



Interamerican Journal of Psychology

ISSN: 0034-9690

rip@ufrgs.br

Sociedad Interamericana de Psicología  
Organismo Internacional

Lipina, Sebastián J.; Martelli, María I.; Vuelta, Beatriz; Colombo, Jorge A.  
Performance on the a-not-b task of Argentinean infants from unsatisfied and satisfied basic needs  
homes  
Interamerican Journal of Psychology, vol. 39, núm. 1, 2005, pp. 49-60  
Sociedad Interamericana de Psicología  
Austin, Organismo Internacional

Available in: <http://www.redalyc.org/articulo.oa?id=28439106>

- How to cite
- Complete issue
- More information about this article
- Journal's homepage in redalyc.org

redalyc.org

Scientific Information System  
Network of Scientific Journals from Latin America, the Caribbean, Spain and Portugal  
Non-profit academic project, developed under the open access initiative

## ***Performance on the A-not-B Task of Argentinean Infants from Unsatisfied and Satisfied Basic Needs Homes***

**Sebastián J. López**  
**María I. Neri**  
**Beatriz**  
**Jorge A. C.**

*Centro de Educación Médica e Investigación Clínica Norberto Quirno*  
*Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICET)*  
*Buenos Aires, Argentina*

### **Abstract**

Studies based on animal and human models have shown structural and functional alterations in the Central Nervous System after exposure to early enriched, or deprived, environments. Poverty, as a complex phenomenon of environmental deprivation, was repeatedly associated with deleterious consequences for early cognitive development. This study compares the performance of 280 Argentinean infants (six- to 14-month-old) from Unsatisfied Basic Needs homes on the *A-not-B* task, as an early executive function predictor. In this task, infants watch as an object is hidden in one of two hiding places (left-right locations), and after a delay period are allowed to search for that object. Results showed that infants from poor homes performed fewer correct responses, and made more perseverative and non-perseverative errors than non-poor infants. Findings suggest that poor home environments bring about a condition that affects the management of the executive system involved in *A-not-B* task resolution.

*Keywords:* *A-not-B* task; cognitive development; poverty; infants.

### **Desempeño en la Prueba A-no-B de Infantes Argentinos Provenientes de Hogares con y sin Necesidades Básicas Satisfechas**

#### **Resumen**

Estudios basados en modelos animales y humanos han mostrado alteraciones estructurales y funcionales en el Sistema Nervioso Central después de la exposición temprana a ambientes empobrecidos o enriquecidos. La pobreza, como fenómeno complejo de privación ambiental, ha sido reiteradamente asociada con efectos negativos en el funcionamiento cognitivo temprano. El presente estudio compara el desempeño de 280 infantes (seis a 14 meses de edad) provenientes de hogares con y sin necesidades básicas satisfechas, en la prueba A-no-B (predictor temprano de funcionamiento ejecutivo). En ella, los infantes observan el ocultamiento de un objeto en una de dos localizaciones espaciales posibles, para buscarlo luego de un retardo. Los resultados muestran que los infantes de hogares con NBI efectuaron menos respuestas correctas consecutivas y más errores perseverativos que los de hogares con NBS ( $p < 0.05$ ). Los resultados sugieren que la condición de pobreza afecta la plasticidad de los recursos cognitivos involucrados en la prueba.

*Palabras clave:* Prueba A-no-B; desarrollo cognitivo; pobreza; infantes.

Executive functioning (EF) refers to a complex and still provisional cognitive construct that involves general-purpose control mechanisms that modulate the operation

dynamics of cognition. Specifically, EF subsume a set of higher order parallel processes such as planning, problem solving, organization,

brain regions, which occurs throughout development and well into the second decade of life (Diamond, 2001a; Klingberg, Forssberg, & Westerberg, 2002; Stuss & Alexander, 2000; Wood & Grafman, 2003). Furthermore, research has identified a stage-like sequence of executive function development characterized by “spurts” in executive abilities beginning from 12 months of age, with the majority of functions coming around the age of eight (Case, 1992; Luciana & Nelson, 1998). Whereas some studies argued that EF only can be identified in four-year-olds and older children (Anderson, 1998; Luciana & Nelson, 1998), others proposed that it appears much earlier (Diamond, 1985, 1990, 2001a; Diamond, Kirkham, & Amso, 2002; Espy, Kaufman, Glisky, & McDiarmid, 2001; Welsh & Pennington, 1988). When age-appropriate tasks demanding integration, effortful, formal and content novelty are available (Phillips, 1997), an increase in non-verbal executive competence in infant (Diamond, 1985, 2001a; Diamond & Goldman-Rakic, 1989; Welsh & Pennington, 1988) and preschool-aged children (Diamond et al., 2002; Espy et al., 2001; Hughes, 1998; Klenberg, Korkman, & Lahti-Nuutila, 2001; Luciana & Nelson, 1998; Zelazo, Carter, Reznick, & Frye, 1997), has been reported in several studies. Complementary, results of developmental studies based on exploratory and confirmatory factor analyses suggest that EF is not homogeneous and that a multistage development of different components proceeds from infancy to adolescence (Anderson et al., 2001; Espy, Kaufman, McDiarmid, & Glisky, 1999; Klenberg et al., 2001; Lehto, Juujärvi, Kooistra, & Pulkkinen, 2003). Finally, at least two EF components were proposed at the core of cognitive development: inhibition of prepotent responses and working memory (Lehto et al., 2003; Miyake et al., 2000; Rusell, 1999).

