the 4-year-old Israeli children ( $M = 16.55$ ) was not statistically different from the minimum cutoff score of 16 [ $t(106) = 1.8$ ,  $p = 0.068$ ,  $d = 0.18$ ].

When conducting  $t$ -tests using the expanded cutoff scores revised for the 3–10-year-old children (obtained at [www.SensoryProfile.com](http://www.SensoryProfile.com)), it was found that unlike the aforementioned findings, the mean scores of the Israeli sample were significantly higher than the minimum cutoff score for Typical Performance including sections H, M, and factor 7.

### *Item-level comparisons*

The findings showed that in most sections of the Sensory Profile, the scores of the Israeli children were lower than the scores of the American children. Of importance was to examine whether, in spite of the differences in scores, the patterns of response were similar in these two cultural groups. That is, whether the observed behaviours, uncommon among typical American children, were also uncommon among typical Israeli children.

In the process of developing the Sensory Profile, Dunn established a criterion to find out which of the Sensory Profile items would be uncommon responses for typical 3–10-year-old children, and subsequently determine which items can identify children who might have sensory processing problems. According to Dunn's criterion, if 80% or more of the children in the sample never or seldom exhibited the behaviour (i.e. items were scored by the parent as 4 or 5), such a behaviour was considered an uncommon behaviour (Dunn, 1994; Dunn and Westman, 1997).

To conduct any meaningful comparisons between the Israeli and American children, the percentage of Israeli children who scored 4 or 5 was calculated for each of the 125 Sensory Profile items. As seen in Figures 1 to 3, in most sections

