Anuario de Psicología/The UB Journal of Psychology
2014, vol. 44, nº 2, 185-198

The first Spanish version of the NEPSY for the assessment of the neuropsychological development in a sample of Spanish children

Ángel Aguilar-Alonso
M. Torres-Viñals
Universitat de Barcelona
E.M Aguilar-Mediavilla
Universitat de les Illes Balears

All the subtests of the first Spanish language version of the NEPSY were administered to a sample of 415 children aged 3 to 12 years old: 193 boys and 222 girls. For statistical analysis, the sample was divided into two groups: one comprising 98 children aged 3-4, and the other 317 children aged 5-12. First, the adjustment of the distribution of the different items of this Spanish version of the NEPSY subtests to the normal curve was checked. The usefulness of these subtests to assess the level of children's development according to their chronological age was then tested using regression analysis. Finally, we checked that the raw scores on the subtest items of this Spanish version of the NEPSY differed significantly between 3 and 4 year olds and between 5 and 6 year olds: in each age pair, the mean scores of the older group increased in accuracy and decreased in runtime and errors.
Keywords: *NEPSY, assessment, neuropsychology, development.*

Primera versión española del NEPSY para la evaluación neuropsicológica del desarrollo en una muestra de niños españoles

Se administran todos los subtests de la primera versión en castellano del NEPSY a una muestra de 415 niños de 3 a 12 años de edad: 193 varones y 222 niñas. Para las tareas estadísticas, se separan en dos grupos: uno de 98 niños

Correspondencia: Ángel Aguilar Alonso, Universitat de Barcelona, Facultat de Psicologia, Departament de Personalitat, Avaluació i Tractaments Psicològics, Passeig de la Vall d'Hebron, 171, 08035. Barcelona, Spain. aaguilaraguilarpsi@ub.edu

de 3-4 años y otro de 317 de 4-12 años. En primer lugar, se comprueba el ajuste de las distribuciones de las distintas variables de los subtest de esta versión española del NEPSY a la curva normal. Posteriormente se comprueba la utilidad de estos para verificar el nivel de desarrollo de los niños por su edad cronológica, mediante un análisis de regresión. Finalmente, se verifica que las diferencias en las puntuaciones directas de las distintas variables de los subtests de esta versión española del NEPSY, entre los niños de 3 y 4 años y entre los de 5 y 6 años, son estadísticamente significativas, de forma que ambos grupos de niños mayores aumentan las medias en exactitud y disminuyen las del tiempo de ejecución y los errores en las diferentes tareas.

Palabras clave: *NEPSY, evaluación, neuropsicología, desarrollo*

Introduction

The *NEPSY: A Developmental Neuropsychological Assessment* was developed by Korkman, Kirk and Kemp in 1998 as a new tool for neuropsychological assessment and research in children. The battery is based on Luria's neuropsychological model. Luria (1973) states that any activity, including speech or motor skills, is a complex functional system that involves a variety of separate processes and requires specific evaluation tasks. One of the advantages of Luria's investigation compared to others is that it allows a qualitative analysis of visible disabilities during the exploration process. In the preparation of NEPSY, Luria's investigation was transformed into a psychometrically elaborated test battery (Korkman, 1988).

The 27 subtests of NEPSY were developed from the components of complex functions proposed by Luria's model. Some other processes that were not originally present were added such as facial recognition or speeded naming. In addition, NEPSY also takes account of neuropsychological theory and practice regarding children's development, and the subtests have different degrees of difficulty depending on the child's age.

NEPSY assesses five functional complex cognitive domains: Attention/Executive Functions, Language, Sensory-motor Functions, Visuospatial Processing, and Memory and Learning. These five basic domains may be affected in different ways, and are composed of 27 different subtests which assess possible contributory factors to a primary deficit. This allows the evaluator to determine whether the alteration is specific to a functional domain (and is thus a primary deficit), or whether it is due to another area (and is thus a secondary deficit).

Since its publication in 1998, NEPSY has been used to diagnose English-speaking children with a range of neurological disorders and injuries. Some studies were cited by the authors in the US edition of the NEPSY manual, and others have appeared in journals in different countries (e.g. Korkman, 1999; Crews & D'Amato, 2009; Molfese, *et al*., 2010, Kikkert, de Jong, & Hadders-Algra, 2013).

