The developmental status of street children in Potchefstroom, South Africa

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ABSTRACT

Owing to the high rate of school failure among the street children of the Thakaneng Shelter in Potchefstroom, South Africa, a study was conducted to determine the neuro-motor, sensory-motor, and cognitive-perceptual developmental status of these children. A descriptive study, using the standardised Quick Neurological Screening Test, the Beery-Buktenica Developmental Test of Visual Motor Integration and Motor Co-ordination and the Test of Visual-Perceptual Skills (non-motor) – lower level, was implemented. There were 17 participants in the 6–12 years age group. The findings revealed that sensory-motor and cognitive-perceptual deficits were most dominant, particularly those necessary for school-related tasks and consequently progress at school. The results confirmed the need for an intervention program that would focus on the skills required for school performance.

Key words: Street children, developmental status, school failure, sensory-motor deficits, cognitive-perceptual deficits

Introduction

"Street children as victims of poverty may be observed huddled in shop doorways, sleeping on cardboard sheets along pavements and even sniffing glue to ease away their misery. This serves as a reminder that the street child phenomenon is a global problem to which South Africa is no stranger"[1].

According to the Consortium for Street Children (CSC), the estimated number of street children in South Africa is 250 000[2]. This number is expected to increase, due to factors that include the levels of adult unemployment and the breakdown in African family support systems. Children end up on the streets as a result of several integrated factors identified by Anirudhra[3] and Reganick[4], which include urbanisation, unemployment, poor economic circumstances, poverty, unaffordable housing, a high crime rate, family disintegration, substance abuse by parents, physical and sexual abuse of children, and death of parents due to HIV/AIDS.

Street children fit the definition of vulnerable children as proposed by Davids *et al*[5], as they are subject to three major problem areas: material (lack of food and shelter); social (risks in the immediate environment); and emotional (insufficient love and support in the absence of regular contact with family members). In addition, they are exposed to the various disruptive elements of the streets, including alcohol and drug abuse (for example glue and gasoline sniffing, and smoking of marijuana). These substances can cause personality changes as well as structural damage to the central nervous system (CNS), leading to cognitive restrictions which can influence the developmental status of the street child[6].

AIDS is a reality for street children, and their knowledge of the disease is poor. Prostitution (also referred to as survival sex by Kruger and Richter[7]) and sexual abuse are common amongst street children and the necessary precautions are not taken to prevent transmission of HIV[7]. According to Boa, Whitbeck and Hoyt[8], street children often show emotional and/or behavioral problems such as hyperactivity, aggression and anxiety, as well as symptoms of depression and substance withdrawal, which may also impact negatively on school performance. Even though they acknowledge their strengths, Richter and Van Der Walt[9] found that many street children suffer from moderate to severe psychological problems.

As the street child phenomenon developed into a global problem, it also came to the attention of governmental and non-governmental organisations, as well as the academic community. According to Anirudhra[3], the perception exists that the government can solve the street child problem through education, since education is the key to social progress. Schools have the potential to give some input to the upliftment of these children. Based on the problems described earlier (including the high prevalence of HIV, psychological problems and substance abuse), the researchers argue that this process needs the input of resources and organisations outside the educational system, for example occupational therapists, social workers, psychologists and volunteer organisations.

The Thakaneng Shelter in Potchefstroom, located in the North West Province of South Africa, is an example of such a resource. The caretakers were trained in childcare to enable them to deal more effectively with the street child. Part of their responsibility is to fetch children from where they live on the streets, dumps and shopping centers, win their trust and bring them to the shelter, where they receive food, clothing and emotional support. During their stay at Thakaneng Shelter, it is arranged for them to attend school. If possible, after careful consideration and evaluation of the domestic situation, the children are reunited with their families. As there was no existing program to provide stimulation for the children after school, an occupational therapy program was suggested by the Potchefstroom Mooi Rotary Club.

In order to compile a stimulation program for children, an understanding of their neuro-motor, sensory-motor and cognitive-perceptual functioning was essential.