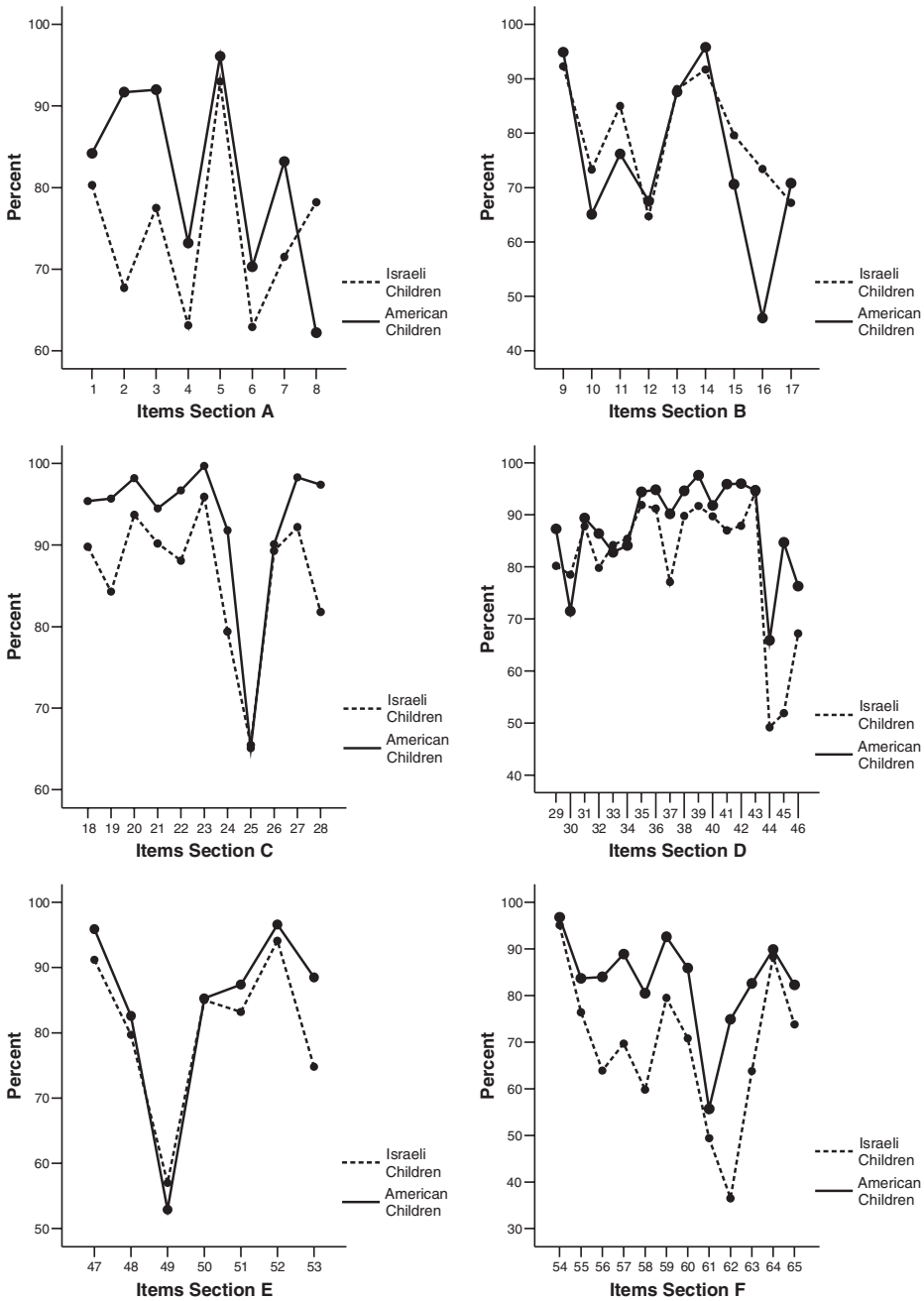


FIGURE 1: The percentage of Israeli and American children who seldom or never exhibit the behaviours described in the Sensory Profile sections related to Sensory Processing. Note. The data on the American sample were published in Dunn and Westman (1997).