Specifically, performance on the *A-not-B* task is often held to be one of the first signs of emerging executive functioning in infancy (Diamond, 1985, 1990, 2001a; Diamond & Goldman-Rakic, 1989; Espy et al., 1999; Goldman-Rakic, 1987; Rusell, 1999; Welsh & Pennington, 1988). The standard *A-not-B* search task is a variant of the delayed-response paradigm devised to study the effects of delay on search

the B well, they search for it in A, even though they have just seen the object being placed inside B. It is often argued that the *A-not-B* error is caused by confusion, such as a failure to understand specifically which is the desired object (Piaget, 1954). Although some have followed piagetian approach (Butterworth, 1970; Appel, Evans, Le Compte, & Wright, 1980), others have emphasized basic cognitive deficits in short-term memory (Cummins & Nelson, 1984), the combination of memory deficits and poor working memory control (Diamond, 1985; Diamond & Goldman-Rakic, 1989) or means-end behavior (Baillargeon & Gauthier, 1988; Berthental, 1996). Other theoretical approaches have emphasized repetition of motoric schemes as the cause of the error (Smith, Thelen, Titzer, & McLin, 1999; Berthental, 1996) or a different version of the task (Diamond, 1985). The Competing-Systems account proposes that there are two organized dissociable systems: a) the response system, by motor experience and the effect of the delay on the similar location; b) the conscious representation system, where the infant’s conscious representation of the location of the hidden object (Zelazo, Reznick, & Spinazzola, 2003). From the most updated meta-analytic studies, it is concluded that the distance between locations are positively related to the proportion of infants who search correctly. The number of A trials and delay between hidden and visible trials are negative predictors (Marcovitch & Zelazo, 2002).

Performance on *A-not-B*, as well as on other executive tasks, has also been significantly associated with maturation and function (or immaturity) of dorsolateral circuits in the prefrontal cortex (Diamond, 2001a; Diamond & Goldman-Rakic, 1989; Nelson et al., 2000). Similar perseveration on *A-not-B* and Delayed Response tasks has been observed in frontally ablated adult monkeys (Diamond & Goldman-Rakic, 1989), intact and frontally ablated 12-month-old human infants (Diamond, 1985). Furthermore, resting frontal EEG activity is positively related to anterior to posterior EEG coherence (Bel

1985, 1990, 2001a). In cross-sectional studies, the *A-not-B* error has been found at delays a few seconds shorter at each age than is found in longitudinal studies. Explanations proposed for this difference included practice effects in longitudinal studies or the unfamiliar condition of experimenter and testing room in cross-sectional studies (Diamond, 1985).

Evidence from experimental contexts have largely demonstrated that in different species certain structural and functional features of the Central Nervous System, such as the resolution of cognitive tasks, can be modulated through the manipulation of environmental conditions during early development (Greenough & Volkmar, 1973; Rosenzweig & Bennet, 1996). Human home environment quality could be associated with deprived or enriched environments, depending on the presence or absence of poverty. Poverty is usually associated with a low home environment quality, and children living in occasional and even persistent poverty present alterations in their cognitive development (Bradley et al., 1989; Brooks-Gunn & Duncan, 1997; McLloyd, 1998). It has been further demonstrated that different aspects of language and spatial processing development, examined through general intelligence or developmental paradigms, are affected in subjects from low-income families and in ethnic minorities (Brooks-Gunn & Klebanov, 1996; Burchinal, Campbell, Bryant, Wasik, & Ramey, 1997; Brooks-Gunn & Duncan, 1997; McLloyd, 1998). Cognitive stimulation in the home, parenting style, physical environment of the home and poor child health were proposed as mediating factors that are affected by lack of income and that influence children's cognitive development (Georgieff & Rao, 2001; Grantham-McGregor & Ani, 1999; Guo & Mullan-Harris, 2000; Mendola, Selevan, Gutter, & Rice, 2002; Ormoy, 2003). Furthermore, systematic differences between societies regarding their cultural patterns, schooling practices and psychological environment, impact performance on both verbal and non-verbal tests (Rogoff & Chavajay, 1995; Sattler, 2001). Thus, skills prescribed by a culture, together with the cognitive strategies that vary among cultures, interact with inherent patterns of brain organization (Eviatar, 2000). Attempts to develop tests that are culture fair have not been successful,

non-poor homes on performance. Theoretical and methodological reasons include: a) to evaluate effects of poverty on performance (infancy) in order to add such effect to studies carried out with older children; b) to use an alternative approach to developmental quotients paradigms, memory and inhibitory control processes in the first years of cognitive development; c) to compare the *not-B* task from a non-Anglo-Saxon sample with the cross-cultural performance differences.

## Method

### Participants

The sample comprised 280 non-poor children (Hispanics or Latinos of any age) from 6 to 14 months (see Table 1 for sample size by age and gender). These participants were selected under sanitary control at *Pedro de Elizalde* Hospital in the city of Buenos Aires between 2000 and 2001. Families inhabited the poorest region of Buenos Aires: Florencio Varela, Quilmes. Entry into the sample followed strict criteria: first maternal language, normal or near-normal hearing, no record of serious medical history of psychiatric illness, no history of injury, seizures, or neurological conditions, no substance abuse or dependence. Children with symptoms of acute disease, were born at a normal weight and height suitable for gestational age, and had a normal gestation, obstetric, and delivery history. All procedures conducted in accordance with APA ethical standards for the treatment of the study sample. Informed consent and administration of the task provided by the parents. Ethics Committee at the *Pediatric Hospital* approved this study.

Table 1.  
Sample Sizes by Group, Age and Gender of Children

SEBASTIÁN J. LIPINA, MARÍA I. MARTELLI, BEATRIZ VUELTA &amp; JORGE A. COLLO

Table 2.  
*Mean Scores of Socioeconomic Variables by Group of the Argentinean Children*

	Group				<i>p</i>
	SBN		UBN		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Education	6,47	2,47	5,86	2,61	NS
Occupation	5,91	1,82	4,18	2,51	< 0,05
Dwelling	11,53	1,09	8,73	2,39	< 0,05
Overcrowding conditions	7,78	1,48	5,59	1,65	< 0,05
Total Score	31,69	4,34	24,36	5,47	< 0,05

*Note:* SBN=Satisfied Basic Needs; UBN=Unsatisfied Basic Needs; NS = not significant; *p*.

