The use of the Sensory Integration and Praxis tests with South African children

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ABSTRACT

Background: *The Sensory Integration and Praxis Tests (SIPT) developed by A. Jean Ayres, are currently one of the best researched and scientifically sound measuring instruments available for detecting developmental problems based on sensory integration functions[2,3]. There is currently no instrument of the stature of the SIPT, available that is standardised on the South African (SA) population. The question that needed to be answered was whether the use of the SIPT on SA children was fair and just, since the SIPT is standardised on a sample of children from the United States (US).*
Methodology: *A quantitative, descriptive research design was used to investigate equivalency between the US normative data and a sample of typically developing SA children.*
Findings: *This research indicated that 12 of the 17 test items of the SIPT can be scored against the normative sample of US children. There are however five tests within the older age bands (6y 0m – 8y 11m) on which the SA sample of children performed moderately to significantly better. This can cause SA children who do have sensory integration dysfunctions to go unidentified by the SIPT.*
Conclusion and Recommendation: *The scores of five of the tests of children in the older age bands must each be adapted with ½ a standard deviation unit to the negative side before clinical interpretation and reasoning are done by the occupational therapist.*

Key words: Sensory Integration, SIPT, use on South African children

INTRODUCTION

The Sensory Integration and Praxis Tests (SIPT) are a set of 17 tests that were developed by A. Jean Ayres during the 1980's and published in 1989 by Western Psychological Services (WPS). The SIPT were developed as diagnostic and prescriptive measuring tools of sensory perception, balance, bilateral coordination, praxis and related measures of the functions of the nervous system that underlie learning and behaviour[1].

Originally, using the SIPT was impractical for occupational therapists (OT's) working in South Africa as the scores obtained were mailed to WPS in Los Angeles, US, for computerised scoring. Only once the results were sent back to SA could the OT interpret the scores and make a final decision regarding dysfunction and possible intervention. This was a time consuming and costly process and unrealistic for intervention, especially for a third world country like South Africa (SA). In recent years WPS developed a software program for scoring the SIPT on personal computers.

The South African Institute for Sensory Integration (SAISI) is responsible for the training of qualified occupational therapists (OTs), in the use of the measurement instruments for the assessment of sensory integration dysfunctions, as well as the treatment thereof. During March 2006, SAISI entered into negotiations with the directors of WPS in Los Angeles regarding the use of the SIPT in South Africa. The outcomes of these negotiations led to an agreement for the use of the SIPT that would be financially viable for South African OT's. During this negotiation process, the representatives of WPS also encouraged research on the use of the SIPT on the SA children, since the SIPT is currently only standardised on a nationally representative sample of children from the US.

The SIPT are currently one of the best researched and scientifically sound measuring instruments for detecting developmental problems based in sensory integration functions[2, 3].

PROBLEM STATEMENT

There is currently no instrument of the stature of the SIPT, available for measuring sensory integration function that is standardised on South African children. The Health Professions Council of South Africa (HPCSA) guidelines for good practice in the Health Care Professions, general ethical guidelines prescribe that Health Care practitioners should act in the best interests of patients[4] and that includes the use of assessment instruments that have been proven to be fair and just, to the diverse population of SA children.

South African Therapists started training on the SIPT during 2006 and this training will be continued by SAISI. The fact remains, that although the SIPT are measuring tools of a very high standard that helps identify sensory integration dysfunctions effectively, it is not yet known how the normative data obtained on a sample of children in the United States of America (US) used in the scoring the SIPT compares to the scores of SA children.

Therefore, in order to consider the ongoing use of the SIPT with SA children, further investigation is needed. Comparative analysis will determine whether or not comparison to the US norms is reasonable, or if additional adaptations and/or revisions are required for viable use of the SIPT with SA children.

RESEARCH QUESTION

This study sought to answer the following question:

Is the use of the SIPT with SA children fair and just when using the normative data obtained from US children for comparison when scoring the SIPT?

LITERATURE REVIEW

The SIPT are the result of more than 50 years of work and research conducted by Dr A, Jean Ayres and other researchers and therapists from around the world. The SIPT contribute to the clinical understanding of children who struggle with irregular behaviour and/or developmental and learning difficulties[3]. The tests are, therefore, primarily diagnostic and descriptive tools to assist therapists in the assessment and intervention of children to identify sensory integrative and practic dysfunctions.