Some of them use adaptations to other languages (e.g. Visu-Petraa, Cheiea, Bengaa, & Micleab, 2012, in the Romanian population).

This paper uses the Spanish version of NEPSY, developed by the Department of Personality, Assessment and Psychological Treatment of the University of Barcelona in 2000 (Aguilar, Torres, Roldán, Mendoza & Sangorrín: NEPSY, una Evaluación Neuropsicológica del Desarrollo, 2000).

Previous research has been carried out with a version of NEPSY in samples of children with typical development and with a variety of diseases and developmental disorders (Sánchez-Lancis & Aguilar, 2000; Sangorrín, Quero & Idiazábal, 2000; Aguilar, & Sánchez-Lancis, 2002a. Aguilar, & Sánchez-Lancis, 2002b; Aguilar-Me-diavilla, Pérez-Castelló, Rigo-Carratalà, &d Sastre-Vidal, 2010; Aguilar-Mediavilla, Sastre-Vidal, Pérez-Castelló & Rigo-Carratalà, 2010; Aguilar & Moreno, 2012).

Korkman, Kirk and Kemp brought out the second edition of NEPSY in 2007, and it is currently in use in a number of countries for the assessment of neurocognitive abilities in preschoolers, children, and adolescents (Brooks, Sherman & Strauss, 2010). It is applied to children from the ages of 3 until 16, in two forms: one for the 3-5 age group, and the other for the 5-6 age group. This new version presents some differences with respect to NEPSY I: The age range is extended to 16 years; domain coverage increases from five to six, with the addition of Social Perception; the administration is based on diagnostic groupings of subtests or on the referral question; more clinically useful subtest scores replace the domain scores of the previous editions; new subtests are introduced (Theory of Mind and Inhibition) and decision trees for subtest selection are introduced to minimize testing time. In addition, the publishers (NCS Pearson) have recently adapted NEPSY II to the Spanish population; the new version will be available soon (Korkman, Kirk, & Kemp, 2014).

Objectives

The aims of this study are:

1. To check the normal distribution of raw scores of the Spanish version of NEPSY subtests.
2. To test the usefulness of the Spanish version of NEPSY subtests for assessing children's level of development by age.
3. To verify the developmental differences in NEPSY raw scores by age in a Spanish sample; i.e., to check that mean scores for accuracy increase, and mean scores for time and errors decrease with increasing age.

Method

Sample

The sample consisted of 415 children (193 boys and 222 girls) between the ages of 3 and 12. The frequencies of the sample by age can be seen in table 1.

TABLE 1. FREQUENCIES OF THE SAMPLE BY AGE.

Ages	*Frequency*	*Percent*
3.00	38	9.2
4.00	60	14.5
5.00	50	12.0
6.00	42	10.1
7.00	41	9.,9
8.00	25	6.0
9.00	26	6.3
10.00	36	8.7
11.00	49	11,8
12.00	48	11.6
Total	415	100.0

They were divided into two separate groups for statistical purposes. The preschool group comprised 98 children aged 3 and 4, and the school group comprised 317 children aged 5 to 12. *'The subtests suitable for preschool and school-age children vary somewhat'* (Korkman *et al*. Manual, 1998, p.45).

All were from normal schools in 14 different centers in Spain (Universities of Barcelona, Santiago de Compostela, Salamanca, Complutense, Cantabria, Granada and Valencia; Hospitals of San Juan de Dios, del Mar and Clinico in Barcelona; Public Schools in Alcañiz, Sitges, Santiago and Madrid).

Children with disorders such as autism, characterial disorder, serious school failure, mental retardation, childhood psychosis, personality disorder, and brain injury were excluded from the sample.

Variables

- Chronological age in months.
- Children's raw scores on the different NEPSY subtests. There are more variables than subtests, since some of them have different scores for measuring the success of the task, the completion time, the errors, the total score

based on various criteria, performance achieved with the preferred and non-preferred hand, etc.