Development of *neuro-motor function* is accompanied by increasing control of muscles during gross as well as fine motor movement. Recent neuroscientific research suggests that movement control is acquired through the cooperation of different brain structures within the CNS[10]. With dysfunction of the CNS, various problems regarding motor skills may occur, which in turn can lead to loss of or delays in the acquisition of motor control[11,12].

With normal progression of neuro-motor development, a number of abilities should already be present at the age of six years. These abilities include coordination of neck muscles for head control, adequate fine motor control and motor planning of hand muscles used during activities such as writing or drawing, sufficient

muscle tone for effective postural control, and the ability to perform coordinated rhythmic movements during the use of large and small muscle groups. Furthermore, eye movements should be smooth and coordinated to enable the child to follow objects easily, as this is required for reading. In addition, the child should be able to speak fluently with sufficient control of muscles used during speech[13]. All these components of neuro-motor functioning are of great importance for successful participation in school-related activities.

Three components play an especially important role in the development of the *sensory-motor system*, namely the tactile, proprioceptive and vestibular systems. These systems contribute to the development of normal muscle tone, automatic reactions, postural control and tactile discrimination, amongst others. Adequate sensory-motor development leads to an intact body scheme, which provides a steady foundation for bilateral integration, the development of dominance and motor planning. In children in the 6–12 years age group, sensory-motor development continues to focus on the further refinement of fine and gross motor abilities, e.g. dexterity, bilateral coordination, running and ball skills[14].

Important *cognitive-perceptual* skills have to develop in the 6–12 year old child. According to the Concrete Operational Stage of Piaget[15], the child is able to manipulate symbols in his mind and make logical deductions. The concrete operational child acquires logic mathematical abilities such as the understanding of classification. This develops into the understanding of transitions. Working, semantic and episodic memory also undergo major changes[16]. Organisation as a memory strategy is used where information is grouped together so that it can be remembered more easily. Attention span and the ability to be more focused develop alongside memory. The perceptual processing of information and decision-making improve during middle-childhood[17].

Community members, who were involved in the Thakaneng Shelter for street children in Potchefstroom, North West Province, were concerned about the problems that these children were experiencing with regard to successful reintegration into the community on a functional level. School failure was identified as one of the main problems. A possible explanation for this was that the children experienced developmental delays, which caused ineffective use of learning opportunities. Furthermore, feelings of inadequacy could cause the children to leave school and return to the streets.

A need existed for recommendations regarding applicable intervention programs, which would lead to the successful reintegration and optimal functioning of the street child within his/her environment, especially at school. As occupational therapists are often involved in the compiling and implementation of stimulation programs for children, the department of Occupational Therapy, University of the Free State in Bloemfontein, was approached by the Potchefstroom Mooi Rotary Club to become involved in this regard.

The life of a street child in the South African context is, to date, unexplored territory in the occupational therapy field of research. As no adequate information concerning the developmental status of street children is available, it was essential to investigate the degree of developmental delay experienced by the children in Thakaneng Shelter in order to make constructive and appropriate recommendations.

The aim of the study was therefore to determine whether street children at the Thakaneng Shelter experienced developmental delays in terms of neuro-motor, sensory-motor and cognitive-perceptual skills, which could have a major negative impact on their successful and functional incorporation into the community, especially at school.

Methodology

A descriptive study using quantitative measures was conducted to determine the developmental status influencing scholastic skills of the street children at Thakaneng Shelter in Potchefstroom.

Sample

The population at Thakaneng Shelter consisted of 56 children between the ages of three and sixteen. Seventeen children, all those between six and twelve years of age living in Thakaneng Shelter at the time of the study, were included in the study. The group consisted of children from the Sotho, Xhosa and Tswana cultures, male and female.

Measuring instruments

Measuring instruments included a demographic questionnaire as well as geno-maps and eco-grams that were used to obtain the children's background information. (The geno-maps and eco-grams are schematic drawings made during an interview with the child, in order to understand more about the family history and social set-up.) The standardised tests that were used included the Quick Neurological Screening Test (QNST-II)[13], the Beery-Buktenica Developmental Test of Visual-Motor Integration and Motor Coordination[18], and the TVPS: Test of Visual-Perceptual Skills (non-motor) – lower level[19].

