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# The Relation Between Length of Institutionalization and Sensory Integration in Children Adopted From Eastern Europe

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**OBJECTIVE.** To examine the relation between length of institutionalization and sensory integration in children adopted from Eastern Europe.

**METHOD.** The Sensory Integration and Praxis Tests (SIPT) and the Developmental and Sensory Processing Questionnaire were administered to 60 adopted children, 4 years to 8 years, 11 months of age. Thirty had longer institutionalization histories (mean: 34 months; LIH group) and the other 30 had shorter institutionalization histories (mean: 3 months; SIH group).

**RESULTS.** The LIH group demonstrated significantly lower scores than the SIH group on the SIPT in vestibular-proprioceptive, visual, and praxis areas, and effect sizes ranged from .09 to 1.13. The LIH group also had significantly more frequent behaviors suggestive of sensory modulation dysfunction compared to the SIH group, particularly in touch and movement seeking, vision, and audition. Effect sizes ranged from 0 to 1.39.

**CONCLUSION.** Longer lengths of institutionalization are associated with more atypical sensory discrimination, praxis, and sensory modulation scores in children adopted from Eastern European orphanages. The areas of sensory integration that appear to be more vulnerable to deprived conditions in early childhood are vestibular-proprioceptive, tactile, visual, auditory, and praxis. Adopted children with lengthy periods of institutionalization may benefit from occupational therapy for early sensory integrative and developmental screenings.

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Over several decades, research on the effects of early living conditions on children's development has established that institutionalization is associated with developmental delays and behavioral problems (Goldfarb, 1945; Provence & Lipton, 1962; Spitz, 1945), and that longer lengths of institutionalization are associated with greater developmental delays and behavioral problems (Ames, 1997; Marcovitch, Cesaroni, Roberts, & Swanson, 1995). Furthermore, research has documented decreased sensory stimulation (Casler, 1975) and social-emotional exchanges (Provence, 1989) in orphanages, but the relationship between length of institution and the qualitative aspects of children's performance, such as sensory integration has not been examined. One possible mechanism underlying behavioral problems could be that institutionalized children are deprived of opportunities for sensory exploration and interaction with a variety of environments during early childhood. As a result, they may not be able to process and utilize sensory information to guide and regulate their behaviors effectively. This model suggests that children who spend extended periods in deprived environments, such as orphanages, will be at greater risk for problems with sensory integration.

Some studies have suggested that institutionalized and postinstitutionalized children exhibit dysfunction in sensory modulation and related functioning (Cermak, 2001; Cermak & Daunhauer, 1997; Cermak & Groza, 1998; Haradon, Bascom, Dragomir, & Scripcaru, 1994). For example, Haradon et al. found that infants in Romanian orphanages had poor reactivity to tactile deep pressure and

poor ocular motor control. Cermak and Daunhauer studied adopted children who had spent an average of 13 months in Romanian orphanages and found that these children had significantly higher scores (suggestive of atypical responses) in vision, audition, touch, and movement on a sensory questionnaire when compared to typically developing American children. Several studies offer preliminary evidence that length of institutionalization is associated with modulation of tactile and vestibular stimuli. Romanian children, 3 to 6 years of age, who were institutionalized for 6 months or more had significantly higher sensory questionnaire scores than Romanian children institutionalized for 2 months or less in the areas of touch (Gilbert, 1997) and movement (Leipprandt, 1997). However, none of the research to date has used performance-based standardized assessments of sensory discrimination and praxis, which would provide a measure of children's performance in comparison to age-matched samples. Standardized assessments also would be supported by evidence of reliability and validity, which are typically lacking for observations and informal measures.

Occupational therapists are frequently involved in the assessment and treatment of postinstitutionalized children due to the children's developmental delays and difficulties with daily occupational performance in school and home environments (Cermak, 2001). Improved knowledge of the relation between institutionalization and sensory integration may help occupational therapists and other professionals understand the behaviors of adopted postinstitutionalized children, and determine how best to facilitate children's occupational performance. This study examined this issue through an investigation of the relation between length of institutionalization and performance on sensory integration assessments in children adopted from Eastern European orphanages.