Instruments

The Spanish version of *'NEPSY A Developmental Neuropsychological Assessment"* (Korkman, *et al.*, 1998), adapted by Aguilar *et al.* (2000). Classified by domains, the subtests are as follows:

- Attention/Executive Functions: 'Tower'*, 'Auditory Attention and Response Set'*, 'Visual Attention', 'Statue', 'Design Fluency'*, and 'Knock and Tap'*.
- Language: 'Body Part Naming' (Preschool children only), 'Phonological Processing', 'Speeded Naming'*, 'Comprehension of Instructions', 'Repetition of Nonsense Words'*, 'Verbal Fluency', and 'Oromotor Sequences'.
- Sensoriomotor Functions: 'Fingertip Tapping'*, 'Imitating Hand Positions', 'Visuomotor Precision', 'Manual Motor Sequences', and 'Finger Discrimination'*.
- Visuospatial Processing: 'Design Copying', 'Arrows' (school children), 'Block Construction', and 'Route Finding'*.
- Memory and Learning: 'Memory for Faces'*, 'Memory for Names', 'Narrative Memory'*.
- 'Sentence Repetition'.
- 'List Learning'*.

[* For school children only.]

Analysis techniques

Statistics: SPSS for Windows 14.0

First, we carried out Kolmogorov-Smirnov tests and kurtosis, skewness and descriptive analyses to assess the assumption of normal distributions of the variables. In order to test the hypothetical linear relationship between the set of NEPSY variables and age, two multiple regression analysis were performed, one for each age group. We then compared the raw scores for the NEPSY variables obtained by the adjoining age groups of 3-4 and 5-6 years. To verify whether the differences were as expected, and whether they were statistically significant, an unequal variance *'t'* test was carried out for independent samples.

Variables for the regression procedure

- Independent variables: Children's raw scores on NEPSY subtests, including accuracy and errors, time, deferred and not deferred task, preferred and non-preferred hand and, where appropriate, total (sum of the two tasks.)
- Dependent variable: Chronological age in months.

Procedure

The sample was recruited with the consent of parents and teachers from state and partially state-funded schools from various cities and towns in Spain. After recording of personal data, all children were individually administered the expanded Spanish version of NEPSY (all subtests indicated for the two age groups), in accordance with the rules of the US edition, usually over two or three sessions. As certain children were unable to complete the full set of subtests, because of their personality traits, school absences due to illness or family reasons, etc., some subgroups of the sample may present different frequencies. The mean time taken to administer NEPSY was 2 hours and 30 minutes.

Results

Objective 1

The distribution of raw scores of different variables tended towards normality, showing acceptable skewness and kurtosis (values between 1 and -1), except for some variables:

- 'Speeded Naming': This subtest was very easy for older children. The variable 'accuracy' had a very low ceiling: skewness -3.63 and kurtosis 13.58. However, this same subtest, the variable 'time' showed acceptable values of normal distribution: skewness .76 and kurtosis .93. That is, age-related differences in performance in this subtest were not manifested in the number of successful completions of the task, but by the time taken to complete it.
- 'Delayed Memory for Faces': skewness -.07, but kurtosis 3.67. This kurtosis is due to the fact that the distribution curve is flat, the number of all possible scores is similar, and number of subjects performing this subtest (n=115) is low.
- Time taken on 'Fingertip Tapping': skewness 2.42 and kurtosis 7.04. The distribution is many times below the mean: that is, the test was fairly easy for many children (n=314).
- Time taken on 'Visual-motor Precision': skewness 1.38 and kurtosis 2.2 (n=168). This subtest is also easy. However, the distribution by 'errors' is standard.
- 'Finger Discrimination'. Preferred Hand: skewness = -2.06 and kurtosis = 5.45, n = 252. No preferred hand: skewness = -.1.88, and kurtosis = 6.04, n = 251. Total scores: -2.09 and 7.43. Many values were at the extremes of the distribution, with a slight peak in right hand scores.
- 'Knock and Tap': skewness = -2.56 and kurtosis = 8.32, n = 249. The distribution was similar to the previous variable.