The QNST-II test[13] was designed for persons five years of age and older. It is compiled and adapted from standard pediatric neurological tests, developmental tables and neuropsychological tests. It consists of fifteen subtests, and aspects that are thoroughly tested include motor development, gross and fine motor development, praxis (motor planning), sense of rhythm, spatial organisation, visual and auditory perceptual skills, balance and vestibular function, attention and concentration. The Beery-Buktenica Developmental Test[18], which is a standardised perceptual-motor test, evaluates specifically visual-motor integration, visual perception and motor coordination. The Visual-Motor Integration and Motor-Coordination subtests were used for this study, to supplement the TVPS[19], a standardised test for visual perceptual skills not requiring motor skills. The TVPS evaluates visual discrimination and memory, visual-spatial relations, as well as visual form constancy, sequencing, foreground-background and closure. All the tests are user and culture-friendly. For the purpose of this study the tests were scored according to the administration procedures and raw scores for the Beery-Buktenica Developmental Test and the TVPS were converted to percentiles scores.

Methods

The evaluators, who were final-year Occupational Therapy students, were trained in using these instruments to ensure that the tests were conducted correctly. Each evaluator remained responsible for a specific questionnaire or test during the course of the study to ensure inter-observer reliability.

Caregivers were trained and used as interpreters to prevent misinterpretation of instructions as far as possible. Tests were performed in the morning to minimise the effect of exhaustion which could have a negative influence on test results. Each test was performed in a different room at Thakaneng Shelter, and these venues remained the same throughout.

The study was approved by the Ethics Committee of the Faculty of Health Sciences of the UFS (ETOVS number 13/03). Written permission to carry out the study was given by the committee in charge of running the Thakaneng Shelter, which included informed consent on behalf of the children. In spite of the informed consent obtained from this committee, a child would still be allowed to refuse participation. Permission for the participants' absence from school during the research period was obtained telephonically from the principals of the particular schools.

The participants were tested anonymously and no child was subjected to activities that caused any physical or emotional discomfort. All information regarding the participants was handled confidentially.

Data analysis

Descriptive statistics, namely means and standard deviations or medians and percentiles, were calculated for continuous data. Frequencies and percentages were calculated for categorical data. Analysis of data was performed by the Department of Biostatistics, UFS.

Results

Demographic data

Out of the 56 children staying in Thakaneng Shelter, 17 complied with the criteria (i.e. were between the ages of six and twelve

years) and were included in the study as the research sample. Thirteen (76.5%) of the participants were boys. Three (17.6%) children were between six and eight years of age, while 14 (82.4%) were in the 9–12 year age group. The youngest and eldest children were 8 years 3 months and 12 years 11 months of age, respectively. Thirteen (76.5%) of the participants were Setswana-speaking, while the remaining four (23.5%) were either isiXhosa- or Sesotho-speaking. All of the boys included in the study group played soccer as a leisure activity on a regular basis, while the girls participated in a variety of games including ballgames and playing with available toys.

Results of the QNST-II test

In each of the subtests, a score can be obtained within one of three possible categories, indicating a severe discrepancy from the normal range of function, moderate discrepancy or normal range of function. Results obtained by means of the QNST-II are shown in *Table I*.

Table I: Results of the QNST-II

Test Item	Number and (%) of participants (n=17)		
	Severe discrepancy	Moderate discrepancy	Normal response
Hand skills	0	9 (52.9)	8 (47.1)
Form recognition	0	10 (58.8)	7 (41.2)
Palm shape recognition	0	2 (11.8)	15 (88.2)
Eye movements	3 (17.7)	8 (47.1)	6 (35.3)
Sound patterns	0	8 (47.1)	9 (52.9)
Finger to nose	0	1 (5.9)	16 (94.1)
Thumb finger circle	0	3 (17.7)	14 (82.4)
Stimulation to hand and cheek	4 (23.5)	4 (23.5)	9 (52.9)
Fast repetitive hand movements	0	1 (5.9)	16 (94.1)
Arm and leg extension	1 (5.9)	5 (29.4)	11 (64.7)
Tandem walk	0	6 (35.3)	11 (64.7)
Stand on one leg	3 (17.7)	9 (52.9)	5 (29.4)
Skipping	1 (5.9)	1 (5.9)	15 (88.2)
Left-right discrimination	0	10 (58.8)	7 (41.2)
Behavioral irregularities	0	4 (23.5)	13 (76.5)