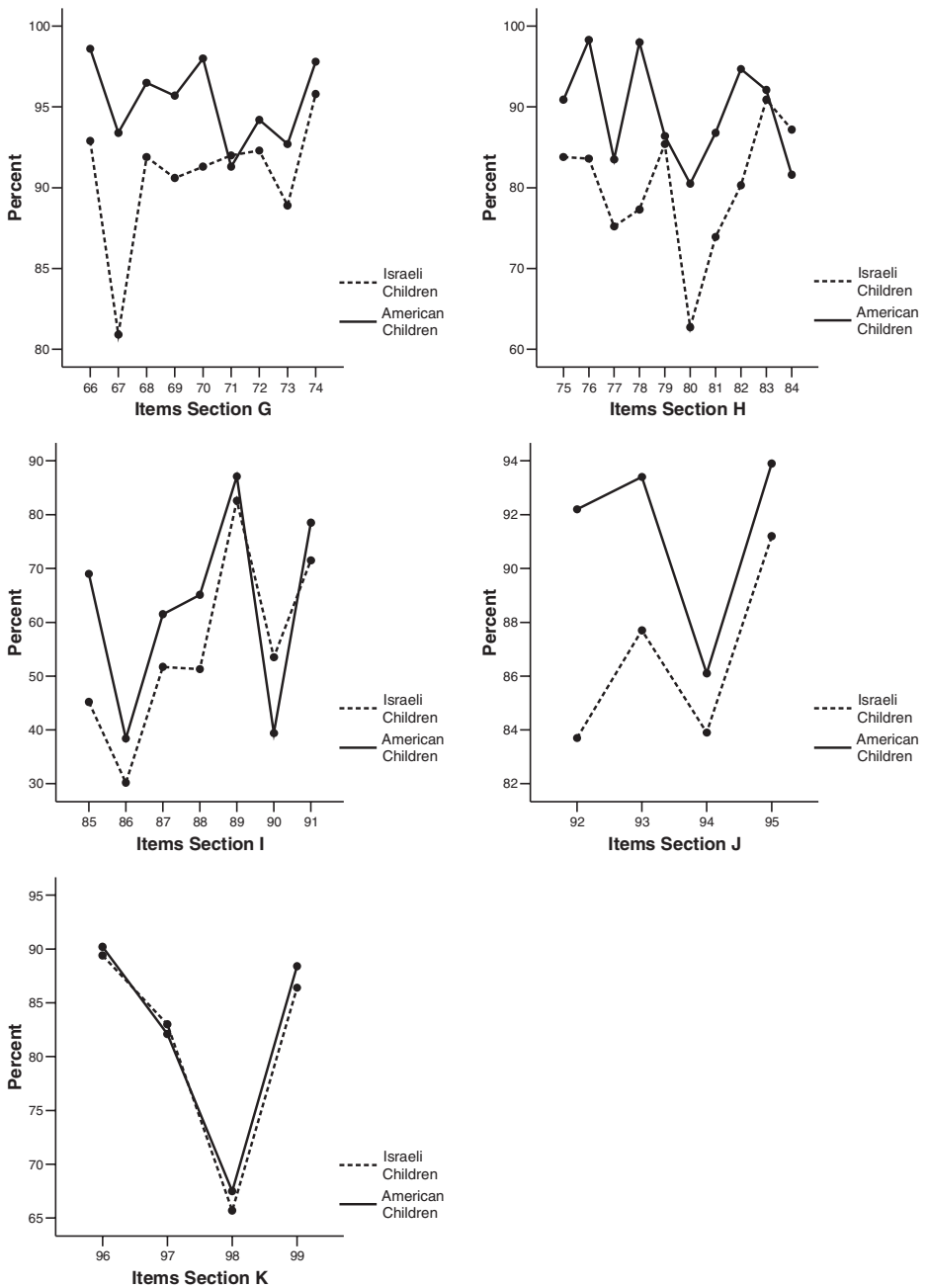


FIGURE 2: The percentage of Israeli and American children who seldom or never exhibit the behaviours described in the Sensory Profile sections related to Modulation.  
Note. The data on the American sample were published in Dunn and Westman (1997).

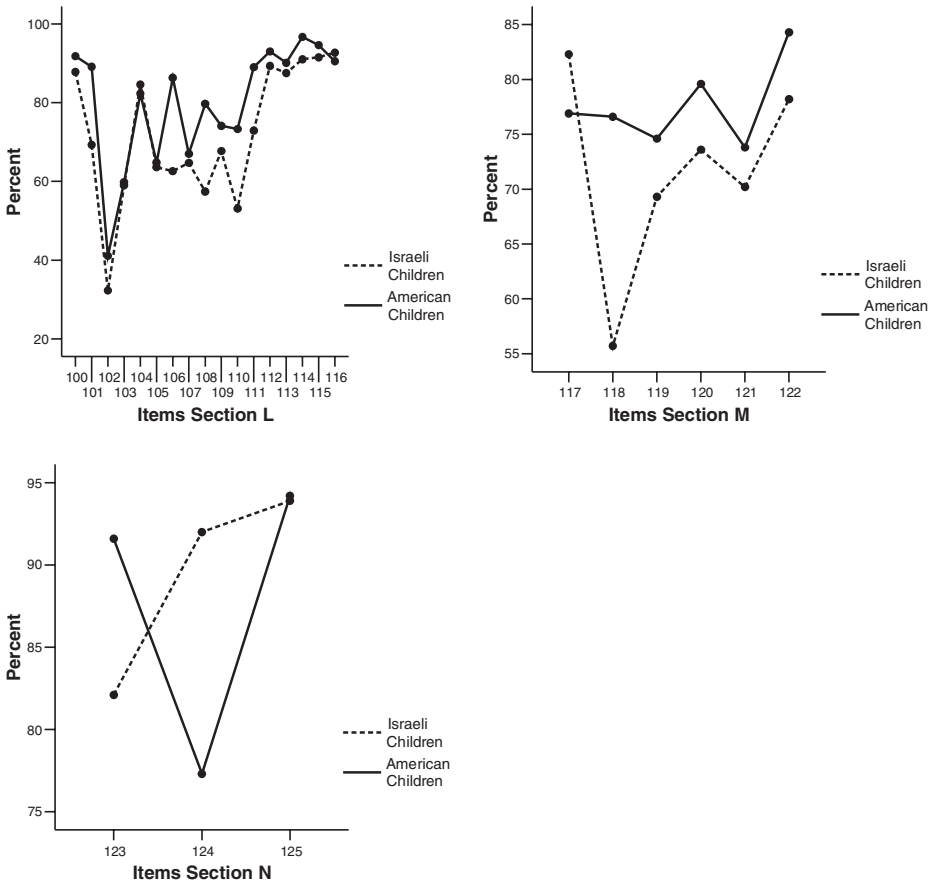


FIGURE 3: The percentage of Israeli and American children who seldom or never exhibit the behaviours described in the Sensory Profile sections related to Behaviour and Emotional Responses.