Objective 2

To assess the children's level of development by age, we applied a multiple regression procedure to verify the *R* correlation between all NEPSY variables (independent variables) and chronological age in months (dependent variable) and to determine the portion of variance accounted for by the independent variables in both groups of children separately (R^2). Table 2 shows the Model Summary obtained in step 8 for the 3-4 year age group using the stepwise method, and in step 13 for the 5-12 year age group. In both groups, the *p* value to enter was 0.05 and the *p* value to be removed was 0.10. The method selected different NEPSY predictors to form multiple regression equations on the age dependent variable.

TABLE 2. MODEL SUMMARY OF THE MULTIPLE REGRESSION PROCEDURE FOR CHILDREN 3-4 AND 5-12 YEARS. INDEPENDENT VARIABLES: NEPSY SUBTESTS. DEPENDENT VARIABLE: CHRONOLOGICAL AGE IN MONTHS.

Age	*R*	*R square*	*Adjusted R square*	*Standard error*	*DF*	*Sig. F*
3-4	.942	.887	.867	.22590	45	.007
5-12	.987	.975	.965	.26677	34	.023

In the 3-4 year age group, the multiple correlation between the set of subtests of the NEPSY and age was very high (.942), and the adjusted R^2 as well (.867). This is an accurate value of the portion of shared variance of the variables. That is, around 87% of the variance in chronological age was accounted for by 'Design Copy', 'Visual Attention: Time', '*Manual Motor Sequences'*, 'Block Construction', 'Narrative Memory', 'Visual Attention: Accuracy', '*Sentence Repetition'*, and 'Imitating Hand Positions: Total score with both hands'. These are the variables that entered (default p=.05) the multiple regression equation in the eighth step; but other variables of the NEPSY were removed (default p=.10), due to their small contribution to the variance. The small significance of *F* (0.007) shows that the likelihood of a given correlation occurring by chance is low.

In the 5-12 year age group, table 2 shows the Model Summary obtained in step 13 using the Stepwise method, with *p* values of 0.05 to enter and .10 to be removed. As in the 3-4 year olds, the multiple correlation between the set of subtests of the NEPSY and age was very high (.975) and the adjusted R^2 as well (.965). That is, 96.5% of the variance in chronological age was accounted for by 'Phonological Processing', 'Repetition of Nonsense Words', 'Narrative Memory', 'Finger Discrimination: Non preferred hand', 'Block Construction', 'Visual At-

tention: Accuracy', 'Finger Discrimination: Preferred hand', 'Speeded Naming: Time', 'Imitating Hand Position: Non preferred hand', 'Arrows', 'Auditory Attention and Response Set', 'Memory for Faces', and 'Oral Motor Sequences'. These are the variables that entered the multiple regression equation (default p=.05), and the rest were removed (default p=.10).

So, we can say with some confidence that the changes in the variables introduced into the equation were related to the age of children in the two groups. We may hypothesize that these changes indicate that with increasing age, accuracy improves, the time taken falls, and the raw scores on the subtests indicated increase. To test this hypothesis, we move on to objective 3.

Objective 3

To verify the expected developmental differences in NEPSY raw scores by age, given the large number of variables and groups we only present the differences obtained in sample groups of the adjacent ages: 3 year-olds versus 4 year-olds, and 5 year-olds versus 6 year-olds.

In table 3 (see next page) we see that Levene's Tests for equality of variances indicate that some variances for 5 year-olds and 6 year-olds differ significantly from each other ($p \leq .05$). Therefore we need to use the unequal variance *'t'* test to check whether the differences in the means of the different variables between the two groups are as expected, and significant.

In summary, the differences between the 5 and 6 year-olds' means are significant ($p \leq .05$) and go in the expected direction: i.e., the means are higher in six year-olds in the subtest variables that require accuracy, and are clearly lower in runtime variables and commission errors. Therefore we can assume that the subtests of the Spanish version of the NEPSY are able to assess differences in children by age, at least in these groups. However, there are some exceptions:

- 'Memory for Faces' has a difference of 2.35, favorable to younger children, although it was not statistically significant (p = .096), and the distribution of their scores was not normal according to the Levene test (p = .002). In contrast, in the variable 'Memory for Faces: Deferred', the difference was as expected (- 2.96) and highly significant (p <.001).
- 'Statue': the mean was slightly higher in younger children, but the difference was not statistically significant.
- On the other hand, the subtests: 'Design Fluency', 'Repetition of Nonsense Words' and 'Knock and Tap' showed the expected differences, but were far from reaching statistical significance. 'Memory for Names' also shows no significant difference; however, the difference was highly significant in the variable 'Memory for Names: Deferred (p < .001).