Severe discrepancies were noted in subtests measuring arm and leg extension and skipping in one (5.9%) participant, eye movement and the ability to stand on one leg in three (17.7%) participants, and double simultaneous stimulation of hand and cheek in four (23.5%) participants. QNST-II subtests in which more than five children (i.e. more than one-third of the participants) showed moderate discrepancies were tandem walking (6; 35.3%), eye movement and sound patterns (8; 47.1%), hand skills and standing on one leg (9; 52.9%), and form recognition and left-right discrimination (10; 58.8%).

Results of the Beery-Buktenica Developmental Test and the TVPS

The results of the Beery-Buktenica Developmental Test of Visual-Motor Integration and Motor Coordination, as well as the TVPS – Test of Visual-Perceptual Skills (non-motor), are shown in *Table II* on page 7 as minimum and maximum percentile scores, as well as median percentile scores obtained by the 17 participants. The average percentile score that represents average performance is 50. The median percentile score obtained for the visual-motor integration section of the Beery-Buktenica test was eight, with scores ranging from one to 25. The results of the visual-motor coordination subtest were similar, with the lowest percentile score being one, the highest 23, and the median was four.

Table II. Participant percentiles on the Beery-Buktenica Developmental Test of Visual-Motor Integration and Motor Coordination and the TVPS (non-motor)

Test	Percentile Scores obtained (n=17)		
	Minimum	Maximum	Median
Beery-Buktenica			
Visual-motor integration	1	25	8
Motor coordination	1	23	4
TVPS			
Visual discrimination	1	95	9
Visual memory	1	95	25
Spatial relations	1	98	16
Form constancy	1	63	9
Figure ground	1	50	9
Visual closure	1	75	25
Sequential memory	1	75	9
Total test score	1	63	4

In the TVPS, a percentile score of 50 is also accepted as the norm. In the subtests of visual discrimination, form constancy, figure ground and sequential memory, a median percentile score of nine was obtained by the participants. The minimum percentile score obtained on these four subtests was one, while the maximum percentile scores were 95, 63, 50 and 75, respectively. Both the visual memory and visual closure subtests had a median percentile score of 25 (minimum one for both, maximum 95 and 75, respectively). The visual-spatial relations subtest yielded a median percentile score of 16 (minimum one, maximum 98). The median of the total test percentile score was four (minimum one, maximum 63).

The most notable problems observed in the participants could be categorised into three major domains of development, namely neuro-motor, sensory-motor and cognitive-perceptual development[20]. These findings are shown in *Table III*.

Discussion

On average, 63.5% of the participants performed within the normal range in the 15 subtests of the QNST-II, while 31.8% showed a moderate and 4.7% a severe discrepancy. These findings are indicative of the presence of neurological signs which can influence motor performance on a gross as well as fine motor level.

Table III: The problems indicated by results categorised into three domains of development

Neuro-motor	Sensory-motor	Cognitive-perceptual
1. Hand skills	1. Simultaneous hand and cheek stimulation	1. Visual discrimination
2. Eye movements	2. One leg stand	2. Left-right discrimination
3. Finger to nose	3. Eye movements	3. Form recognition
4. One leg stand	4. Finger to nose	4. Visual figure ground
	5. Left-right discrimination	5. Visual form constancy
	6. Hand skills	6. Visual spatial relationships
	7. Visual-motor coordination	7. Visual memory
	8. Visual-motor integration	8. Visual sequential memory
		9. Visual closure

A considerable number of the QNST-II subtests revealed definite problems. Due to the fact that left-right discrimination is considered a basic reading readiness skill, the lack thereof may cause problems with effective reading and writing. Poor hand skills may cause the child to tire quickly when writing and negatively influence his schoolwork[14]. When figure recognition and production is lacking, problems may occur with the correct naming of objects and figures, leading to further restriction of progress in reading.