### Poverty Measure

Before performing on the task, a socioeconomic scale (NES; see Appendix A for details) was administered to infant mothers. NES scale, used in other studies in Argentina (for example, CESNI, 1995), is derived from the Unsatisfied Basic Needs (UBN) direct method for measure poverty (Boltvinik, 2000; INDEC, 1994). It includes several indicators that attempt to capture different dimensions of poverty at the household and individual levels. Income direct method was not used in this study due to either lack of information or of reliable information. A total score (TS) was obtained based on scores from parents educational background (Ed), parents occupational background (Oc), dwelling (Dw) and overcrowding conditions (Ov) ( $TS=Ed + Oc + Dw + Ov$ ). TS, Ed, Oc, Dw and Ov were the dependent variables. Scores were assigned directly to parents for educational and occupational backgrounds, but only the higher was considered for the Total Score. In the case of dwelling, first scores assigned to each item were summed (SS) (type, floor, water, bathroom, ceiling, external walls and home property), and then a final score (FS) was assigned to this figure according to the following criteria: for SS between zero and five the FS was three; for SS between six and 11 the FS was six; for SS between 12 and 17 the FS was nine; for SS between 18

measurement of *A-not-B* error (perseveration). A tetragonal wooden table measuring 35 inches in width was used, in which two wells measuring four inches in diameter and ten inches in depth were cut. Both wells were separated by 11 inches and equidistant from one another and from the sides of the table. The wells were covered with cloths with sides of approximately ten inches. Several toys were used in each test. The size was suitable for hiding in the wells. Toys of different shape and color to get children's attention were used.

### Measures and Procedure

Infants were tested individually in a quiet room at the hospital. Testing was scheduled at times that did not interfere with regular meals. Examiners tested the hypotheses of the study. Infants were seated on a lap facing the experimenter across the table. The experimenter was placed behind and recorded the behavior. A set of toys was available so the experimenter could choose the most attractive to each infant. If the infant hid the current toy, a different toy was used. A score of 1 was given if the parent holding the infant's hands. The experimenter hid the toy in one well and covered both wells.

## PERFORMANCE ON THE A-NOT-B TASK OF ARGENTINEAN INFANTS FROM UNSATISFIED AND SATISFIED

and the opportunity to retrieve and play with the toy. Reward was contingent on removal of the correct cloth to maximize motivation to reach correctly. Any response other than a correct retrieval was scored as incorrect. Infants were scored as making an error if they reached to the empty, covered well, if they reached simultaneously to both wells, or if they did not reach at all. As in other studies (Diamond, 1985; Diamond & Goldman-Rakic, 1989; Matthews, Ellis, & Nelson, 1996), the most common type of error was reaching to the empty, covered well. When infants did not reach correctly, the mother and the experimenter remained neutral, and the experimenter removed the correct cloth and retrieved the toy as the infant watched. When an infant retrieved the toy correctly from the same well two trials in a row, the toy was hidden in the other well. The delay between covering of the wells and release of the infant's hands was varied from less than one to ten seconds. The task was first administered with delays lower than 1 second. When each child reached 90% efficiency (correct trials/administered trials), the delay was increased to five seconds. Again, once the efficiency criterion was reached, the delay was increased to ten seconds, repeating the criterion one last time. Each infant received between ten and 15 trials per delay. If there was no response 30 seconds after the delay, the trial was considered over (did not reach at all) and the next trial was administered. The cut criteria were five consecutive incorrect trials. The administration of the task took about 20 minutes per infant.

Five dependent variables were calculated following Espy et al., (1999, 2001) criteria: 1) *correct responses*, defined as the total number of correct retrievals pondered by the total number of administered trials per delay (efficiency); 2) *consecutive correct responses*, defined as the total number of consecutive correct trials pondered by the total number of administered trials per delay [for example, if in a given delay an infant correctly responded on all the following trials AABBAABBAA, his consecutive

reward consecutively for two trials. The delay was chosen to achieve measurement consistency for all infants.

### Experimental Design and Analysis

Two multivariate analysis of variance (MANOVA) tests were used to examine group-related NES characteristics, *group* (*UBN*, Unsatisfied Basic Needs; *SBN* (non-Unsatisfied Basic Needs) was the fixed factor, and *educational background* (*Ed*), *occupational background* (*Oc*), *dwelling* (*Dw*), and *overcrowding* (*Ov*) were the dependent variables. In the first test, related-performance, *group* (*UBN*, Unsatisfied Basic Needs) was the fixed factor; *age* (6 to 14 months) and *delay* (1: one second; 2: five seconds; 3: ten seconds) were the independent variables (Design: Intercept+Age+Delay+Group). The dependent variables were *correct responses*, *consecutive correct responses*, *errors*, and *non-perseverative errors*. The *group* variable was not included in the MANOVA because it did not correlate with any of the other dependent variables of the task. To examine related performance on this variable, in addition, T-Test and Mann-Whitney test were used to compare obstetric history and delivery variables. The Kolmogorov-Smirnov test was used to test for normality that samples came from a normal distribution. The Levene's test was used to test nonrandom (dependence) of the variables and arc sine transformations for statistical analysis. Box's Test of Equality of Covariance Matrices, Levene's Tests of Equality of Error Variances, and in all cases. The probability of a Type I error was set at .05 for all analyses. All analyses were conducted using Stata Version 7.0.

## Results

### NES Scale Analysis

MANOVA results indicated a significant difference between groups, *group*, Wilk's  $\lambda=0.41$ ,  $F(4,238)=78.14$ ,  $p<.001$ . The analysis showed that the *SBN* group had significantly less scores in *occupational background*, *educational background*, and *overcrowding*.