TABLE 3. DIFFERENCES IN MEAN PERFORMANCE IN THE VARIABLES OF THE SUBTESTS OF THE NEPSY BETWEEN CHILDREN AGED 5 AND 6: T TEST FOR INDEPENDENT SAMPLES, UNEQUAL VARIANCE TEST.

Variables	*Levene's Test Sig.*	*t*	*DF*	*Sig.*	*Mean 4 years*	*Mean 5 years*	*Mean diff.*
Design Copy	.96	-4.020	83.90	.000	45.06	52.57	-7.51
Phonological Processing	.89	-3.752	83.00	.000	13.13	17.32	-4.20
Memory for Faces	.002	1.684	74.56	.096	20.42	18.07	2.35
Tower	.30	-2.248	81.62	.027	10.25	12.07	-1.81
Auditory Attention and Response Set	.48	-2.093	80.00	.040	63.78	76.17	-12.38
Speeded Naming: Accuracy	.16	-1.514	59.84	.135	53.94	57.11	-3.17
Speeded Naming time	.06	2.572	58.87	.013	170.17	133.38	36.79
Arrows	.918	-3.961	85.15	.000	10.70	15.83	-4.83
Memory for Faces: Deferred	.073	-3.797	59.8	.000	9.00	11.96	-2.96
Memory for Names	.031	-1.152	71.80	.253	13.08	14.3	-1.18
Fingertip Tapping	.94	.317	86	.752	117.38	113.58	3.80
Visual Attention: Accuracy	.863	-4.111	49.71	.000	23.94	31.00	-7.06
Visual Attention: Time	.102	1.877	46.42	.067	242.61	221.12	21.49
Comprehension of Instructions	.659	-2.688	84.64	.009	16.39	18.43	-2.04
Imitating Hand Position: Preferred hand	.001	-4.072	53.73	.000	7.43	9.67	-2.24
Imitating Hand Position: Non-pref. hand	.018	-5.573	59.50	.000	6.17	9.30	-3.12
Imitating Hand Position: Total	.001	-4.933	78.66	.000	14.33	18.41	-4.08
Visual-Motor Precision: Errors	.000	7.006	53.42	.000	56.06	13.20	42.86
Visual-Motor Precision: Time	.92	-1.094	51.55	.279	133.39	65.83	-19.21
Narrative Memory	.26	-3.993	85.98	.000	12.85	17.41	-4.56
Memory for Names: Deferred	.129	-4.612	46.51	.000	3.26	4.81	-1.56
Memory for Names: total	.811	-1.148	55.30	.256	15.63	17.11	-1.48
Block Construction	.023	-3.754	32.98	.001	9.04	11.56	-2.52
Sentence Repetition	.319	-1.942	61.70	.057	16.48	18	-1.52
Statue	.013	.532	36.43	.598	24.41	23.72	.69
Design Fluency	.166	-.846	56.45	.401	13.02	13.95	-.93016
Repetition of Nonsense Words	.094	-1.387	56.41	.171	25.34	27.48	-2.14
Route Finding	.494	-3.599	43.49	.001	3.13	5.3	-2.18
Verbal Fluency: Semantics	.209	-2.629	24.89	.014	18.29	22.91	-4.61
Verbal Fluency: Phonetics	.265	-2.753	8.000	.025	5.00	8.78	-3.78
Verbal Fluency: Total	.062	-12.64	8.000	.000	17	30.78	-13.78
Manual Motor Sequences	.763	-2.445	42.16	.019	36.63	42.04	-5.41
Oral Motor Sequences	.946	-2.078	40.13	.044	31.39	35.35	-3.96
Finger Discrimination: Preferred hand	.030	-3.754	66.99	.000	14.52	16.69	-2.17
Finger Discrimination: No pref. hand.	.804	-1.280	62.80	.205	14.65	15.35	-.69
Finger Discrimination: Total	.141	-2.886	66.95	.005	29.17	32.04	-2.87
Knock and Tap	.825	-.187	46.20	.852	25.35	25.61	-.260

TABLE 4. DIFFERENCES IN MEAN PERFORMANCE IN THE VARIABLES OF THE SUBTESTS OF THE NEPSY BETWEEN CHILDREN AGED 3 AND 4: T TEST FOR INDEPENDENT SAMPLES, UNEQUAL VARIANCE TEST.