### *Length of Institutionalization and Child Development*

Institutionalization refers to living in hospitals or orphanages and may be characterized by limited social interactions, exploration, and play, and possibly medical care and nutrition (Johnson, 2000). Longer periods of institutionalization (e.g., > 6–8 months) have been associated with greater developmental delays (Morison, Ames, & Chisholm, 1995; Sweeney & Bascom, 1995), growth delays, eating problems, social behavioral problems (Ames, 1997; Marcovitch et al., 1995), and attention and activity level problems (Morison & Ellwood, 1997). In contrast, children with shorter periods of institutionalization (i.e., less than 6 months) tend to have better developmental outcomes than children institutionalized for more than 6 months (Marcovitch et al., 1997; O'Connor, Rutter, Beckett, Keaveney, & Kreppner, 2000).

However, a few studies of Romanian adoptees have suggested that even children adopted at young ages (e.g., < 4 months) have difficulties with behavioral control such as high activity levels (Ames, 1997; Marcovitch et al., 1995). Kadlec and Cermak (2003) found that Romanian children who spent 2 months or less in an orphanage showed more difficulties in activity level, organization (e.g., attention to task, difficulty with changes in plans), and social-emotional functions compared to American born children matched for age and gender.

## **Early Rearing Environments and Animal Research**

Research with animals supports the findings observed in institutionalized children; enriched conditions facilitate development and deprived conditions interfere with development. Environmental complexity appears to contribute greatly to brain development, problem solving, and coping behavior in young animals. Studies with young animals have shown that increasing environmental complexity through toys and play experiences results in greater brain growth such as a thicker somatosensory cortex (Diamond, 1990). The presence of toys, however, is not enough to produce the most marked changes in brain growth; toys and materials need to be changed frequently (i.e., there must be *varied* experience, or else the brain growth is not as pronounced).

Diamond (1990) also found that rats from enriched environments demonstrated better maze performance and brain growth. Rats that learned new complex motor coordination tasks developed significantly greater numbers of synapses within the cerebellum compared to animals that engaged in an equivalent amount of movement by running in a wheel or treadmill (Black, Jones, Nelson, & Greenough, 1998). These findings suggest that the presence or absence of new learning experiences influences brain development and that a certain degree of environmental complexity is important for optimal brain development and functional behaviors.

Institutionalized infants typically live in impoverished environments that lack environmental complexity, particularly with regard to sensory-motor experiences. For example, Casler (1975) reported that institutionalized infants received only 18% as much holding, rocking, and tactile stimulation as infants living with families. The limited vestibular-proprioceptive and tactile experiences provided in orphanages may be a consequence of a low caregiver to child ratio typically found in Eastern European institutions; 1:10–20 (Johnson, 2000). Most orphanages in Romania were stark, quiet, and devoid of visual or auditory stimulation (Ames & Carter, 1992). Few toys were available to

children and one study found that as the availability of toys for children to play with in the orphanage increased, the number of areas of delay on the Revised Denver Prescreening Developmental Questionnaire decreased, and Developmental Quotients on all areas of the Gesell Developmental Screening increased (Morison et al., 1995). During the early years of development, the young human brain is sculpted by a variety of sensory and learning experiences (Dawson, Ashman, & Carver, 2000; Porges, 1993). Therefore, children who spend extended time in institutions usually experience less environmental complexity and thus may be at greater risk for neurobehavioral dysfunction.

### *Mechanisms Underlying Behavioral Development*

The poorer developmental and behavioral outcomes of postinstitutionalized children clearly suggest that the impoverished environment of orphanages fails to provide adequate conditions for typical development to occur. Provence (1989) attributed the institutionalized children's developmental delays or deviations to the lack of consistent physical, social, and emotional care that is usually provided through maternal caregiving. It is possible that the reduced opportunities of active engagement with environments during the early years of development may negatively influence the institutionalized child's ability to process and use sensory information in order to organize, guide, and regulate behavior. Therefore, the processes through which postinstitutionalized children integrate sensory perception and actions may be atypically or inadequately developed. Although we cannot measure sensory integration directly via brain processes, we can measure responses believed to reflect sensory integration functioning. If our hypothesis is correct, then we would expect that postinstitutionalized children would demonstrate greater dysfunction in sensory integration relative to the normative sample, and dysfunction of sensory integration would be related to length of institutionalization.

Therefore, in the present study we compared sensory integration functioning (sensory discrimination, praxis, and sensory modulation) of longer-institutionalized and shorter-institutionalized children adopted from Eastern European countries.