Ayres defined sensory integration as "the neurological process that organises sensation from one's own body and from the environ-

ment and makes it possible to use the body effectively within the environment"[2:4]. Sensory integration theory describes and explains the relationship of mind, body and brain-behaviour to help explain why individuals behave in a certain way. It also describes intervention strategies used to remediate specific sensory integration difficulties and predict how the individual's behaviour will change as a result of the intervention.

The theory of sensory integration is based on the assumption that there is plasticity within the central nervous system allowing ability to change[2]. Another assumption of sensory integration theory is that the brain functions as an integrated whole. According to Ayres, higher-order integrative functions evolved from and are dependant on the integration of lower order structures and sensory-motor experiences[5]. Sensory integration is viewed as occurring mainly within lower (sub cortical) centres. Lower structures of the brain are believed to develop and mature before higher-level structures and the development of optimal functioning in higher areas is partly dependant on the development and optimal functioning of the lower order structures[5]. Both cortical and sub cortical structures, contribute to sensory integration. Higher-order (cortical) centres of the brain are responsible for abstraction, perception, reasoning, language and learning[2,5].

Another assumption in the theory of sensory integration is that people have an inner drive to develop sensory integration through participation in sensorimotor activities[2,5]. Children with sensory integrative dysfunctions often experience difficulties in actively participating in activities, trying new experiences, or meeting challenges[2]. According to Florence Clark in the foreword of Smith Roley, Blanche & Schaaf[6], one of the key barriers to occupational justice for children are sensory integration dysfunctions. When neural mechanisms do not support function it can result in a child refraining from engagement in meaningful occupations and thus lead to some form of occupational deprivation[6].

The SIPT were developed with the specific aim of identifying sensory integration disorders that interfere with meaningful participation in daily occupations and that affect quality of life[1]. Sensory integration functions that are measured by the SIPT are inclusive of visual and tactile discrimination, visual motor skills, bilateral integration and sequencing as well as praxis. All these functions are dependent on the integration of the visual, tactile, vestibular and proprioceptive systems[1,2,7]. Sensory integration is a dynamic process that occurs throughout the lifespan and is dependent on the interaction between the individual and the environment[2]. Children with sensory integration dysfunction can experience difficulties with visual perception, bilateral motor and sequencing skills, discriminatory skills, handwriting and tool manipulation as well as the planning and execution of novel motor actions[2,3,7].

The SIPT results assist the therapist in deciding on the type of sensory integration dysfunction a child may or may not experience. The cluster groups that are described in the SIPT Manual[1] are:

1. **Low Average Bilateral Integration and Sequencing:** Children whose test scores fall within this group do not neccesarily have a dysfunction. The therapist needs to consider all the test scores of bilateral and sequencing functions and then conclude whether or not the child has a bilateral integration and sequencing dysfunction or not.
2. **Low Average Sensory Integration and Praxis:** Children whose test scores fall within this group have scores in the low average range on all the tests but are not neccesarily experiencing functional problems.
3. **Generalised Sensory Integration Dysfunction:** Children testing within this group tend to have below average scores on all test items and experience both practic and somatosensory difficulties.
4. **Dyspraxia on Verbal Command:** Children testing within this group are likely to have severe difficulty with Praxis on Verbal Command and this dysfunction is not seen as a sensory integration dysfunction but rather one of a higher cortical involvement[1,2].
5. **Visuo- and Somatodyspraxia:** Children testing within this group typically have low scores on the test items that require visual perceptual skills and/or tactile, vestibular and proprioceptive processing.
6. **High Average Sensory Integration:** Children testing within this group achieve average to high scores on all tests and demonstrate above average functioning in all areas.

The results of the SIPT thus provide the OT with information about the nature and extent of the sensory integration dysfunction a child may or may not experience. Through interpretation of the results and clinical reasoning the OT trained and experienced in sensory integration will not only be able explain to parents, caregivers and other health practitioners why a child is experiencing certain developmental or functional challenges but is also able to plan sensory integration intervention strategies that will address these challenges[1,2,5].

METHODOLOGY

Study design

A quantitative, descriptive research design was used. The equivalence between the U.S. normative data (inclusive of a small sample of children with learning disabilities or sensory integration issues) and a sample of typically developing SA children was investigated.