Note. The data on the American sample were published in Dunn and Westman (1997).

of the Sensory Profile (i.e. A to N), the patterns of response of the Israeli children were similar to the American children. That is, the observed behaviours that were uncommon behaviours (i.e. above the 80% mark) for typical American children were also uncommon behaviours for typical Israeli children. The only exceptions were those behaviours described in items 2, 7, 37, 45, 53, 55, 56, 57, 58, 60, 63, 65, 77, 78, 80, 81, 106, and 108. These behaviours which were common behaviours (i.e. observed frequently) among the Israeli children were uncommon (i.e. rarely observed) among the American children. In contrast, the behaviours described in items 11, 15, 16, 117, and 124 were uncommon behaviours (i.e. rarely observed) among the Israeli children and were more common (i.e. observed frequently) among American children.

It should also be noted that although the behaviour described in item 118 (Writing is illegible) was considered a common behaviour in both the Israeli and the American children (i.e. below the 80% mark), there was a distinct difference between the two groups. As seen in Figure 3, this behaviour seemed to occur more frequently among the Israeli children. The reason for such a difference is that notably a large percentage of the Israeli parents (apparently more than the American parents) did not score this item because it was not applicable to their children. If, however, the valid percentage had been considered (i.e. counting only cases with scores), then the percentage of Israeli children who seldom or never display the behaviour, described in item 118, would have been 81%, which is much closer to the percentage reported for the American children.

## Discussion

The main purpose of this investigation was to examine the extent to which the patterns of response of a sample of typical Israeli children, as reported in the Sensory Profile, were similar to a national sample of typical American children so that the utility of the scoring system, established for American children, can be applied to Israeli children. Although the mean scores of the Israeli children in some age groups and some sections and factor clusters are significantly different from the scores of the American children, the degree to which these scores differ (as indicated by the effect size) is not large in magnitude. When distributions of two populations are identical, these distributions overlap perfectly, i.e. 100% overlap and effect size ( $d$ ) = 0 (Cohen, 1988). With the exception of section M and factor 9 in the younger age groups, the effect size in all other sections and factor clusters ranges between 0.2 and 0.6 (i.e. 85% and 62% overlap). In addition, although the mean scores of the Israeli children are lower than the mean scores of the American children their scores are within the established range of what is considered Typical Performance.

These preliminary findings seem promising in that they provide initial support for the clinical use of the scoring system of the Sensory Profile in Israel – a scoring that was developed by Dunn (1999) to interpret the scores on the Sensory Profile and determine the child's sensory processing abilities. However, two points are worth noting: first, in section M (Behavioural Outcomes of Sensory Processing), the scores of the 3-year-old and the 4-year-old typical Israeli children fall below the minimum cutoff score of Typical Performance. In fact, their scores are at the range that would be considered at risk according to the established scoring system. One possible explanation for such an alarming performance in these younger age groups is that the Israeli parents might have perceived some items in section M as related to older children, e.g. item 117, 'Talks self through tasks' and item 120, 'Uses insufficient ways of doing things, e.g. wastes time, moves slowly, does things the harder way than is needed'. As such, when scoring these items on their 3- and 4-year-old children, the Israeli

parents tended to score the item low, suggesting that the behaviour occurred more frequently because of the child's younger age. In so doing, the mean score for the section, as one would expect, was lower than the mean score of the American children. It is important to point out, however, that when considering the expanded cutoff scores revised for the 3–10-year-old children, the mean scores of the Israeli children in the younger age group fall within the typical range of performance. Second, the data on the Israeli children not only show lower mean scores in some sections and factor clusters, but they also show a greater variability in scores (i.e. higher standard deviation values) compared to the scores of the American children. Considering that the range of typical performance is defined as scores that are within one standard deviation of the mean (Dunn, 1999), it is no surprise that the typical range of performance of the Israeli children is somewhat wider than the range established for the American children (as illustrated in the Appendix) – in particular, section F (Oral Sensory Processing) and factor 4 (Oral Sensory Sensitivity).