### *Hypotheses*

1. Longer-institutionalized (LIH) children (i.e., those children who have spent 18 months or more in orphanages) will score significantly lower on the tactile, vestibular, and visual-perceptual tests of the Sensory Integration and Praxis Tests (SIPT) compared to shorter-institutionalized (SIH) children (i.e., those who have spent less than 6 months in orphanages). Both groups

will score lower than the SIPT normative sample on these tests.

2. The LIH group will score significantly lower on the five SIPT tests that measure praxis (Bilateral Motor Coordination, Sequencing Praxis, Oral Praxis, Graphesthesia, and Postural Praxis) and the two visual construction tests (Constructional Praxis, Design Copying) compared to the SIH group. Both groups will score lower than the SIPT normative sample.
3. The LIH group will show significantly higher scores (i.e., more atypical responses) on the Touch, Movement, Vision, and Audition domains of the Developmental and Sensory Processing Questionnaire than the SIH group.

## Methods

### *Participants*

Participants were recruited through: (a) newsletters of support groups for adoptive families; (b) the Internet home page of the Association for Research in International Adoption and the Adoption Board; (c) a database of adopted postinstitutionalized children who had participated in a sensory history questionnaire study; and (d) a database of adopted children who were evaluated at the International Adoption Clinic at the Tufts New England Medical Center.

The participants consisted of 60 school-age children, between 4 years, 0 months and 8 years, 11 months old, adopted from Eastern European countries to the United States (Table 1).

**Table 1. Demographic Characteristics of Participants**

	Group	
	LIH	SIH
Gender		
Females	12	14
Males	18	16
Age		
<i>M</i>	74.7	76.1
<i>SD</i>	17.8	16.5
Range	51–107	48–98
Length of Institutionalization		
<i>M</i>	34.0	3.0
<i>SD</i>	11.5	2.4
Range	18–54	0–6
Age Adopted		
<i>M</i>	38.0	9.5
<i>SD</i>	14.7	15.7
Range	18–72	0–66
Time in Adoptive Homes		
<i>M</i>	37.5	66.5
<i>SD</i>	18.9	23.0
Range	13–77	29–97

*Note.* All data are reported in months.  
LIH = Longer-institutionalized  
SIH = Shorter-institutionalized

Of the sample, 30 were institutionalized for > 18 months (LIH group) and 30 were institutionalized for < 6 months (SIH group), and this difference was significant,  $t(58) = 14.5, p < .001$ . Length of institutionalization was reported by the adoptive parents who received this information through their adoption agencies. Conditions and quality of the orphanages were unknown by some parents and thus were not collected for this study. Two Romanian children in the SIH group had not been institutionalized; they lived with their birth families until adoption. The groups did not differ in age,  $t(58) = -0.30, p = .76$ , and gender,  $\chi^2(1, N = 60) = 1.07, p = .30$ . The 30 in the LIH group were randomly drawn from an eligible group of 46 children, and the 30 SIH participants represented a convenience sample because SIH children were difficult to locate and recruit. All had lived with their adoptive families for at least 1 year. The LIH children had spent a shorter amount of time in their adoptive homes compared to the SIH children. Children were excluded from the study if parents reported diagnoses such as fetal alcohol syndrome, congenital anomalies, deafness, blindness, fragile X syndrome, pervasive developmental disorders, mental retardation, and neurological disorders associated with brain damage (e.g., cerebral palsy).

In the LIH group, seven children were from Romania, 19 were from Russia, and four were from other countries (i.e., Hungary, Moldova, Latvia, Kazakhstan). In the SIH group, 15 children were from Romania, 13 were from Russia, and two were from other countries (Moldova, Albania). Age at institutionalization was collected on all participants but the study did not specify inclusion criteria for age of placement in an orphanage or hospital. The majority of participants in each group were institutionalized from 0–1 months of age (73% for LI and 74% for SI). Four of the LI group were institutionalized after 6 months of age (range: 8–30 months), while five of the SI group were institutionalized after 6 months of age (range: 14–30 months). Although it is possible that the children institutionalized after 6 months might have better outcomes because they were with their birth families for a short time, scatter plots revealed that their data points were not skewed to either the low or high end of the range.