Variables	*Levene's Test Sig.*	*t*	*gl*	*Sig.*	*Mean 3 years*	*Mean 4 years*	*Mean Diff.*
Design Copy	-8.79	-8.796	75.37	.000	17.55	35.27	-17.71
Body Part Naming	.564	-2.330	58.30	.023	8.17	10.70	-2.53
Phonological Processing	.046	-3.799	67.23	.000	7.31	9.45	-2.1
Visual Attention: Accuracy	.046	-2.199	58.72	.032	30.21	33.59	-3.38
Visual Attention: Time	.000	5.396	54.92	.000	270.73	183.41	87.33
Comprehension of Instructions	.017	-8.275	94.27	.000	9.71	15.07	-5.36
Imitating Hand Position: Preferred hand	.014	-3.519	45.41	.001	4.62	6.38	-1.76
Imitating Hand Position: Non-pref. hand	.187	-3.789	46.79	.000	3.59	5.17	-1.58
Imitating Hand Position: Total	.005	-8.493	94.17	.000	8.49	13.80	-5.31
Visual-Motor Precision: Errors	.001	5.221	49.50	.000	61.23	24.34	36.89
Visual-Motor Precision: Time	.001	-1.563	37.53	.127	77.94	103.14	-25.20
Narrative Memory	.201	-4.628	89.43	.000	5.26	9.83	-4.57
Block Construction	.000	-9.260	94.52	.000	5.42	7.60	-2.18
Sentence Repetition	.117	-3.425	60.33	.001	10.51	13.63	-3.12
Statue	.117	-2.529	64.34	.014	18.97	22.76	-3.81
Verbal Fluency: Semantics	.012	-5.452	42.96	.000	10.37	15.50	-5.12
Manual Motor Sequences	.001	-9.813	94.48	.000	18.35	35.05	-16.70
Oral Motor Sequences	.297	-4.141	74.47	.000	17.92	26.22	-8.30

In the sample of 3-4 year olds, the Levene test also showed that the scores for some variables are not normally distributed, and so an unequal variance '*t*' test was used. Table 4 shows that the differences were as expected, with a clearly superior performance of older children on the subtests. These differences in means were statistically significant, with increases in accuracy and successful completions and decreases in errors and performance time, except for the variable 'Time' on the 'Visuomotor Precision' subtest. In this subtest, the children must draw a line down a track without touching the sides and without turning the paper, as fast as they can. Four year olds produced a lower mean of errors by touching the sides and turning the paper, but some took longer to execute the task: that is, they were slower because they were more careful, whereas many of the smaller ones were quick and impulsive, and made many errors drawing the line. However, this difference did not reach statistical significance *(p*=.127), so the result may be due to chance.

Conclusions and Discussion

We observed a general tendency towards a normal distribution of the variables of the Spanish NEPSY subtests, albeit with some exceptions. In general, some of the subtests were easy for many older children.

We used multiple regression to check the discriminatory capacity of the Spanish version of NEPSY subtests to differentiate between normal school children according to their chronological age. The adjusted R^2 was high for both 3-4 and 5-6 year olds. Not all variables of the Spanish version of NEPSY entered the regression equation, so we might think that these variables are unnecessary or redundant; it should be noted that the sample comprised normal school children, and NEPSY was also designed for children with different types of problems including deficiencies and disorders related to areas of the nervous system which need to be evaluated by different and specific subtests. This has been shown in many publications on the Spanish and English versions. The regression analysis suggests that some subtests are not sensitive enough to explain common variance with age, but may help to assess children's neuropsychological disorders.