The main problems noticed during eye tracking were jerky horizontal and lateral eye movement which may obstruct fluent reading, resulting in poor comprehension and diminished reading speed. Eight (47.1%) of the children showed moderate to severe discrepancies on the double simultaneous stimulation of hand and cheek, indicating the potential presence of problems with reading, verbal and cognitive abilities. Poor performance in standing on one leg, which was observed in twelve (70.6%) participants, has many implications. Balance is associated with auditory perceptual skills[11], which influences reading skills, sequencing of words and letters, as well as handwriting. Auditory perception and phonological skills are necessary for reading progress, and therefore poor performance in the sound pattern test, observed in eight (47.1%) children showing moderate discrepancies, could possibly result in poor academic achievement[14].

The findings observed in this group of street children were a cause of concern, taking into account that the norm for both the Beery-Buktenica Developmental Test and the TVPS is considered to be a percentile score of 50. The median percentile scores obtained by the participants for these two tests were much lower than 50, ranging between four and 25, as shown in *Table II*.

The median total test percentile score obtained on the TVPS was four, indicating that the visual-perceptual development skills of the population were totally inadequate. As adequate perceptual discrimination is considered necessary for the development of reading and writing skills[12], the results showed that this group of street children could undoubtedly be considered as disadvantaged with regard to this particular level of development.

The norm for the Beery-Buktenica Developmental Test, is also a percentile score of 50. In the two subtests of visual-motor integration and motor coordination, the median percentile scores of eight and four, respectively, were obtained. It could thus be concluded that these children were severely compromised with regard to the ability to reproduce on a motor level what is perceived visually. This ability plays a fundamental role in elementary activities such as writing down information from a blackboard.

The TVPS median percentile scores ranged between nine and 25 for the eight individual subtests, and were slightly less alarming than the Beery-Buktenica test results. Nevertheless, the TVPS results indicated that the development of the participants' visual-spatial abilities was compromised. These abilities are required to perceive the relations between oneself and other objects in space, as well as the relations of different objects to each other. Visual-spatial abilities are indispensable in activities such as reading and writing.

According to the Wall Model of Occupational Performance[20], the adequate development of skills tested by the TVPS is essential for the development of visual-motor integration and coordination (which is evaluated by the Beery-Buktenica test). Based on this statement, it was expected that the TVPS and Beery-Buktenica results would complement each other as they did.

As seen in *Table III*, the main cluster of problems occurred in the sensory-motor and cognitive-perceptual domains. The Wall Model of Occupational Performance[20] emphasises that the components of sensory-motor development are the building blocks of higher cognitive perceptual abilities needed for functional progress, of which school progress is an important aspect. Therefore, the higher cognitive perceptual abilities will only develop once the basic components of sensory-motor development are addressed.

The findings of this study unequivocally indicate an occurrence of potential sensory-motor and cognitive-perceptual problems in this group of street children. With the degree of developmental delay experienced by these children, it is conceivable that they will not be able to cope with the educational and academic demands made on them within mainstream schools, in addition to their specific social and emotional challenges. This statement is in line with Richter[9] who asserted that the cognitive disabilities of some boys will preclude alternatives to street life if they do not receive special educational help. As part of rehabilitation and support programs, an intervention program directed at the development of sensory-motor and cognitive abilities in these children is therefore of utmost importance.

A number of recommendations are proposed by the authors. Firstly, it is important to bring the developmental problems concerning the street child, as found in this study, to the attention of the Minister of Education. This matter has most probably not been addressed, as teachers are not empowered to handle the specific needs and problems of the street child. Secondly, collaboration between the Department of Education and the Department of Health to create community service Occupational Therapy posts within the school system, should be strongly encouraged. Community service occupational therapists can deliver a valuable service in addressing developmental delays not only within the population of street children, but with any child showing atypical development. Thirdly, the results of this study should be considered by occupational therapists involved in the treatment of street children. After completion of the study, a recommendation was made to the community occupational therapists working in Potchefstroom to get involved in the Thakaneng Shelter project. A stimulation program, including a user-friendly guide, focusing on the sensory-motor and cognitive-perceptual development of the child was provided to the caretakers of Thakaneng Shelter. Finally, further comparative studies should be performed on street children in all the major cities in South Africa in order to obtain a more complete picture of this subgroup of the population.