### *Instruments*

*Sensory Integration and Praxis Tests.* The Sensory Integration and Praxis Tests (SIPT; Ayres, 1989) consists of 17 tests that measure visual, tactile, kinesthetic perception, and motor performance. Scores between  $-1.0$  and  $+1.0$  are considered in the average range, whereas scores below  $-1.0$  suggest possible problems (Ayres, 1989). Evidence for construct validity, discriminant validity, and test–retest reliability are report-

ed in the *SIPT Manual* (Ayres, 1989). The SIPT tests were categorized based upon previous studies (Ayres & Marr, 2002; Lai, Fisher, Magalhaes, & Bundy, 1996) (see Table 2).

*Developmental and Sensory Processing Questionnaire.* The Developmental and Sensory Processing Questionnaire (DSPQ), developed by Cermak and Miller (1993), asks adoptive parents about their child's current and past sensory modulation and related behaviors. Survey questions were drawn from a literature review and existing sensory history checklists such as early forms of the Sensory Profile (Dunn, 1994) and Occupational Therapy Associates' Sensory History Checklist (Occupational Therapy Associates, 1993). Validity and reliability studies have not been published for the DSPQ, but the DSPQ was chosen because it had been used previously with adopted postinstitutionalized children, and at the time of the study, there were no standardized measures of sensory processing.

The DSPQ addresses 12 domains: seven sensory domains (Touch Avoids, Touch Seeks, Movement Avoids, Movement Seeks, Vision, Audition, and Taste-Smell) and five behavioral domains. Parents are asked to rate the frequency of observed behaviors suggestive of sensory modulation problems, using a 3-point Likert scale (Often = 2, Sometimes = 1, and Rarely = 0). The total score for each domain is the sum of the item responses. Higher scores indicate higher frequencies of behaviors suggestive of sensory modulation problems. The DSPQ is not standardized and therefore it is possible that high scores on some items may be found in typically developing children as well.

### *Procedure*

After receiving approval by the Institutional Review Board, participants were recruited. After parents and children signed consent and assent forms, respectively, researchers mailed the DSPQs to the parents. Parents' questions were answered either by phone, e-mail, or at the testing appointment. The principal investigator, a SIPT-certified tester, administered the SIPT to participants. The tester was not blind to the child's group membership, but scoring of the SIPT largely consists of subjective quantitative measurements (e.g., time) and interrater reliability is high (Ayres, 1989).

### *Results*

To calculate power, we used the effect size ( $d = .44$ ) from a pilot study that compared longer and shorter-institutionalized children (first 20 of present sample) on the SIPT (Lin, 1998). Power was calculated to be .52, meaning this study had a 52% chance of detecting an effect of  $d = .44$  or larger if the effect exists in the population (Cohen, 1988). Although power of .80 is typically desirable, 152 partici-

**Table 2. Comparisons of Mean Sensory Integration and Praxis Test Scores Between Longer-Institutionalized and Shorter-Institutionalized Groups**

Category	Test	LIH <i>z</i> -score		SIH <i>z</i> -score		<i>t</i>	<i>df</i>	<i>p</i>	<i>d</i>
		<i>M</i>	( <i>SD</i> )	<i>M</i>	( <i>SD</i> )				
Tactile	FI	-0.84	(1.06)	-0.64	(0.97)	-0.74	58	.23	.20
	LTS	-0.64	(1.27)	-0.40	(1.12)	-0.77	57	.22	.20
Vestibular-proprioceptive	KIN	-1.96	(1.17)	-0.86	(1.15)	-3.66	58	.0003*	.96
	SWB	-1.79	(1.12)	-0.65	(1.14)	-3.93	58	.0001*	1.03
	PRN	-0.41	(0.59)	-0.47	(0.59)	0.34	55	.37	.09
Form & Space	SV	-1.51	(1.01)	-0.38	(1.18)	-4.01	58	.0001*	1.05
	FG	-0.73	(1.06)	0.02	(1.06)	-2.75	58	.004*	.72
	MFP	-1.06	(1.35)	-0.10	(1.06)	-3.04	58	.002*	.80
Visual construction	DC	-1.72	(1.22)	-0.44	(1.07)	-4.31	58	.0001*	1.13
	CPr	-0.99	(1.09)	-0.34	(1.12)	-2.27	58	.01	.60
Praxis	BMC	-0.64	(0.91)	0.19	(0.77)	-3.82	58	.0002*	1.02
	PPr	-1.11	(1.28)	-0.34	(1.12)	-2.49	58	.008	.65
	OPr	-0.91	(0.97)	-0.06	(0.93)	-3.43	58	.0006*	.90
	SPr	-0.96	(0.96)	-0.02	(0.86)	-4.00	58	.0001*	1.05
	GRA	-0.78	(0.94)	-0.51	(0.84)	-1.18	58	.12	.47
Visual-motor	MAc	-0.39	(1.68)	0.09	(0.95)	-1.39	46	.09	.36
Other	PrVC	-1.39	(1.35)	-0.36	(1.03)	-3.31	58	.0008*	.87