Although the ages compared are close (5-6 and 3-4), we found that for the most part the Spanish NEPSY was useful in differentiating children by chronological age, except in certain subtests in which the differences did not reach statistical significance. Its domains and subtests are designed to assess children's capacities, the level of their nervous system development, their cognitive processes, their general and fine motor activity, and their sensory aptitudes. All this is very important to determine children's developmental state, and to know whether their level is comparable to that reached by their peers; but there is also a clinical interest in comparing them with other children with disorders, as a result of dysfunction of the nervous system or other organic bases of child development. Thus, in terms of clinical interest, the low ceiling –that is to say, the low upper limit of the

achievement for older children – suggests that the questions on the test were not difficult enough to measure true ability or knowledge. Normally, a test ends when a child makes errors or misses a specific number of consecutive questions, as in NEPSY. Nevertheless, some clinical tests have been designned for people that classified in statistical normality can solve 100% of their items. An example is the Bilingual Aphasia Test (Paradis & Libben, 1087; Gómez-Ruiz, 2008). In the case of NEPSY, some of the subtests were easy for older children, such as 'Fingertip Tapping', 'Visual-motor Precision', 'Finger Discrimination' and 'Knock and Tap'. But some children fail tests which others of their age and condition pass – for instance, if they have some neuropsychological dysfunction, injury or disorder that prevents them from completing the task, whether it is easy or difficult.

We present the differences in mean performance in the different variables of the NEPSY subtests between 3 year-olds and 4 year-olds, and between 5 year-olds and 6 year-olds. The results show that, in these pairs of ages at least, with increasing age success rates rise and time taken and errors both fall. We can assume that such age differences can be explained by the level of maturity reached by the nervous system. Thus, we conclude that the age effect on the variables of this first Spanish version of the NEPSY is the result of neuropsychological development of the children in the five functional domains studied.

These results corroborate those published by the authors of the NEPSY who assume that it is useful to show the effect of age on the development of neurocognitive performance: «The fourth purpose for developing de NEPSY was to create a reliable and valid instrument for the study of normal and atypical neuropsychological development in preschool and school-age children. Because de NEPSY was standardized on a single sample of children. It is possible to detect patterns of age-related quantitative and qualitative changes in the children's performance» (Korkman *et al*, *Manual*, p.3, 1998). For this fourth purpose, the authors present different performance tables by age in the first USA version.

Moreover, related works have been published, such as the effects of the age and duration of reading instruction on the development of phonological awareness, rapid naming, and verbal memory spam (Kokman, M., Barron-Linnankoski, S. & Lahti-Nuuttila, P. (1999), and how the errors decrease with age (Fiducia , & O'Leary, 1990). More recently, a paper has been published on the neurocognitive development in five-to 16-year-old North Amercan children, using the USA version of the NEPSY II (Korkman, Lahti-Nuuttila, Laasonen, & Holdnacck, 2013).

REFERENCIAS

Aguilar, A., & Moreno, V. (2012). *Neuropsychological differences between samples of dyslexic and reader children by means of NEPSY*. Anuario de Psicología/The UB Journal of Psychology, 42(1), *35-52.*

Aguilar, A., & Sánchez-Lancis, E. (2002a). Capacidad discriminativa del NEPSY en trastornos del desarrollo del lenguaje y de la comunicación. Comunicación al *Congreso Internacional de Foniatría, Audiología, Logopedia y Psicología del Lenguaje*. Salamanca..

Aguilar, A., & Sánchez-Lancis, E. (2002b). Neuropsychological profile of children with different disfunctions and behavioral problems, by means of the NEPSY. *American Journal of Medical Genetics. Neuropsychiatric Genetics, 114(7),* 809.

Aguilar-Mediavilla, E., Pérez-Castelló, J., Rigo-Carratalà, E., & Sastre-Vidal, M. (2010). Procesos cognitivos en niños con Trastorno Específico del Lenguaje. *VI Congreso Internacional de Adquisición del Lenguaje*. Barcelona (Spain).

Aguilar-Mediavilla, E., Sastre-Vidal, M., Pérez-Castelló, J., & Rigo-Carratalà, E. (2010). Procesos lectores iniciales en niños con Trastorno Específico del Lenguaje. *XXVII Congreso Internacional de AELFA: Nuevos Retos y Posibilidades*. Valladolid (Spain).