With the implementation of these recommendations, it is likely that the future of the street children of Thakaneng Shelter would hold prospects of a better life. Although this research is only a drop in the ocean in terms of the life of street children in South Africa, the researchers trust that it will contribute to the improvement of the quality of living of these children.

As Anirudhra has stated the re-introduction of the street child to innovative learning strategies which are tailored to suit his/her aptitude and abilities within a supportive, stimulating and secure environment based on love and trust, will lead him/her to discover not only education but the human virtues of love and a sense of belonging[3].

Acknowledgements

- Fourth-year Occupational Therapy students Esna Carroll, Mara de Wit, Joanne Flanegan, Elizabeth Laubscher and Janie Rautenbach for conducting the tests;
- Mooi Rotary Club, Potchefstroom for financial support;
- All the staff and children at Thakaneng Shelter who participated in the study;
- Daleen Struwig, medical writer, Faculty of Health Sciences, University of the Free State, for technical and editorial preparation of the manuscript for publication.

References

1. Schafer P. The twilight world of street children. Reader's Digest, 1989, 134: 19–24.
2. Consortium for Street Children. "Reports on street children". <http://www.streetchildren.org.uk/reports/South%20Africa%20Child.doc> (17 Feb 2009).
3. Anirudhra K. Street Children in South Africa: Working Towards Socio-educational Solutions. UNISA: Pretoria, 1998.
4. Reganick K."Prognosis for Homelessness: Children and Adolescents." *Childhood Education*. 1997. <http://www.thefreelibrary.com/Prognosis+for+homless+children+and+adolescents.-a019263545> (3rd Aug 2009).
5. Davids A, Nkomo N, Mfecane S, Skinner D, Ratele K. Multiple Vulnerabilities: Qualititative data for the study of orphans and vulnerable children in South Africa. HSRC Press: Pretoria, 2006.
6. Norton S. Is behavior or morphology a more sensitive indicator of central nervous system toxicity? Environmental Health Perspectives, 1978; 26: 21–27.
7. Kruger JM, Richter LM. South African street children at risk for AIDS? African Insight, 1996; 26: 3–6.
8. Boa W, Whitbeck LB, Hoyt DR. Abuse, support and depression among homeless and runaway adolescents. Journal of Health and Social Behaviour, 2000; 41: 408–420.
9. Richter L, Van der Walt M. The psychological assessment of South African street children. Children, Youth and Environments, 2003; 13(1): 1–19.

10. Shumway-Cook A, Woollacott MH. Motor Control. Theory and Practical Applications. Lippincott Williams and Wilkins: Philadelphia, 2001.
11. Case-Smith J. Occupational Therapy for Children, 4th ed. Mosby: Toronto, 2001.
12. Gesell A, Amatruda CS. Developmental Diagnosis. Normal and Abnormal Development. 2nd ed. Harper and Row Publishers: London, 1969.
13. Mutti MC, Martin NA, Sterling HM, Spalding NV. Quick Neurological Screening Test. 2nd ed. Academic Therapy Publications: Novato CA, 1998.
14. Seifert KL, Hoffnung RJ. Child and Adolescent Development. Houghton Mifflin Company: Boston, 1987.
15. De Kock D. Music for Learning. Maskew Miller Longman: Cape Town, 1989.
16. Zaichkowsky LD, Zaichkowsky LB, Martinek TJ. Growth and Development. The Child and Physical Activity. C.V. Mosby Company: St. Louis, 1980.
17. Reynolds CR, Fletcher-Janzen E. *Handbook of Clinical Child Neuropsychology*. Plenum Press: New York, 1989.
18. Beery KE. The Beery-Buktenica Developmental Test of Visual-Motor Integration. Modern Curriculum Press: New Jersey, 1997.
19. Morrison FG. TVPS: Test of Visual-Perceptual Skills (non-motor) – lower level. Academic Therapy Publications: Novato CA, 1982.
20. Van Jaarsveld A, Janse van Rensburg E. The Wall Model of Occupational Performance. CD Publication, Department of Occupational Therapy, University of the Free State: Bloemfontein, 2010.