Study population

A convenience sample of 775 typically developing children obtained from SAISI members who had attended a SIPT administration course, passed a peer review on the administration of the SIPT, and submitted the SIPT reports of typically developing SA children between the ages of 4 years 0 months and 8 years 11 months to SAISI formed the study population. The tests were conducted between October 2006 and December 2009.

Inclusion and Exclusion criteria

Inclusion criteria

- Typically developing children were defined as those children with no diagnosed developmental delay or any other pathology that would be likely to impact development.
- Children whose home or language of education was either English or Afrikaans. This criterion was used due to the fact that the instructions of the SIPT were at the time of the study only available in English and Afrikaans.
- Only children living and growing up within the SA context were included in the SA sample.

Exclusion criteria

- Children who at the time of testing were receiving or who had received therapeutic intervention for conditions related to developmental delays.
- Children with any diagnosed sensory impairment e.g. visual or hearing difficulties or impairments.

Measurement

All the children were tested with the Sensory Integration and Praxis Tests[1], which consist of 17 tests, aimed at measuring sensory perception, praxis and related sensory-motor functions as already discussed in the literature review.

There are specific guidelines for the administration of the SIPT described in the test manual and these are dealt with in detail during the SIPT test administration course. Each test in the SIPT is designed to be "child friendly" and to involve as little language as possible[1].

The tests included in the SIPT are Space Visualisation (SV), Figure-Ground Perception (FG), Standing and Walking Balance (SWB), Design Copying (DC), Postural Praxis (PPr), Bilateral Motor Coordination (BMC), Praxis on Verbal Command (PrVc), Constructional Praxis (CPr), Postrotary Nystagmus (PRN), Motor Accuracy (MAc), Sequencing Praxis (SPr), Oral Praxis (OPr), Manual Form Perception (MFP), Kinaesthesia (KIN), Finger Identification, (FI), Graphesthesia (GRA), and Localisation of Tactile Stimuli (LTS)[1].

Although the SIPT include many sub-scores inclusive of time scores, accuracy scores, and preferred hand use, only the major standard score (SD) for each of the 17 SIPT that were administered was used in the comparison. The SIPT major scores are the scores that have the strongest psychometric properties and represent "the single scores for each test that is seen as the major summary of the performance on that test"[1:170].

Validity and Reliability of the SIPT

The validity and reliability of the SIPT have been well researched and described in the literature[1,2].

Discriminatory analysis of each of the 17 tests of the SIPT showed significant ($p = < .01$) ability to discriminate between normal and dysfunctional children within the US[1].

Construct validity:

The construct validity of the SIPT was determined through many factor analyses of the SIPT (and precursors to the SIPT), from several different populations including children with and without diagnosed sensory integrative disorders and learning difficulties[1]. Cluster analyses also determined whether the tests were able to accurately measure and identify clinically significant groups of individuals. Independent research has provided evidence in support of the validity of the cluster analysis[1].

Reliability:

The final sample for measuring test-re-test reliability of the SIPT was small (approximately 50 children) and most of the children in the test-retest analysis had identified dysfunction (i.e. approximately 10 typically developing children were included in the sample). Test-retest reliability scores ranged between .48 on the Post Rotary Nystagmus Test to .93 on Design Copying. Considering that an acceptable reliability score for research purposes is .70 it is noteworthy that the accuracy scores of 13 of the 17 test items showed a reliability of .70 and more[1], especially since the sample included so few typically developing children.

Interrater reliability coefficients ranged from .94 to .99[1(Table 25:213)]. The test thus has high interrater reliability, most likely due to the detailed scoring and the fact that therapists using the SIPT undergo extensive training.

Ethical approval

- Ethical approval for this study was obtained from the Ethics committee of the Faculty of Health Sciences of the University of the Free State (ETOVS 157/08).
- Permission for the use of the data for research and publication purposes was obtained from SAISI.
- Confidentiality during the research process was maintained by assigning a number to each child tested which was used on the data sheet instead of his/her name.

Data Analysis

The data of the US children which were used to establish equivalency is kept by WPS, which is the publisher of the SIPT and which also own the copyright on all the data that have been collected in the original standardisation process when the SIPT was developed[1]. The data of the SA sample were extracted from the SIPT computerised reports and sent to WPS.

Western Psychological Services thus conducted the data analysis on the SA test sample, in comparison to the 12 stratified age groups between the ages 4 years 0 months to 8 years 11 months of the normative US sample. The ages 4 years 0 months to 5 years 11 months are divided into 4 month intervals and ages 6 years 0 months and above are divided into 6 month intervals.