*Note.* Values in parentheses denote standard deviations. One-tailed *p* values are given. MAc *t* and *df* values represent the unequal variance version of *t* tests. LIH = longer-institutionalized; SIH = shorter-institutionalized; SV = Space Visualization; FG = Figure-Ground Perception; MFP = Manual Form Perception; KIN = Kinesthesia; FI = Finger Identification; GRA = Graphesthesia; LTS = Localization of Tactile Stimuli; PrVC = Praxis on Verbal Command; DC = Design Copying; CPr = Constructional Praxis; PPr = Postural Praxis; OPr = Oral Praxis; SPr = Sequencing Praxis; BMC = Bilateral Motor Coordination; SWB = Standing and Walking Balance; MAc = Motor Accuracy; PRN = Postrotary Nystagmus. *d* ≥ .80, large; *d* ≥ .50, medium; *d* ≥ .20, small.  
\*Results are significant after adjusting for multiple testing.

pants would be needed and testing this number of participants was not feasible due to time and cost constraints. Lower power increases the chance of committing a Type II error, or failing to reject the null hypothesis when it is false (Hulley & Cummings, 1988). To ensure that differences between groups were not overlooked due to low power, effect sizes (i.e., magnitude of difference) were calculated for the differences between the LIH and SIH groups for the SIPT and sensory processing measures.

An alpha level of .05 was used for all statistical tests. Hochberg's procedure was used to control the alpha level for multiple *t* tests (Benjamini & Hochberg, 1995).

### Sensory Discrimination and Praxis

Directional *t* tests were performed to examine the first hypothesis, that children who were institutionalized for longer periods of time (LIH group) would score significantly lower on the tactile, vestibular proprioceptive, and visual form and space tests of the Sensory Integration and Praxis Tests (SIPT) than children who spent shorter amounts of time in institutions (SIH group). Results partially support the hypothesis. The LIH group scored significantly lower than the SIH group on five of the nine SIPT tests: vestibular-proprioceptive (Standing and Walking Balance, Kinesthesia) and visual form and space perception (Space Visualization, Figure-Ground Perception, Manual Form Perception) (see Table 2). The effect sizes for these five tests were medium to large.

Results also partially support the second hypothesis

that the LIH group would score significantly lower on the praxis and visual-motor tests of the SIPT compared to the SIH group. The LIH group had significantly lower scores on three of the five praxis tests (Bilateral Motor Coordination, Sequencing Praxis, Oral Praxis). Moreover, the effect sizes for these praxis tests were large (see Table 2). Although the differences between groups on the remaining two praxis tests (Postural Praxis, Graphesthesia) were not significant, the effect sizes were of medium magnitude (see Table 2). In the visual construction tests, the LIH group had significantly lower Design Copying scores than the SIH group. Although the difference between groups was not statistically significant on the Constructional Praxis test, the effect size was medium. The LIH group also scored significantly lower than the SIH group on Praxis on Verbal Command, a test that is not typically considered a unique measure of praxis because of its heavy emphasis on language. Overall, the LIH group scored lower than the SIH group, and these differences were of moderate to large magnitude in 12 of 17 SIPT tests (see Table 2).

Both the LIH and SIH groups were hypothesized to score lower than the SIPT normative sample on tactile, vestibular, visual, and praxis tests. The LIH group's mean scores were below  $-1$  *SD* on seven of 17 SIPT tests, with 8 of the 10 other mean scores falling more than  $1/2$  *SD* below the normative sample (see Table 2). In contrast, none of the SIH group's mean SIPT test scores fell below  $-1$  *SD*.

A few participants in both groups were not institutionalized from birth, so age of institutionalization may have

been a confounder. However, partial correlations between length of institutionalization and SIPT, while controlling for age of institutionalization, revealed that 8 of the 17 partial correlations (praxis, visual-motor, visual perception) were significant and of moderate magnitude. Thus, in this sample, age at institutionalization did not appear to influence the association between length of institutionalization and the praxis and visual-related tests of the SIPT.