The comparisons between the Israeli and American children, at the item level, confirmed that the patterns of response of the Israeli children were quite similar to those of the American children (and even identical in some sections, such as section K). Thus, these findings provide further evidence that the responses of typical Israeli and American children to daily sensory experiences are similar. However, a number of behaviours/responses uncommon or rarely observed among typical American children appear more common or frequently observed in typical Israeli children:

'Holds hands over ears to protect ears from sound' (item 2).

'Doesn't respond when name is called but you know the child's hearing is OK' (item 7).

'Withdraws from splashing water' (item 37).

'Touches people and objects' (item 45).

'Leaves clothing twisted on body' (item 53).

'Avoids certain tastes or food smells that are typical part of children's diet' (item 55).

'Will only eat certain tastes' (item 56).

'Limits self to particular food textures/temperature' (item 57).

'Picky eater, especially regarding food textures' (item 58).

'Shows strong preference for certain smells' (item 60).

'Seeks out certain tastes or smells' (item 63).

'Mouths objects (for example, pencil, hands)' (item 65).

'Fears falling or heights' (item 77).

'Avoids climbing/jumping or avoids bumpy/uneven ground' (item 78).

'Takes excessive risks during play, for example, climbs high into a tree, jumps off tall furniture' (item 80).

'Takes movement or climbing risks during play that compromise personal safety' (item 81).



'Expresses feeling like failure' (item 106).

'Has temper tantrums' (item 108).

Attempting to explain the differences between the Israeli and American children on the basis of unique cultural characteristics would be somewhat speculative. Nevertheless, the fact that Israeli children consistently scored lower (i.e. behaviours were more common) on items related to food preferences (i.e. items 56, 57, 58, 60, and 63) is an interesting finding. As it turned out, typical Israeli children, compared to typical American children, appear to be fussy eaters and more selective in their food preferences. From the list provided by the parents, Israeli children seemed to prefer tastes like sweet, sour, or salty, and to prefer foods like soups, pasta, chicken cutlets ('schnitzel'), hamburgers, French fries ('chips'), potatoes and rice. The fact that Israeli children were reported to show preferences for these foods is not a surprise because these types of foods are common in Israel. Culture has long been known to influence the choices people make, whether at a younger or an older age, with regard to their food and drink preferences (Roininen et al., 2001). This point was clearly demonstrated in a study conducted by Zellner et al. (1999). These researchers found that people in the United States showed greater preference for drinking tea over coffee, whereas in Spain, it was the reverse, people showed greater preference for coffee over tea because in Spain, coffee is a common drink even for children. Hardoff et al. (1999), who followed the changes in eating habits of Ethiopian adolescents who immigrated to Israel, reported their strong preferences for cooked vegetables over raw vegetables, in particular their rejection to eating cucumbers, because in Ethiopia, cucumbers are considered donkeys' food.

While preferences to specific food types may seem culturally related, the characteristics of the Israeli children as 'picky eaters' are more difficult to explain culturally. The differences between the Israeli and American children whether related to food preferences or to the other behaviours might be related to differences in the perception or the interpretation of these behaviours by the Israeli parents. Dunn (1994) first presented this idea in her initial report on the development of the Sensory Profile for the American children. Accordingly, parents tended to indicate that a certain behaviour occurred more frequently in their typical children because they, unlike the developers of the Sensory Profile, perceived the behaviour as common or desirable. For example, if the behaviour 'Looks carefully or intensely at people/objects' occurred frequently, it was thought to indicate slow processing of visual input, whereas a parent seemed to perceive the behaviour as displaying curiosity, and thus indicated that the behaviour occurred frequently. Some of the behaviours that the Israeli parents identified as occurring frequently among their children, might suggest that these parents interpreted or perceived the behaviour as common or desirable. For example, the behaviour 'Doesn't respond when name is called but you know the child's hearing is OK' (item 7), might have been interpreted as typical, and somewhat of a positive sign that a child is focused on a task, or conversely, as a sign of