Table 3.  
*Mean Values and Comparison of Pre and Perinatal Variables by Group of the Argentinean C*

Variable	Group					
	<i>M</i>	SBN <i>SE</i>	<i>n</i>	<i>M</i>	UBN <i>SE</i>	<i>n</i>
<i>Obstetric history</i>						
Previous pregnancies	1,85	0,11	122	1,80	0,09	103
Previous deliveries	1,20	0,08	122	1,51	0,09	103
Previous abortions	0,46	0,06	122	0,17	0,04	103
Previous cesareans	0,25	0,05	122	0,06	0,02	93
Prenatal care						
<i>First examination (month)</i>						
Obstetric examinations	2,26	0,11	122	2,56	0,14	87
Maternal smoking	7,31	0,23	98	6,78	0,34	93
High temperature episodes	0,26	0,04	122	1,42	0,03	109
Hemorrhages	0,04	0,01	122	0,06	0,02	99
Diabetes Mellitus	0,09	0,02	122	0,11	0,03	103
Maternal anemia	-	-	116	-	-	100
Urinary infections	0,20	0,03	122	0,12	0,03	100
Exposure to radiologic studies	0,21	0,03	116	0,30	0,04	100
Pregnancy-related hypertensive episodes	-	-	122	0,13	0,03	93
	0,09	0,02	122	0,19	0,04	100
<i>Delivery</i>						
APGAR 8	8,51	0,77	92	8,91	0,28	89
APGAR 10	9,92	0,29	92	9,91	0,27	89
Weight at birth	3155,46	29,22	122	3256,55	49,97	103
Weeks of pregnancy	39,02	0,09	104	39,21	0,13	99
Anesthesia in delivery	0,65	0,09	102	0,70	0,06	98
Stress in delivery	-	-	122	-	-	103
<i>Neonatal Data</i>						
Intensive care unit (ICU)	0,13	0,03	100	0,07	0,03	100
Reanimation	-	-	110	-	-	103
Jaundice	0,41	0,05	116	0,31	0,05	103
<i>Puerperium</i>						
Post-partum depression	-	-	122	-	-	103
Breast feeding	0,90	0,03	122	0,88	0,03	103
Iron supplement	0,75	0,04	104	0,94	0,02	100
<i>Infant present data</i>						
Present weight	9407,12	84,17	122	9100,45	138,71	103
Present height	72,97	0,27	122	72,03	0,33	103
Present cephalic Perimeter	45,81	0,15	116	45,50	0,13	103

PERFORMANCE ON THE A-NOT-B TASK OF ARGENTINEAN INFANTS FROM UNSATISFIED AND SATISFIED

Test). For this reason the variable was eliminated from subsequent analysis.

Regarding age, the consecutive correct responses,  $F(1,442)=38.59, p<0.01, B=0.57$ , increased and non-perseverative errors,  $F(1,442)=28.38, p<0.01, B=-0.38$ , decreased with age in both groups. In contrast, perseverative errors was steady across ages,  $F(1,442)=2.65, p<0.10, B=-0.04$ . Comparisons of these variables with Delay revealed that in both groups the consecutive correct responses significantly decreased at longer delays,  $F(1,442)=11.42, p<0.001, B=-0.131$ , while the perseverative errors,  $F(1,442)=0.15, p=0.69$ , and non-perseverative errors,  $F(1,442)=0.04, p=0.84$ , remained unchanged. Subjects of

both groups and all ages made perseverative errors in the condition of less than 1 second

Comparisons between groups showed that subjects from the SBN group made fewer consecutive correct responses,  $p=0.03, B=-0.198$ , and more perseverative errors,  $F(1,442)=8.54, p<0.01, B=0.06$ , and non-perseverative errors,  $F(1,442)=5.27, p=0.02, B=0.01$  (Means and Standard Deviations).

Finally, no differences were observed when comparing A trials before the first perseverative error,  $F(1,355)=0.91, p=0.34$ . Mean and standard deviations were  $3.21\pm 2.24$  ( $n=197$ ) for SBN group and  $3.21\pm 2.24$  ( $n=160$ ) for poor group.

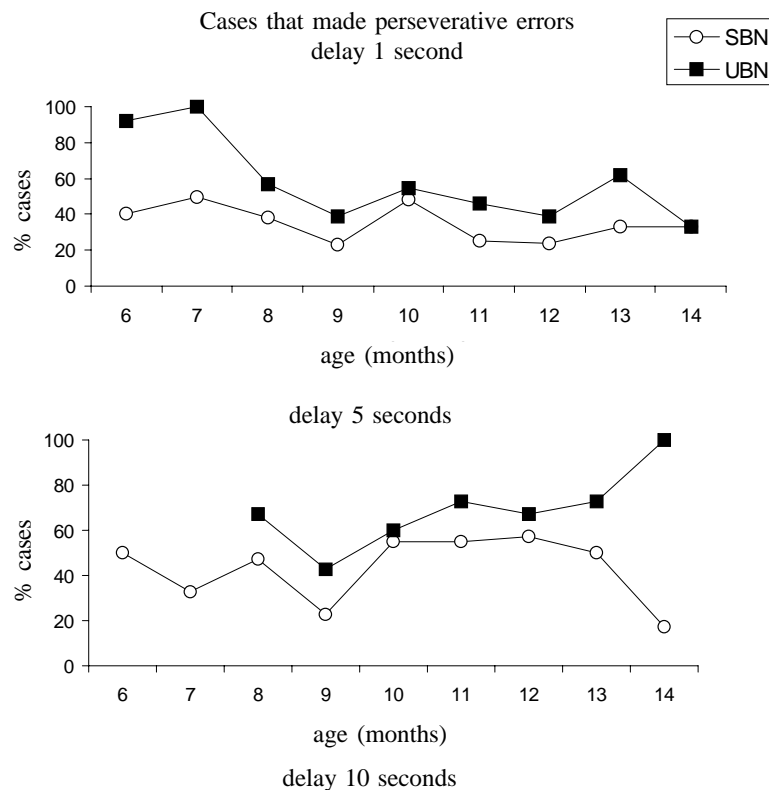




Table 4.