Brooks, B.L., Sherman, E.M.S., & Strauss. E. (2010). Test Review: NEPSY-II: A developmental neuropsychological assessment, second edition. *Child Neuropsychology, 16*, 80-101.

Crews, K.J., & D'Amato, R.C. (2009). Subtyping children's reading disabilities using a comprehensive neuropsychological measure. *International Journal of Neuroscience, 119,* 1615-1639.

Dixon, L.A., & Kelly, Th.P (2000). The reliability and validity of using the NEPSY with English preschool children. Paper in *International Workshop on Children Neuropsychological Assessment. The Year 2000*, Barcelona.

Fiducia , D., & O'Leary, D.S. (1990). Development of a behavior attributed to the frontal lobes and the relationship to other cognitive functions. *Developmental Psychology, 6(2)*, 85-94.

Gómez Ruiz, I. (2008). *Aplicabilidad del Test de la Afasia para Bilingües de Michel Paradis a la población catalano/castellano parlante. Tesis Doctoral*. Dtor. Á. Aguilar. Universitat de Barcelona

Kikkert, H. K., de Jong, C., & Hadders-Algra, M. (2013). Minor neurological dysfunction and cognition in 9-year-olds born at term. *Early Human Development 89*, 263-270.

Korkman, M. (1988). *A proposed neuropsychological test battery for young developmentally disabled children. Theory and evaluation* (Academic Dissertation, University of Helsinki, 1988).

Kokman, M., Barron-Linnankoski, S., & Lahti-Nuuttila, P. (1999). Effects of the age and duration of reading instruction on the development of phonological awareness, rapid naming, and verbal memory spam. *Developmental Neuropsychology,* 16(3), 415-431.

Korkman, M. (1999). Applying Luria's diagnostic principles in the neuropsychological assessment of children. *Neuropsychology Review, 9,2*, 89-105.

Korkman, M., Kirk, U., & Kemp, S. (1998). *NEPSY. A developmental neuropsychological assessment.* San Antonio: The Psychological Cor. Harcourt Brace & Co. Spanish version, Á. Aguilar, C. Roldán, M. Torres, M., Mendoza, & J. Sangorrín, NEPSY. Una evaluación neuropsicológica del desarrollo, Department of Personality, Assessment and Psychological Treatment, University of Barcelona, 2000.

Korkman, M., Kirk, U., & Kemp, S. (2007). *NEPSY - Second edition (NEPSY® - II).* San Antonio (TX): NCS Pearson.

Korkman, M., Lahti-Nuuttila, P., Laasonen, M., & Holdnacck, J. (2013). Neurocognitive development in five-to 16 year-old North American children: A cross-sectional study. *Child Neuropsychology, 19(5),* 516-539.

Korkman, M., Kirk, U., & Kemp, S. (2014). *NEPSY-II*. Madrid: NCS Pearson.

Luria, A.R. (1973). *The working brain: An introduction to neuropsychology* (B. Haigh, Trans). London: Penguin.

Molfese, V.J., Molfese, P.J., Molfese, D.L., Rudasill, K.M., Armstrong, N., & Starkey, G. (2010). Executive function skills of 6–8 year olds: Brain and behavioral evidence and implications for school achievement. *Contemporary Educational Psychology, 35,* 116-125.

Paradis, M., & Libben, G. (1987). *The assessment of bilingual aphasia*. Hillsdale (NJ): Lawrence Erlbaum Associates.

Sánchez-Lancis, E., & Aguilar, A. (2000). Relaciones entre las puntuaciones obtenidas por un grupo de niños con diferentes trastornos clínicos en las escalas WISC-R y en el NEPSY. Paper in *International Workshop on Children Neuropsychological Assessment. The Year 2000*, Barcelona.

Sangorrín, J., Quero, A., & Idiazábal, M.A. (2000). Estudio neuropsicológico en niños con diagnóstico de TDAH. Paper in *International Workshop on Children Neuropsychological Assessment. The Year 2000*, Barcelona.