being noncompliant. Related to this is the behaviour 'Holds hands over ears to protect ears from sound' (item 2) might also be an overt indication of unwillingness to listen to the parent. The behaviour, 'Touches people and objects' (item 45), might have been perceived as exploratory in nature, when referring to the touching of objects. Another example is the behaviour, 'Fears falling or heights' (item 77), which could have been interpreted by the Israeli parent as a natural reaction of a vigilant child, particularly when referring to the fear of heights and not as an indication of oversensitivity to movement or as 'gravitational insecurity' (as suggested by Ayres, 1979). The behaviours, 'Takes excessive risks during play, e.g. climbs high into a tree, jumps off tall furniture' (item 80), and 'Takes movement or climbing risks during play that compromise personal safety' (item 81), might have been perceived by the Israeli parents as typical of a child, particularly in reference to climbing. From a cultural point of view, risk-taking and fearlessness are attributes that are regarded as positive and even desirable. Such characteristics emphasize the characterization of the Israeli native as 'tough', 'aggressive', and 'fearless', attributes that are, according to Kahn (1993), in contrast with the characteristics of the Diaspora Jews (in past generations), who have been viewed as weak and submissive. These characteristics of the Israeli natives, according to Kahn, reflect a mechanism that allows them to cope with the continuous threats to their security. Expressions of fear and 'being afraid to be afraid' are considered un-Israeli.

The findings suggest that the Israeli children do not differ substantially from the American children in their responses to sensory experiences encountered in daily life. It is important, however, to consider the following shortcomings: First, given the nature of the methodology, the sample of typical Israeli children was self-selected. That is, the parents who completed the Sensory Profile volunteered to participate and their motivation to do so is unknown. From the sample characteristics of the parents it appears that a larger percentage of parents were professionals with a health-related and academic background. As such, it is possible that they were more 'tuned in' to certain behaviours, and thus indicated that a behaviour occurred more frequently among their children. By so doing, they might have contributed to the lower score of the Israeli sample. Further investigation is needed to examine this assumption.

Second, even though the data collection procedure covered wide geographical areas, the Israeli sample of children under-represented families who immigrated from the former Soviet Union and Ethiopia. These groups might have changed the outcomes in that the scores on the Sensory Profile would have increased or decreased. Thus, clinicians who use the Sensory Profile should be cautious in interpreting scores of children from these unrepresented groups.

Third, the item-level analysis revealed that in a number of items, behaviours/responses uncommon or rarely observed among American children appear more common or frequently observed in Israeli children, in particular the items comprising section F (Oral Sensory Processing) and factor 4 (Oral Sensory Sensitivity). This finding raises the question whether these items are useful in identifying

sensory processing problems among Israeli children. While emerging data have shown distinct differences in the sensory profile between Israeli children with and without disabilities (Tal-Saban et al., 2002), little is known about how the groups differ on the items identified in this study. Further validity studies on clinical groups (such as children with autism) are needed with particular focus on the items related to oral sensory processing (section F and factor 4) in order to determine the extent to which these items distinguish between children who might have sensory processing problems.

Finally, the findings suggest that the range of typical performance of the Israeli children is wider than the range established for the American children in some sections and factor clusters. That is, the cutoff scores of the Israeli children at the lower-end range of typical performance are lower than the established cutoff scores. Consequently, clinicians in Israel might erroneously interpret a low score as a potential problem. Collecting additional data on a national representative sample of typical Israeli children might be useful in order to verify that using the Sensory Profile cutoff scores does not result in 'false alarms' (i.e. implying that there is a problem in sensory processing when in fact, there is none).

In conclusion, the findings of this study highlight the complexity of applying an assessment tool to a population other than the one for which the assessment was developed and standardized. While the findings provide initial support for the application of the scoring system of the Sensory Profile in Israel, clinicians need to be cautious about interpreting scores in those sections and factor clusters in which the range of typical performance of the Israeli children does not completely overlap with the range established for the American children (as illustrated in the Appendix).