*Means and Standard Deviations of A-not-B Dependent Variables by Group, Age and Delay*

Age <sup>2</sup>	Dependent Variable <sup>1</sup>															
	Consecutive Correct Responses						Perseverative Errors						Non-Perseverative			
	SBN			UBN			SBN			UBN			SBN			
	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>
1-second delay																
6	0,5	0,3	15	0,3	0,2	12	0	0	15	0,1	0,1	12	0,1	0	15	0,2
7	0,4	0,3	23	0,3	0,2	11	0,1	0	23	0,1	0,1	11	0,2	0,1	23	0,2
8	0,7	0,2	19	0,5	0,3	16	0	0	19	0,1	0	16	0,3	0,3	19	0,5
9	0,6	0,3	13	0,6	0,3	11	0	0	13	0	0	11	0,1	0,1	13	0,1
10	0,7	0,2	27	0,6	0,3	12	0	0	27	0	0,1	12	0,1	0,1	27	0,1
11	0,7	0,2	12	0,7	0,3	12	0	0	12	0	0	12	0	0,1	12	0,1
12	0,6	0,2	11	0,7	0,2	18	0	0	11	0,1	0	18	0	0,1	11	0,1
13	0,6	0,1	7	0,6	0,3	11	0	0	7	0	0	11	0,2	0,1	7	0,2
14	0,8	0,2	5	0,8	0,1	5	0	0	5	0	0	5	0	0	5	0
5-second delay																
6	0	0	5	^-	^-	^-	0	0	5	^-	^-	^-	0,5	0,1	5	^-
7	0,4	0,3	5	^-	^-	^-	0	0	5	^-	^-	^-	0,3	0,2	5	^-
8	0,3	0,2	12	0,2	0,2	5	0	0	12	0,1	0,1	5	0,2	0,2	12	0,3
9	0,5	0,3	8	0,3	0,3	5	0	0	8	0,1	0,1	5	0,1	0,1	8	0,2
10	0,5	0,2	19	0,4	0,2	7	0,1	0,1	19	0,1	0,1	7	0,1	0,2	19	0,2
11	0,6	0,2	9	0,4	0,1	9	0,1	0,1	9	0,1	0,1	9	0,1	0,2	9	0,1
12	0,6	0,2	8	0,5	0,3	12	0	0,1	8	0,1	0,1	12	0,1	0,1	8	0,2
13	0,4	0,2	5	0,5	0,1	6	0,1	0,1	5	0,1	0,1	6	0,3	0,2	5	0,3
14	0,8	0,1	4	0,3	0,3	3	0	0	4	0,1	0	3	0	0	4	0,2
10-second delay																
6	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-
7	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-
8	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-	^-
9	0,9	0,1	3	^-	^-	^-	0,1	0,1	3	^-	^-	^-	0,1	0,1	3	^-
10	0,9	0	2	^-	^-	^-	0	0	2	^-	^-	^-	0	0	2	^-
11	0,7	0,2	3	0,6	0,3	3	0	0	3	0,1	0	2	0	0,1	3	0,3
12	0,5	0,4	3	0,5	0,4	3	0	0	3	0,1	0,1	3	0,2	0,2	3	0,3
13	0,7	0,6	2	0,6	0,5	2	0	0	2	0	0	2	0	0	2	0
14	0,7	0,1	3	^-	^-	^-	0	0	3	^-	^-	^-	0	0	3	^-

*Note:* SBN=Satisfied Basic Needs group; UBN=Unsatisfied Basic Needs group; <sup>1</sup>correct responses eliminated (see Results); <sup>2</sup>in months.

*perseverative errors* used in the present study (Espy et al., 1999), does not consider as such those errors occurring following reversals. Another difference with the results obtained in Anglo-Saxon studies (Butterworth, 1977; Diamond, 1985; Diamond & Goldman-Rakic, 1989; Gratch & Landers, 1971) is that with the delay of <1 second all the children made *perseverative errors*. This could be interpreted: a) as an effect of the cross-sectional nature of the study (practice effects, or unfamiliar condition with the experimenter and testing room) (Diamond, 1985); b) as the alteration of functions of cognitive specific domains, e.g. attention (Anderson, 1998; Klenberg et al., 2001); or c) as a combination of them. More investigation would be needed to refute these hypotheses. Due to the cross-sectional character of this study, and the duration of the delay periods used, we cannot provide a further insight regarding the delay needed to produce perseverative errors.

According to our results the *SBN* group made significantly more *consecutive correct responses* and fewer *perseverative and non-perseverative errors* than the *UBN*. Thus, *SBN* infants performed better on the *A-not-B* task than the *UBN*, which is attributable to an increase in the two types of errors, i.e., perseverative and non-perseverative. The former error has been associated with immaturity concerning object permanence (Piaget, 1954), with impairment of the inhibitory control, and with mechanisms involved in spatial working memory processes (Diamond, 1985, 1990, 2001). *Non-perseverative errors* are more likely to be associated with attention, space codification and search strategies than with inhibitory control (Ahmed & Ruffmann, 1998; Diamond, 1990, 2001; Diamond & Goldman-Rakic, 1989). Present results do not allow to clearly determining whether *perseverative* and *non-perseverative errors* were either mnemonic immature, produced by attentional deficits, or by difficulties in inhibitory control or in codifying spatial locations. Regarding development of unsuitable manual search strategies (which also include motor components) results showed that infants were able to reach correctly. It could be argued that *UBN* infants' performance was associated

or that the decodification of task conditions (spatial representation) was also difficult for *SBN* infants at the high level of difficulty (ten seconds).