Because data analysis is limited by the fact that the individual case-by-case data is not available for the original SIPT normative sample, only means and standard deviations that were available for each age group were used in this research study. Thus, commonly used data analytic methods such as analysis of variance and linear regression could not be used with these data. Therefore, the strategy was to compare the mean SIPT scores, by age group, between the SA and US normative samples, using a measure of effect size (*d*, Cohen)[8]. Calculation of *d* does not require access to case-level data.

The magnitude and pattern of *d* among the SIPT were examined to determine if the US norms provide an adequate measure of normative SIPT performance on SA children. There are no hard-and-fast rules for making this judgement. However, it is conventional in clinical test development to treat small effect sizes ($d = .20$ or less) as clinically insignificant and therefore as not requiring separate norms for clinical interpretation[8] and it would mean that the clinical interpretation of the scores according to the US norms would be fair. A Cohen's *d* of .50 is considered a medium difference and .80 a large difference[8]. For presenting and discussing the results of this research it was decided to regard effect sizes greater than .40 as differences that present challenges regarding the interpretation of results. According to Springer[9:3] "a Cohen's d of at least .40 is approximately two-thirds the distance between small and moderate levels of differences. As a result d values of at least .40 are considered approaching a moderate level". Negative effect sizes will be indicative of better performance within the US sample whilst positive effect sizes will be indicative of better performances within the SA sample.

RESULTS

A total number of 775 South African children were included in this research. There were 353 boys (45.55% males) and 422 girls (54.45% females). The US sample consisted of 1997 children of whom 1003 were boys (50.23% males) and 994 were girls (49.77% females). The SA sample had 625 (81%) white children whilst the US sample had 1539 (78%) white children. The SA sample included 28 (3.6%) black children whilst the US sample had 234 (12%) black children. There were 52 (6.7%) coloured children in the SA sample and 38 (4.5%) children did not have their racial group recorded, whilst the US sample included 113 (6%) Hispanic children and 33 (2%) children classified as "other".

The age and gender distribution of the SA sample are illustrated in *Table I*. Most of the children (69%) were in the age intervals between 6 years 0 months and 8 years 11 months.

Table I: Age and gender distribution of participants in SA sample (n=775)

Age Intervals	Males	Females	Total
4y 0m - 4y 3m	8	12	20
4y 4m - 4y 7m	14	16	30
4y 8m - 4y 11m	11	21	32
5y 0m - 5y 3m	15	24	39
5y 4m - 5y 7m	27	28	55
5y 8m - 5y 11m	25	37	62
6y 0m - 6y 5m	53	67	120
6y 6m - 6y 11m	44	49	93
7y 0m - 7y 5m	49	53	102
7y 6m - 7y 11m	36	40	76
8y 0m - 8y 5m	35	40	75
8y 6m - 8y 11m	36	35	71
TOTAL	353	422	775

In the data analysis the SIPT major scores obtained by the SA children were compared to the US normative group to establish what the differences in effect size were between the two groups. As already discussed Cohen's *d* was used to describe the effect size within this research as described in the section on data analysis.

Results of Total Sample (all age intervals)

Table II provides a total picture of the results of effect sizes of all age intervals, male and female, and of all the tests. Kinesthesia, for example, indicates that from the 24 groups (two for each age interval, male and female), 19 (79.12%) of the age intervals had a small effect size (small effect sizes ranging between -.20 and .20).

Table II(a): Test items effect size (Cohen's d-values)