Although many of the LIH group's mean SIPT scores fell in the low average to below average range, the group mean does not reveal how many of the group members performed below average. Therefore the percentage of LIH and SIH members who scored below  $-1$  *SD* on the SIPT was calculated. Based on normal curve data, one would expect 16% of the participants' scores to fall in this range. However, more than twice this percentage of LIH participants scored in this lower range on 14 of 17 tests and 50% or more of the LIH participants scored below  $-1$  on seven of the tests (see Table 3). In comparison, the distribution of scores in the SIH group was comparable to that of the normative sample.

### Sensory Modulation

The third hypothesis proposed that the LIH group would score significantly higher (more problems) than the SIH group on the sensory domains of the Developmental and Sensory Processing Questionnaire: Touch Avoids, Touch Seeks, Movement Avoids, Movement Seeks, Vision, and Audition. Results from directional *t* tests and Hochberg's procedure to correct for multiple testing partially support the hypothesis. The LIH group had significantly higher mean scores than the SIH group in Touch Seeks,

Movement Seeks, Touch Total, Movement Total, Vision, and Audition. These differences were typically of a large magnitude (see Table 4).

## Discussion

The results of this study generally support the hypotheses that a longer length of institutionalization would be associated with poorer performance on measures of sensory discrimination, praxis, and sensory modulation.

Sensory integration is a self-organizing process that develops through the individual acting within the environment (Spitzer, 1999). The association between length of institutionalization and sensory integration may reflect in part the paucity of sensory experiences (Casler, 1970, 1975) and reduced opportunities for exploration and social-emotional interactions (Provence, 1989) commonly associated with institutional life. When sensory-rich experiences and learning opportunities are limited, children may be at risk for difficulties in processing and interpreting sensory information. Therefore, it was not surprising that the LIH group demonstrated generalized sensory integration dysfunction. In contrast, the SIH group's scores were within the average to low-average range and comparable to the SIPT normative sample. Thus, the SIH group did not show sensory discrimination and praxis problems beyond what one would expect to find in the population of typical children. Our finding suggests that sensory integrative functioning is correlated with length of institutionalization, which parallels O'Connor et al.'s (2000) finding that cognitive outcomes were correlated with length of institutionalization. Although our results indicate that the SIH children perform typically in sensory discrimination and praxis, the causal mechanisms remain unknown. Either the SIH children did not experience deprivation to the extent that it influenced sensory integration development or any effects of deprivation were ameliorated by the adoptive environments.

These findings are consistent with studies that found an association between longer lengths of institutionalization and poorer developmental outcomes (O'Connor et al., 2000; Rutter et al., 1998), but our study is the first to extend this investigation to sensory integration. Our results suggest that extended lengths of institutionalization (and associated factors) are associated with sensory integration, even after 3–5 years (average) of living with adoptive families. We can only speculate that length of institutionalization influences sensory integration. Further research is needed to investigate the causal mechanisms leading to lower sensory discrimination and praxis scores of postinstitutionalized children. In addition, there

**Table 3. Percentage of Participants in Each Group Scoring Below  $-1$  *SD* on Sensory Integration and Praxis Tests**

Test	LIH Group ( <i>n</i> = 30)	SIH Group ( <i>n</i> = 30)
Space Visualization	77%	40%
Figure-Ground Perception	27%	13%
Manual Form Perception	47%	13%
Kinesthesia	73%	43%
Finger Identification	40%	37%
Graphesthesia	43%	27%
Localization of Tactile Stimuli	30%	30%
Praxis on Verbal Command	60%	20%
Design Copying	73%	27%
Constructional Praxis	50%	30%
Postural Praxis	53%	30%
Oral Praxis	40%	13%
Sequencing Praxis	47%	13%
Bilateral Motor Coordination	40%	3%
Standing and Walking Balance	67%	37%
Motor Accuracy	40%	13%
Postrotary Nystagmus	13%	23%

LIH = Longer-institutionalized  
SIH = Shorter-institutionalized

**Table 4. Comparison of Longer-Institutionalized and Shorter-Institutionalized Groups on Developmental and Sensory Processing Questionnaire Domains**