This study did not apply the traditional method of measurement of establishment of poverty (Espy et al., 1999) as most Anglo-Saxon studies do (Barnes & Gunn, 1997; McLloyd, 1998). The main reason for lack of reliability in the information obtained was the need to identify homes whose poverty was more than five years. The application of the method used (Boltvinik, 2000) allowed to characterize the different profiles of poverty: 1) The *SBN* group was characterized by low levels of paternal education (qualified workers), low quality home conditions (rooms), little physical space in the home, high levels of overcrowding (more than three people per room), paternal educational level was also low, although the statistical differences were not significant. The profile of the *SBN* group differed from the *UBN* group in previous studies (Lipina, Vuelta & Colombo, 2000). In these cases paternal education levels were higher (professionals), home conditions quality and the mean total score in the questionnaire (11.84 points more than that of this study).

Concerning the conditions of the home, regarding prenatal care, the mothers of the *UBN* group, who smoked tobacco, had more episodes of hypertension during deliveries, abortions and cesarean. Concerning the *SBN* group and episodes of hypertension during pregnancy, we considered prenatal risk factors for hypertension (Mendola et al., 2002; Ornoy, 2003; Wadhvani & Graziano, 2001). Yet, since the percentage of mothers who consumed tobacco was 17% (with an average of one cigarette per day) and that of episodes of hypertension was low, we suggested that the contribution of hypertension to the differences observed in cognitive performance could have been high. The groups did not differ in the following indicators: obstetric history (previous pregnancies), prenatal care (first examination, obstetric history, temperature episodes, hemorrhage

Between the mechanisms mediating the effects of poverty on children's cognitive development proposed by Guo and Mullan-Harris (2000), that of the inadequate physical environment of the home is the only one that this study can confirm in the UBN group. Cognitive stimulation at home and parenting style have not been evaluated. Regarding these last two factors, in different studies with African-American cases, positive associations were found between levels of poverty and of home stimulation, evaluated with the HOME scale (Bradley, 1989). On the other hand, in the study carried out by CESNI (1995), such associations were found, which suggests the need for more investigation.

The *SBN* and *UBN* functional characteristics herein described are far from representing the general population of these age groups and cultural contexts. To achieve global outcomes, further study including a higher number of cases, and diverse cultural origin, are needed in order to correlate this (working memory and inhibitory control) and other executive functions with ethnicity, home stimulation, type of neighborhood, and other environmental features associated with poverty. Aside from these pending matters, results from the present study allowed to (a) identify a specific executive functioning profile in infants from Unsatisfied Basic Needs homes, (b) the use of an alternative approach for the analysis of intelligence or developmental quotients paradigms in the study of poverty effects on cognitive performance, and (c) the attainment of a Latin-American infant executive performance database, which could be used either in intervention programs, or to test theoretical issues regarding executive components and sub processes.

## References

- Ahmed, A., & Ruffman, T. (1998). Why do infants make A not B errors in a search task, yet show memory for the location of hidden objects in a nonsearch task? *Developmental Psychology*, 34, 441-453.
- Anderson, V. (1998). Assessing executive function in children: biological, psychological and developmental considerations. *Neuropsychological Rehabilitation*, 8, 319-349.
- Anderson, V., Anderson, P., Northam, E., Jacobs, R., & Catroppa, C. (2001). Development of executive functions through late childhood and adolescence: An Australian sample. *Developmental Neuropsychology*, 20, 295-406.

- Brooks-Gunn, J., & Duncan, G. J. (1997). The effects of poverty on children's cognitive development. *Children and Poverty*, 7, 55-71.
- Brooks-Gunn, J., & Klebanov, P. K. (1996). Ethnicity, intelligence test scores: role of economic deprivation and maternal characteristics. *Child Development*, 67, 101-111.
- Burchinal, M. R., Campbell, F. A., Bryant, D. M., & T. (1997). Early intervention and mediating performance of children of low-income African Americans. *Child Development*, 68, 935-954.
- Butterworth, G. (1977). Object disappearance and the WISC-III IV task. *Journal of Experimental Child Psychology*, 24, 1-14.
- Case, R. (1992). The role of the frontal lobes in the development of executive functions. *Brain and Cognition*, 20, 51-71.
- CESNI (1995). *Proyecto Tierra del Fuego [Projecto Tierra del Fuego]*. Buenos Aires, Argentina: Fundación Jorge M. Sarmiento.
- Cummings, E. M. & Bjork, E. L. (1983). Perseveration on a choice visible displacement hidden task. *Psychology*, 142, 283-291.
- Diamond, A. (1985). Development of the ability of working memory and executive action, as indicated by infants' performance on the WISC-III IV task. *Development*, 56, 863-883.
- Diamond, A. (1990). Developmental time course of working memory and the neural bases of high-level memory in infant monkeys and the neural bases of high-level memory in humans. *Annals of the New York Academy of Science*, 602, 1-14.
- Diamond, A. (2001a). A model system for studying the development of executive functions in the prefrontal cortex during early development in continuously treated phenylketonuria. In Ch. A. Nelson & M. Luciana (Eds.), *Handbook of developmental cognitive neuroscience* (pp. 488-500). Cambridge, USA: The MIT Press.
- Diamond, A. (2001b). Looking closely at infant executive functions: experimental procedures in the A-not-B task. *Developmental Psychology*, 37, 38-41.
- Diamond, A., & Goldman-Rakic, P.S. (1989). Comparison of the development of working memory in rhesus monkeys on Piaget's AB task: Evidence for a dorsolateral prefrontal cortex. *Experimental Brain Research*, 80, 656-674.
- Diamond, A., Kirkham, N., & Amso, D. (2002). Can children hold two rules in mind and inhibit a prepotent response? *Developmental Psychology*, 38, 352-362.
- De Luca, C. R., Wood, S. J., Anderson, V., Buchan, A., Mahoney, K., & Pantelis, C. (2003). Normative data for the Development of executive function over time (DEFT) test: I: Development of executive function over time. *Clinical and Experimental Neuropsychology*, 25, 1-14.
- Espy, K. A., Kaufman, P. M., Glisky, M. L., & McDiarmid, M. D. (2002). New procedures to assess executive functioning. *The Clinical Neuropsychologist*, 15, 46-58.
- Espy, K. A., Kaufman, P. M., McDiarmid, M. D., & Glisky, M. L. (2003). Executive functioning in preschool children: Performance on delayed response format tasks. *Brain and Cognition*, 51, 1-14.
- Eviatar, A. (2000). Culture and brain organization. *Brain Research*, 884, 52-61.
- Georgieff, M. K., & Rao, R. (2001). The role of nutrition in executive functioning. In Ch. A. Nelson & M. Luciana (Eds.), *Handbook of developmental cognitive neuroscience* (pp. 491-504). Cambridge, MA: MIT Press.