	4Y0-4Y3		4Y4-4Y7		4Y8-4Y11		5Y0-5Y3		5Y4-5Y7		5Y8-5Y11		6Y0-6Y5		6Y6-6Y11		7Y0-7-5		7Y6-7Y11		8Y0-8Y5		8Y6-8Y11	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
	n=8	n=12	n=14	n=16	n=11	n=21	n=15	n=24	n=27	n=28	n=25	n=37	n=53	n=67	n=44	n=49	n=49	n=53	n=36	n=40	n=35	n=40	n=36	n=35
SV	-.04	-.01	-.25	.27	-.21	.03	.44	-.02	-.06	-.08	-.12	-.24	.04	.37	.03	.17	.26	.28	-.20	.03	.03	-.01	.05	.05
FG	.45	.30	.44	.71	.52	.22	.26	.29	.41	.16	.56	.20	.35	.19	.29	.16	.01	.21	-.18	.40*	.15	.09	.43*	.39
MFP	-.43	-.15	-.01	.18	.16	-.25	-.18	-.04	.18	-.27	-.07	-.28	.48*	-.12	.33	-.11	.49*	.10	.16	.32	.08	.00	.50*	.36
KIN	-.19	-.20	.14	.17	.22	.20	.01	.52	.06	.01	.03	-.07	.12	.08	-.01	.03	-.09	-.20	-.12	.02	-.32	.06	-.28	.21
FI	.48	.47	.32	.82	.70	.41	-.23	.60	.37	.41	.00	.46	.39	.03	.23	.06	.06	.33	.21	.17	.24	.09	.36	.13
GRA	.22	.10	.72	.67	.42	.19	.04	.43	-.13	.19	.03	.25	.36	.21	-.13	.26	.15	.30	-.05	.39	-.04	.14	.42*	.07
LTS	.86	.16	.43	.00	.58	-.18	-.31	.43	.07	-.27	.12	.39	.24	.13	.46*	.02	.34	.34	.49*	.24	-.02	-.06	-.01	.45*
PrVC	-.03	-1.2	-.05	-.13	-.16	-1.0	.14	.25	-.48	-.36	-.17	-.06	-.09	.09	-.20	-.03	.17	.21	.11	-.07	.19	-.10	.16	.14
DC*	-.22	-.82	-.31	-.05	.26	.24	.03	-.22	-.08	-.22	.21	.48	.49*	.43*	.07	.33	.61*	.65*	.49	.79*	.65*	.58*	.66*	.77*
CPr	.00	-.27	.15	.30	-.23	.30	.45	.57	.34	.32	.13	.16	.28	.20	.02	-.05	.41*	.25	.07	.17	.43*	.24	.29	.52*
PPr	.75	-.25	.39	.67	.77	.32	.39	.56	.45	.22	.26	.37	.08	.19	.17	.05	.31	.34	.09	.31	.27	-.06	.11	-.04
OPr*	.97	.31	.61	.55	.37	.47	.54	.96	.12	.32	.47	.55	.47*	.30	.10	.11	.52*	.53*	.15	.53*	.40*	.25	.47*	.05
SPr	-.13	-.55	.29	.54	.11	.09	-.17	.71	-.02	.14	.19	.39	.23	.38	.07	.31	.45*	.53*	.11	.70*	.39	.31	.24	.28
BMC*	.45	-.10	.11	.62	.67	-.04	-.03	.95	.25	.35	.45	.41	.63*	.31	.36	.26	.99*	.68*	.51*	.70*	.47*	.51*	.86*	.46*
SWB*	.24	.14	.83	.29	.68	.70	.61	.68	.22	.30	.63	.73	.44*	.55*	.19	.28	.68*	.35	.43*	.41*	.37	.34	.33	.52*
MAc*	.96	.24	.89	.79	.83	.39	.45	.64	.33	.25	.60	.42	.20	.03	.26	.30	.10	.38	.42*	.40*	.14	.45*	.61*	.42*
PRN	-.52	-.21	.37	-.30	.03	.28	-.10	.08	.00	.00	.33	.06	-.03	.14	.04	.11	.37	.13	.29	-.04	-.09	-.15	.37	.01

M = Male F = Female

Effect size: > -.20 and < .20 (Total Sample)

* Effect size: > .40 (Older age intervals)

Clinical interpretation of scores according to US norms will be fair

*Presents challenges regarding the interpretation of results

Statistically this means that the clinical interpretation of the scores according to the US norms will be fair to use with SA children. Similarly the test of Praxis on Verbal Command where 18 (75%) of the gender and age intervals had a small effect size, (*Table II*), was followed by SV (16 or 67%), PRN (15 or 62.5%) and the MFP (14 or 58.33%).