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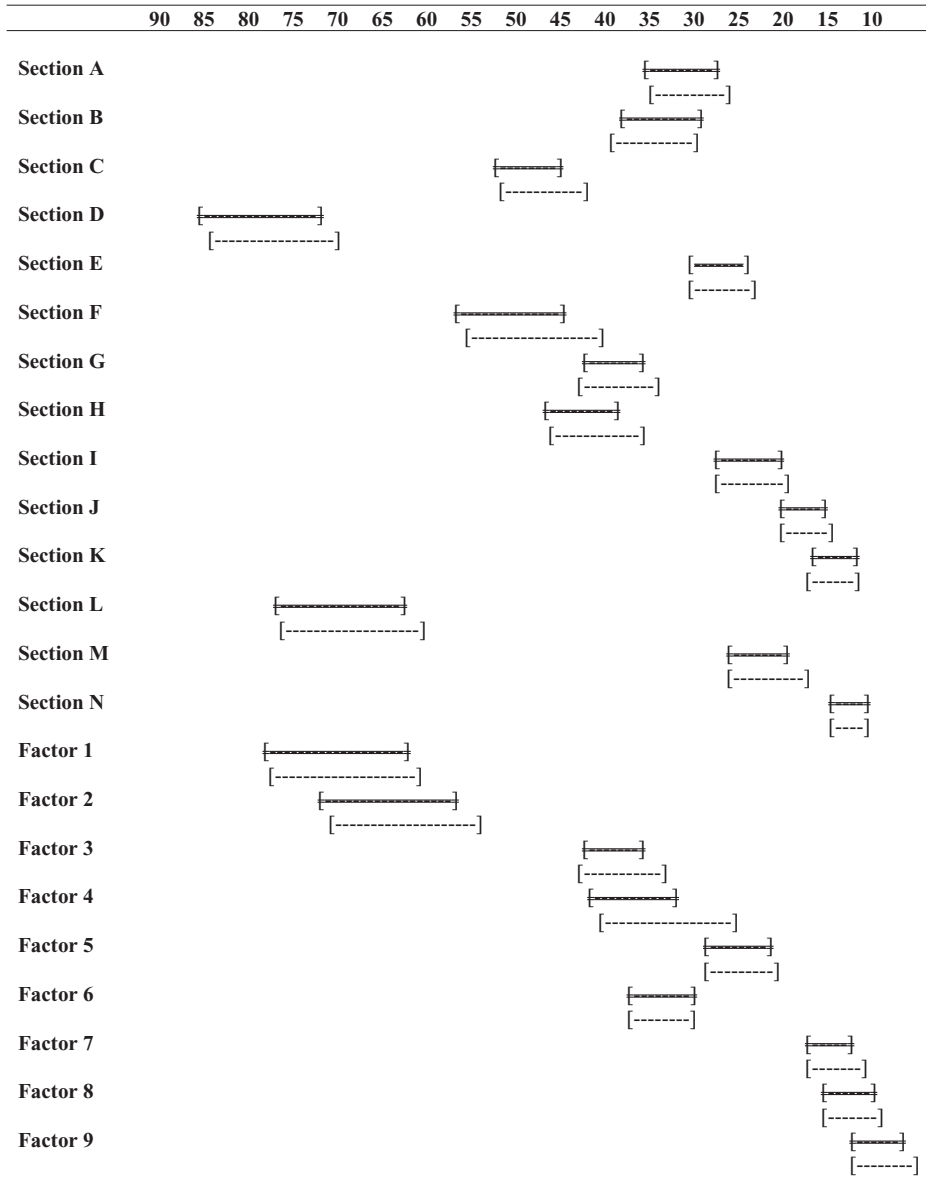
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Appendix: Cutoff scores of typical performance for the 3–10-year-old American and Israeli children

Appendix  
Cut scores of typical performance for the 3-10-year-old American and Israeli children



— American Children (based on the revised extended cut scores for 3-10 year-old obtained at [www.SensoryProfile.com](http://www.SensoryProfile.com))

----- Israeli children

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