PERFORMANCE ON THE A-NOT-B TASK OF ARGENTINEAN INFANTS FROM UNSATISFIED AND SATISFIED

- Guo, G., & Mullan-Harris, K. (2000). The mechanisms mediating the effects of poverty on children's intellectual development. *Demography*, *37*, 431-447.
- Harris, P. L. (1987). The development of search. *Infant Perception*, *2*, 155-207.
- Hughes, C. (1998). Finding your marbles: Does preschoolers' strategic behavior predict later understanding of mind? *Developmental Psychology*, *34*, 1326-1339.
- Hughes, C. (2002). Executive functions and development: Emerging themes. *Infant and Child Development*, *11*, 201-209.
- INDEC (1994). Mapas de la pobreza en la Argentina. *Documento de Trabajo Nro. 4*. Buenos Aires, Argentina: CEPAL.
- Klenberg, L., Korkman, M., & Lahti-Nuutila, P. (2001). Differential development of attention and executive functions in 3-to 12-year-old Finnish children. *Developmental Neuropsychology*, *20*, 407-428.
- Klingberg, T., Forssberg, H., & Westerberg, H. (2002). Increased brain activity in frontal and parietal cortex underlies the development of visuospatial working memory capacity during childhood. *Journal of Cognitive Neuroscience*, *14*, 1-10.
- Lehto, J. E., Juujärvi, P., Kooistra, L., & Pulkkinen, L. (2003). Dimensions of executive functioning: Evidence from children. *British Journal of Developmental Psychology*, *21*, 59-80.
- Lipina, S. J., Vuelta, B. L., Martelli, M. I., Bisio, N., & Colombo, J. A. (2000). Planificación en niños de edad preescolar: efectos de la pertenencia a hogares con Necesidades Básicas Insatisfechas (NBI) [Planning in preschoolers: Effects of Unsatisfied Basic Needs (UBN)]. *Anuario de Investigaciones (UBA/Psicología)*, *8*, 436-454.
- Luciana, M., & Nelson, C. A. (1998). The functional emergence of prefrontally-guided working memory systems in four- to eight-year-old children. *Neuropsychologia*, *36*, 273-293.
- Marcovitch, S., & Zelazo, P. D. (1999). The A-Not-B error: results from a logistic meta-analysis. *Child Development*, *70*, 1297-1313.
- Mareschal, D., Plunkett, K., & Harris, P. (1999). A computational and neuropsychological account of object-oriented behaviors in infancy. *Developmental Science*, *2*, 306-317.
- Matthews, A., Ellis, A. E., & Nelson, C. H. (1996). Development of preterm and full-term infant ability on AB, recall memory, transparent barrier detour and means-end tasks. *Child Development*, *67*, 2658-2676.
- McLloyd, V. C. (1998). Socioeconomic disadvantage and child development. *American Psychologist*, *53*, 185-204.
- Mendola, P., Selevan, S. G., Gutter, S., & Rice, D. (2002). Environmental factors associated with a spectrum of neurodevelopmental deficits. *Mental Retardation and Developmental Disabilities Research Reviews*, *8*, 188-197.
- Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., & Howerter, A. (2000). The unity and diversity of Executive Functions and their contributions to complex "Frontal Lobe" tasks: a latent variable analysis. *Cognitive Psychology*, *41*, 49-100.
- Nelson, C. A., Monk, C. S., Lin, S., Carver, L. J., Thomas, K. M., & Truwit, L. J. (2000). Functional Neuroanatomy of Spatial Working Memory in Children. *Developmental Psychology*, *36*, 109-116.
- Ornoy, A. (2003). The impact of intrauterine environment in neurodevelopmental neurobehavioral studies in children and disorders. *Toxicology Letters*, *2*, 140-141.
- Phillips, L. H. (1997). Do "frontal tests" measure executive functions? A comparison of assessment and evidence from fluency. (Ed.), *Methodology of frontal and executive functions*. Have, USA: Psychology Press.
- Piaget, J. (1954). *The construction of reality in the child*. New York: Doubleday Books.
- Rogoff, B., & Chavajay, P. (1995). What's become of Piaget's theory of cognitive development? *American Psychologist*, *50*, 129-141.
- Roselli, M., & Ardila, A. (2003). The impact of executive functions on non-verbal neuropsychological measurement. *Neuropsychology and Cognition*, *52*, 326-333.
- Rosenzweig, M. R., & Bennet, E. L. (1996). Effects of training and experience on brain plasticity. *Brain Research*, *78*, 57-65.
- Russel, J. (1999). Cognitive development as a function of the amount of Piaget. *Developmental Psychology*, *35*, 129-141.
- Sattler, J. M. (2001). Assessment of culturally and linguistically diverse children: research findings and recommendations. (Ed.), *Assessment of children*. Cognitive Psychology Press, San Diego, USA: Jerome M. Sattler.
- Smith, L. B., Thelen, E., Titzer, R., & McLin, M. L. (1996). The context of acting the task dynamics of the A-Not-B task. *Developmental Psychology*, *32*, 235-260.
- Sociedad Argentina de Pediatría (1997). *Criterios de crecimiento y desarrollo*. Buenos Aires, Argentina: Editorial Médica.
- Stuss, D. T. & Alexander, M. P. (2000). Executive functions: A conceptual view. *Psychological Review*, *107*, 251-276.
- Wasserman, G. A., Liu, X., Pine, D. S., & Graziano, M. S. A. (2000). Maternal smoking during pregnancy and child behavior problems. *Neurotoxicology and Teratology*, *23*, 1-10.
- Welsh, M. C., & Pennington, B. F. (1988). Assessment of executive functions in children: Views from developmental neuropsychology. *Developmental Neuropsychology*, *4*, 199-230.
- Wood, J. N., & Grafman, J. (2003). Human prefrontal cortex: A review of representational perspectives. *Nature Reviews Neuroscience*, *6*, 11-21.
- Zelazo, P. D., Carter, A., Reznick, J. S., & Frye, D. (2000). The development of executive function: A problem-solving perspective. *General Psychology*, *1*, 198-226.
- Zelazo, P. D., Reznick, J. S., & Spinazzola, J. (1998). Executive function and response control in a multistep problem-solving task. *Developmental Psychology*, *34*, 203-214.