Sensory Domain	LIH score		SIH score		<i>t</i>	<i>df</i>	<i>p</i>	<i>d</i>
	<i>M</i>	( <i>SD</i> )	<i>M</i>	( <i>SD</i> )				
Touch Avoid	6.27	(5.71)	3.97	(4.04)	1.80	52.2	.04	.46
Touch Seek	2.60	(2.03)	1.03	(1.07)	3.75	43.9	.0003*	.97
Movement Avoid	1.33	(2.35)	1.33	(2.64)	0.00	58.0	.50	0
Movement Seek	8.07	(3.67)	5.23	(2.42)	3.53	50.2	.0005*	.91
Vision	3.20	(2.19)	0.83	(1.02)	5.37	41.0	.0000*	1.39
Audition	2.90	(2.02)	1.33	(1.56)	3.36	54.5	.0007*	1.31
Taste-Smell	1.77	(1.57)	1.00	(1.53)	1.92	58.0	.03	.50
Touch Total	10.83	(8.09)	5.30	(4.85)	3.21	47.5	.0012*	.83
Movement Total	9.40	(4.05)	6.57	(3.05)	3.06	58.0	.0017*	.80

*Note.* One-tailed *p* values are given (alpha level = .05). Unequal variance *t*-test versions are reported for Touch Avoid, Touch Seek, Movement Seek, Vision, and Audition, which explains the varying degrees of freedom for each. *d* ≥ .80, large; *d* ≥ .50, medium; *d* ≥ .20, small.

\*Results are significant after adjusting for multiple testing.

is a need to examine progressions of behavior after adoption since these children experience radical changes in their social, physical, and cultural environments. Parents of many postinstitutionalized children have reported that their children showed indicators of sensory defensiveness when first adopted, but these behaviors often decreased and were replaced with sensory seeking and hyperactive behaviors (S. Cermak, personal communication, December 16, 2001). Studying changes in environmental characteristics and behavior over time in postinstitutionalized children may help clarify the relations between environmental contexts and sensory modulation during early development.

### Limitations

In this study is the fact that length of institutionalization is confounded with time spent in adoptive homes, such that in order to have children of comparable age in the LIH and SIH groups, longer lengths of institutionalization correspond with shorter lengths of time with adoptive families. Since postinstitutionalized children have consistently shown developmental gains and better growth in their adoptive homes, time spent in adoptive homes has been commonly viewed as another variable that influences outcomes of postinstitutionalized children. However, O'Connor et al. (2000) compared children who varied in length of institutionalization but were matched for time in the adoptive home and found that length of institutionalization, rather than time in adoptive homes, was the primary factor associated with subsequent cognitive and physical development.

A second limitation is that the SIH group was not randomly selected from a pool of eligible participants due to the limited number of volunteers for this group. Possible reasons for the lack of SIH participation may include: (a)

the parents of SIH children did not think that their children had developmental or sensory integration issues, or (b) they may not have been members of the organizations that posted the study. Additionally, the results may not be generalizable to children adopted after institutionalization in other countries since the sample consisted of children from Eastern Europe.

Finally, this study had limitations with regards to the measures of sensory integration. Although the SIPT is a standardized test, it only has norms for children in the United States, so the conclusions that postinstitutionalized Eastern European children have problems in sensory integration must be considered with caution. Also, the measure used for assessing sensory modulation dysfunction, the DSPQ, lacks studies of validity and reliability, although it is highly similar to and based upon an early version of a current standardized measure, the Sensory Profile (Dunn, 1999).

### Future Research

This cross-sectional study documents, but does not explain why, children with longer institutionalization histories show more sensory integration dysfunction than children with shorter periods of institutionalization. The LIH group's sensory integrative difficulties could be attributed to a number of causes, including orphanage environment, pre- and post-natal health, and nutrition. Thus, research is needed to track the children's health and sensory integration over time, while collecting data on potential mediators, such as caregiving quality, nutrition, and physical environmental characteristics. The findings from such studies including measures of brain function could lead to more specific programs to prevent or minimize the effects of institutionalization, and may offer valuable information about the interplay between environment, sensory development, and behavioral development, within a temporal context.

## Conclusion

The results of this study suggest that longer lengths of institutionalization are associated with more atypical sensory integration (sensory modulation and praxis) in children adopted from Eastern European orphanages. Longer-institutionalized children showed generalized sensory integration dysfunction, which can be manifested by difficulties in the areas of tactile, vestibular-proprioceptive, visual, auditory, and praxis function. Occupational therapists working with children who have been exposed to early environmental deprivation may wish to consider assessing sensory integration functioning of these children if they are experiencing difficulties with their occupational performance and/or participation in school, home, and community contexts.▲

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