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Assessing tactile perception in limited visibility could be child's-play: developing the Tupperware Neuropsychological Task

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ABSTRACT

In task-environments with limited visibility (e.g. rescue workers in smoke), individuals rely on tactile perception as a primary mode of data acquisition. They need to translate tactile information into three-dimensional images, to solve problems mentally, before translating them into motor actions.

To assess this ability in an inexpensive, standardised way, the Tupperware Neuropsychological Task (TNT) was developed. It is a timed task using the Tupperware™ Shape O Toy. Participants completed the TNT blindfolded, and also completed standardised measures of spatial visualisation, tactile form perception and memory, and fine motor coordination.

Healthy adults (N=170) aged 19 to 30 completed the tasks on all tests on an individual basis. This paper reports normative data for the TNT, including mean completion time and standard deviations. It also reports small but significant correlations with other measures of tactile form perception, mental rotations, motor manipulation and tactile recall. This suggests that the TNT taps all these constructs in one task, which would make it an economical measure of the functions required to work effectively in low visibility environments.

Key words: tactile form perception; mental rotation; tactile memory

Introduction

Within the South African context, formal neuropsychological tests are expensive, and often require substantial infrastructure (tables/chairs, pen/paper, blocks/cards, etc.), as well as some level of educational attainment, which makes administration difficult under unusual circumstances (e.g. "field testing").

While education levels are improving generally, a large proportion of the South African population has limited education[1], but most of this section of the population are still intelligent and enthusiastic, often making ability tests for individuals with limited education either too simple or not interesting enough[2]. They often require more stimulating tasks to assess their abilities by practical means.

The author has been using the Tupperware™ *Shape O Toy* in practice as a playful way to assess psychomotor development and other fine motor skills of patients. It is easy to use, fun to do, and elicits much information through simple observation. The playful nature, three-dimensional form, and time challenge aspects of the task generates interest and stimulates. The robust plastic three-dimensional forms also make it appropriate for use with individuals with visual challenges (e.g. limited sight).

The author's experience suggested that this toy might provide information on a number of psychological functions, as the toy appeared sensitive to tactile form perception, visuo-spatial perception, and fine motor coordination. Furthermore, it appeared sensitive to the effect of anxiety on neuropsychological performance, concentration, and frustration tolerance, as well as eliciting information on logical processing (in problem-solving). As these were subjective observations made by the author, the thought was born to test them by correlating performance on the *Shape O Toy* with standard neuropsychological measures.

Apart from the general population, individuals who work in environments where there is limited visibility (for example, due to water or smoke), good sensory-motor coordination is essential. This would include groups such as rescue workers (e.g. firemen)[3], and military personnel (e.g. divers or bomb disposal operators)[4,5]. They often work where visibility is obscured by smoke, dirty water, or their protective clothing. In a task-environment where visibility has deteriorated, individuals rely on tactile perception as a primary mode of data acquisition[5]. They need to translate tactile information into three-dimensional images, and then solve the problem by mentally manipulating the image before translating it into motor actions, with tactile sensation acting as the feedback mechanism. Other occupational groups include technicians[6] who may need to work where they cannot see their hands, in particular when they work from a diagram or design with their hands out of their sight.

To assess this ability in an inexpensive, standardised way, the Tupperware Neuropsychological Task (TNT) was developed. In essence the TNT is a timed task using the Tupperware™ *Shape O Toy*, with a standard instruction sheet and scoring rules, formulated by the author. It is easy to transport, easy to administer, easy to interpret, and requires little formal education to complete. The TNT is in essence a 'home-made' task to assess performance in unusual circumstances such as limited visibility. For any task to be