SEBASTIÁN J. LIPINA, MARÍA I. MARTELLI, BEATRIZ VUELTA &amp; JORGE A. COLCO

**APPENDIX A**  
**NES Scale for Measure Poverty**

<b>educational background</b>			
	Father	Mother	Years of education
Complete University	12	12	18
Incomplete University	10	10	12-18
Complete College	10	10	15
Incomplete College	9	9	12-15
Complete Secondary	9	9	12
Incomplete Secondary	6	6	7-12
Complete Primary	3	3	7
Incomplete Primary	1	1	0-7
No education	0	0	0
<b>Educational Score:</b>			
<b>occupational background</b>			
	Father	Mother	
CEO	12	12	
Professional	11	11	
In charge of a small company	10	10	
Technical employer	8	8	
Administrative employer	7	7	
Seller	7	7	
Independent manufacturer	6	6	
Independent technician	6	6	
Qualified worker	4	4	
Non qualified worker	2	2	
Non permanent worker	1	1	
Servant	1	1	
Unemployed	0	0	
Does not work	0	0	
<b>Occupational Score:</b>			
<b>dwelling</b>			
Type			
Home	2	Sheared	Bathroom
Appartment	2	Toilet	
Shanty	0		Ceiling
Tenancy Room	0	Asphalt	
Hostel	0	Flagstone	
Shop premises	0	Roof tile	
Motor home	0	Metal sheet	
Homeless	0	Plastic sheet	
		Cardboard sheet	
	Floor	Canes, wooden boards	
Ceramic tile, carpet, wood	3		
Cement, fixed brick	1		External walls
Ground, non-fixed brick	0	bricks, stones, concrete	
	Water	wood	
Public net	2	Metal sheet	

Unsatisfied in New Zealand, Mantell appealed to the secretary of state for the colonies; he was refused an interview and resigned his New Zealand appointment. By the end, these are unable to create and nurture a nutritious relationship of give & consider, and often feel unsatisfied in whichever partnership they have. In actual fact, most members of our society who are normal, are partially satisfied in all their basic needs and partially unsatisfied in all their basic needs at the same time. In fact, feelings of insecurity or anxiety in a relationship, or anything that interferes with feelings of security are one of the greatest contributors to feeling unsatisfied in your relationship. In 3% of cases unsatisfied for is used. Satisfied Basic Needs homes on the A-not-B task, as an early executive function predictor. In this task, infants watch as an object is hidden in one of two hiding places (left-right locations), and after a delay period they are allowed to search for that object. Results showed that infants from poor homes performed fewer consecutive correct responses, and made more perseverative and non-perseverative errors than non-poor infants ( $p < 0.05$ ). Findings suggest that poor home environments bring about a condition that affects the management of resources involved in A-not-B task resolution. Key Performance on the A-not-B task of Argentinean infants from unsatisfied and satisfied basic needs homes. *Interamerican Journal of Psychology*, 39, 49-60. Mezzacappa, E. (2004). Alerting, orienting, and executive attention: Developmental properties and sociodemographic correlates in an epidemiological sample of young, urban children. *Child Development*, 75, 1373-1386. Mcloyd, V. C. (1998). Socioeconomic disadvantage and child development. Performance on the A-not-B task of Argentinean infants from unsatisfied and satisfied basic needs homes. SJ Lipina, MI Martelli, B Vuelta, JA Colombo. *Interamerican journal of psychology* 39 (1), 49-60, 2005. 184. 2005. Poverty and brain development during childhood: An approach from cognitive psychology and neuroscience. SJ Lipina, JA Colombo. *American Psychological Association*, 2009. 157. 2009. Far transfer to language and math of a short software-based gaming intervention. AP Goldin, MJ Hermida, DE Shalom, ME Costa, M Lopez-Rosenfeld, *Proceedings of the National Academy of Sciences* 111 ( As economies advance, a growing proportion of their activities focuses on the production of \_ . A) products B) events C) experiences D) luxury goods E) services. Page: 5. When consumers share a strong need that cannot be satisfied by an existing product, it is called \_ . A) negative demand B) latent demand C) declining demand D) irregular demand E) nonexistent demand. Page: 8.