Table III: Range of effect size (Cohen's d-values)

TEST ITEMS		Age Intervals: 4y0-5y11 n=238	Age Intervals: 6y0-8y0 n=537
Space Visualization	SV	[-.25 to .44]	[-.20 to .37]
Figure-Ground Perception	FG	[.16 to. 71]	[.01 to .43]
Manual Form Perception	MFP	[-0.43 to .18]	[-.12 to .50]
Kinesthesia	KIN	[-.20 to .52]	[-.32 to .21]
Finger Identification	FI	[-.23 to .82]	[.03 to .39]
Graphesthesia	GRA	[-.13 to .72]	[-.13 to .42]
Localisation of Tactile Stimuli	LTS	[-.31 to .86]	[-.06 to .49]
Praxis on Verbal Command	PrVC	[-1.20 to .25]	[-.20 to .21]
Design Copying	DC	[-.82 to .48]	[.07 to .79]
Constructional Praxis	CPr	[-.27 to .75]	[-.05 to .52]
Postural Praxis	PPr	[-.25 to .75]	[-.06 to .34]
Oral Praxis	OPr	[.12 to .97]	[.05 to .53]
Sequencing Praxis	SPr	[-.55 to .71]	[.07 to .70]
Bilateral Motor Coordination	BMC	[-.10 to .95]	[.26 to .99]
Standing & Walking Balance	SWB	[.14 to .83]	[.19 to .68]
Motor Accuracy	MAc	[.24 to .96]	[.03 to .61]
Postrotary Nystagmus	PRN	[-.25 to .37]	[-.15 to .37]

Tests and age intervals that presents challenges regarding the interpretation of results

The tests of DC, BMC and MAc each only had four of the age and gender groups (16.67%) showing insignificant effect sizes followed by the SWB with only two of the age groups (8.3%) with insignificant effect sizes (see *Table II*).

The age groups with 35 or more participants per gender group were the older age groups from 6 years 0 months to 8 years 11 months. The *d*-values, (which can be observed in *Table II*) that generally fell within the insignificant to moderate difference ranges for effect size were the SV, FG, MFP, Kin, FI, GRA, LTS, PrVc, CPr, PPr, OPr, SPr, and PRN (see *Table II*). The values tended to shift towards more positive *d*-value scores on the test items, indicating that the larger samples of SA children tended to perform better on some of the test items than the US normative sample. The *d*-values for PRN stayed within a narrow band, no matter the number of participants in the groups: 4 years 0 months to 5 year 11 months *d* values ranged between -.52 to .37 whilst the 6 years 0 months to 8 years 11 months *d*-values ranged between -.15 to .37 (*Table II*). This range of *d*-values also stayed mostly within the insignificant difference range.

When looking at *Table II* (age intervals 6y 0m to 8y 11m) and the *d*-values of the different age and gender groups, the test results of DC, BMC, OPr, SWB and MAc, indicated that five or more of the twelve age and gender groups within each of these test items, had *d*-values more than .40 to the positive side, meaning that the SA sample's effect sizes were moderate to large on these respective test items. On the other tests only between naught and three of the age and gender groups had *d*-values of .40 and more.

The younger age intervals (5 years 11 months and younger) consisted of 235 participants whilst the older age intervals (6 years and older) consisted of 537 participants. Because the reliability of results increases with greater numbers it was decided to focus on the age intervals 6 years 0 months to 8 years 11 months for the discussion and recommendations regarding the findings.

The DC test indicated that the *d*-value of the 6 years and older age groups ranged between .07 and .79 (see *Table III*). Ten of the twelve groups had a *d*-value of more than .40 (see *Table II*). The *d*-values of BMC ranged between .26 and .99 (*Table III*) and nine of the twelve age and gender groups had a *d*-value of more than .40 (see *Table II*). OPr's *d*-values ranged between .05 and .53 (*Table III*) and six of the twelve groups had a value of .40 or more (see *Table II*). With SWB the *d*-value ranged between .19 and .68 (*Table III*) and six of the twelve groups had a value of more than .40 (see *Table II*). The *d*-value of MAc ranged between .03 and .61 (*Table III*) and five of the twelve age and gender groups had values of .40 or larger (*Table II*).

What is also noteworthy was that the *d*-value scores of .40 or larger were fairly evenly distributed between the males and females (see *Table II*) meaning that there were no observable differences between the genders.

DISCUSSION OF THE RESULTS

Of the SA sample 45.55% were boys and 54.45% girls. The US sample consisted of 1997 children of which 50.23% were boys and 49.77% were girls. There was more or less a 5% difference in the two groups with the SA sample having a small percentage more girls compared to the US sample.

The ethnic distribution the SA sample also compared well with the US sample regarding the number of white children included. The SA sample had 81% white whilst the US sample had 78% white children. The SA sample had only 3.6% black children whilst the US sample had 12% black children. Although these figures are not representative of the SA population, the reality, according to the SA researcher, is that these figures, to a great degree, are representative of the children that access sensory integration therapy in SA.

When looking at the effect size in the comparisons of the major scores of the gender and age intervals 6y 0m - 8y 11m (*Table II*), those tests that had a majority of small effect sizes were SV, KIN, PrVC, PPr and PRN. These tests for the older age intervals can thus be treated as clinically insignificant. This finding is also strengthened when looking at KIN, PrVc, SV, and PRN where no effect size scores are greater than .37 which is smaller than the effect size of .40 that was stated for purposes of this research, as the effect size value that would present challenges for interpretation.

On the tests of FG (*d*-values ranging between .01 and .43), FI (*d*-values ranging between .03 and .39), LTS (*d*-values ranging between -.06 and .49), GRA (*d*-values ranging between -.13 and .42), MFP (*d*-values ranging between -.12 to .50), CPr (*d*-values ranging between -.05 and .52) and SPr (*d*-values ranging between .07 to .70), there were only between naught and three of the twelve age and gender groups that had an effect size value of .40 or more (*Table II*). The fact that there were also no definite patterns concerning gender or age band groups in these findings, leads to the conclusion that these test items can be treated as not having moderate to significant differences in effect size. It would thus be safe to accept that the last mentioned 12 tests of the older age intervals could be scored using the US norms due to the smaller effect size (*Table IV* on page 17).

The tests that did show a moderate to significant effect size are DC, BMC, OPr, SWB and MAc, as five or more of the twelve gender and age groups within each of the tests, had *d*-values of more than .40 to the positive side (*Table II*), meaning that the SA children tended to perform better on these test items than did the US normative sample.

The *d*-values of BMC for the older age interval ranged from .26 to .99 (*Table III*), with nine of the 12 groups indicating an effect size of .40 and larger (*Table II*). The values of SWB ranged from .19 to .68, with six groups indicating an effect size of .40 and larger (*Table II*). The BMC and SWB together with OPr, where the *d*-values of for the older age interval ranged from .05 to .53 (*Table III*) and with

Table IV: Recommended SIPT score adaptations for SA children

TEST ITEMS		Younger Ages: 4y0-5y11	Older Ages: 6y0-8y0
Space Visualization	SV	No adaptation	No adaptation
Figure-Ground Perception	FG	No adaptation	No adaptation
Manual Form Perception	MFP	No adaptation	No adaptation
Kinesthesia	KIN	No adaptation	No adaptation
Finger Identification	FI	No adaptation	No adaptation
Graphesthesia	GRA	No adaptation	No adaptation
Localisation of Tactile Stimuli	LTS	No adaptation	No adaptation
Praxis on Verbal Command	PrVC	No adaptation	No adaptation
Design Copying	DC	No adaptation	Adapt SIPT score with -0.5
Constructional Praxis	CPr	No adaptation	No adaptation
Postural Praxis	PPr	No adaptation	No adaptation
Oral Praxis	OPr	No adaptation	Adapt SIPT score with -0.5
Sequencing Praxis	SPr	No adaptation	No adaptation
Bilateral Motor Coordination	BMC	No adaptation	Adapt SIPT score with -0.5
Standing & Walking Balance	SWB	No adaptation	Adapt SIPT score with -0.5
Motor Accuracy	MAc	No adaptation	Adapt SIPT score with -0.5
Postrotary Nystagmus	PRN	No adaptation	No adaptation

six of the 12 groups indicating an effect size of .40 and larger (*Table II*), are used in the diagnosis of Bilateral Integration and Sequencing (BIS) deficits (See *Figure 1*). BMC, OPr and SWB are three tests that, when scores are low, contribute to the diagnosis of a BIS deficit[1]. If SA children perform better than their American couterparts on these tests it may mean that SA children with BIS difficulties may not be identified if the American normative data are used.

OPr and SWB are also two of the tests used in the diagnosis of Somato Dyspraxia (See *Figure 1*). The same can be said for the diagnosis of Somato Dyspraxia[1].

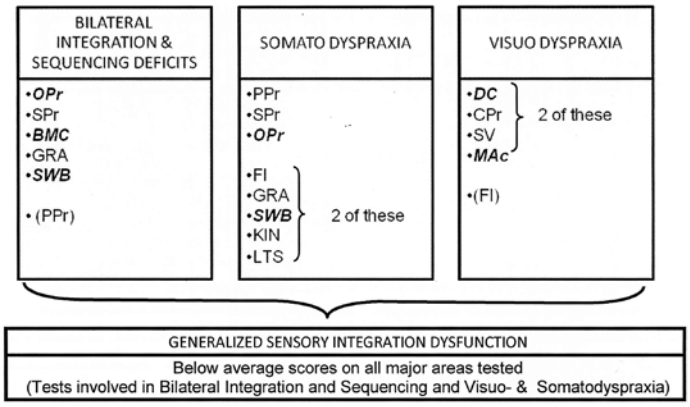

Figure 1: Sensory Integration Dysfunctions (SIPT Manual, Ayres, 1984)

DC, where the *d*-values for the older age intervals ranged from .07 to .79 (*Table III*) and with ten of the 12 groups indicating an effect size of .40 and larger (*Table II*), together with MAc, (*d*-values ranging from .37 to .61 (*Table III*) and five groups indicating an effect size of .40 and larger (*Table II*)) are two tests used in the diagnosis of Visuo Dyspraxia. These scores will have the same implication as already mentioned when a diagnosis of Visuo Dyspraxia are made, as they are two of four of the major scores considered for diagnosing this dysfunction. According to the cluster analysis done on the SIPT[1], Visuo- and Somato Dyspraxia are often seen together in children.

All five of the mentioned test items also play a role in a Generalised Sensory Integration Dysfunction[1], where the same implication will also be true.

The implications of this research and how it could be handled are addressed in the conclusion and recommendations.

CONCLUSION AND RECOMMENDATIONS

This research indicated that 12 of the 17 tests of the SIPT can be scored using the normative sample of the US children without additional interpretation. There are however five tests (DC, BMC, OPr, SWB and MAc) within the older age bands (6y 0m – 8y 11m) that showed that the SA sample of children performed moderately to significantly better than the US sample and that could therefore cause children who do have sensory integration dysfunctions to go unidentified by the SIPT. Although clinical reasoning plays a considerable role in diagnosing children with sensory integration dysfunction, the results of the SIPT are heavily relied on, in the reasoning process[1].

A moderate *d*-value effect size ($d = .50$) is equal to ½ a Standard Deviation (SD) unit[10]. The fact that 41 of the 49 *d* values of DC, BMC, OPr, SWB and MAc tests were more than .40 (*Table II*) and fell in the moderate positive effect size difference range (the other eight fell within the large effect size difference range) contributes to the recommendation that, before interpreting a SA child's major SIPT scores, the scores of these five tests of children in the age bands of 6y 0m – 8y 11m must each be adapted with ½ a SD unit (-0.5) to the negative side before clinical interpretation and reasoning is done by the OT. In *Table IV* the necessary adaptations to the scoring are given for the relevant tests and age intervals. When this adaptation to computerised scoring of DC, BMC, OPr, SWB and MAc results have been done and used in the clinical reasoning process the authors are of the opinion that the use of the SIPT, although scored according to the US norms, will be more fair and just for use on SA children.

Two questions still remain:

1. Why not standardise the SIPT on the SA population? The answer is that WPS are currently considering a shorter version of the SIPT[11] and therefore recommended that the adaptations to scoring are made as stated above and that SAISI, together with WPS, be involved in the standardisation of a shorter version (or any other revision) of the SIPT on the SA population.
2. What about the children that have already been tested with the SIPT in SA? It is true that some children may not have, up to now, been diagnosed with a sensory integration dysfunction, when they actually did have a dysfunction. Since, children are looked at holistically within the test/ treatment paradigm, a child who is experiencing functional difficulties receives intervention from the OT where the main choice of a Frame of Reference might not have been a sensory integration framework. However, a sensory integrative approach could have been included because of the therapist's observations.

   The positive side of these research findings is that up to now the chances of over diagnosing a SA child with a sensory integration dysfunction were slim.

   The fact that the SA sample was a convenience sample is a limitation of this research; however it is quite a large sample (775 children) for research within the occupational therapy field of paediatrics within the SA context.

   Therapists' level of competency in the administration of the SIPT varied in that 36.73% of the SIPT's were done by therapists that were competent test administrators of the Southern California Sensory Integration Test (an earlier version of the SIPT) and had done the SIPT conversion course and 63.27% of SIPT's were done by therapists who completed the SIPT administration course and who passed a peer review on the administration of the SIPT. They were however inexperienced testers.

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