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Substitutional mediation in matching to sample with words: comparison between children and adults

Mediación substitutiva en igualación de la muestra con palabras: Comparación entre niños y adultos

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ABSTRACT

Children and adults were trained with three procedures of conditional discrimination in a computerized matching to sample task with words, in order to assess the level of mediation generated by them. Matching was done on the basis of color, size of letters, semantic equivalence and semantic inclusion. Three procedures were used: choice of comparative instances (Scom), choice of relations (Ssor) and choice of sample instances (Ss); subjects passed through all of them according to a latin square design. Tests of concurrent choice of Ssor, Scom and Ss were used for the transference phases, before, during and after training. In general all subjects scored higher with synonymy; children scored low both in acquisition and intramodal transference, while adults showed high scores for semantic matches; extramodal transference was null for children and high for adults in synonyms. Choice of relations produced the highest scores for physical matches with both children and adults. Order of exposure did not affect children's performance in a significant way, while adults scored slightly better with initial exposure to choice of comparative instances. Children preferred physical matches, in spite of rating higher for synonyms, on the other hand adults preferred synonyms. Latencies for synonyms were the shortes in adults; while children did not show differential latencies. Types of mediation are discussed in terms of differences among procedures, differences in level of detachment implied in learning physical and semantical matches and differences in verbal competence.

DESCRIPTORS: mediation, second order discrimination, words, color, semantic inclusion, size, semantic equivalence, adults, children.

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RESUMEN

Se estrenó a niños y a adultos con tres procedimientos de discriminación condicional en una tarea computarizada de igualación de la muestra con palabras, para evaluar el nivel de mediación por ellos generado. La igualación se hizo con base en el color, el tamaño de las letras, la equivalencia semántica y la inclusión semántica. Se emplearon tres procedimientos: elección de instancias de comparación, elección de relaciones y elección de instancias de muestra; los sujetos pasaron por todas las condiciones, de acuerdo a un diseño de cuadro latino. Se emplearon pruebas concurrentes con los tres tipos de elección en las fases de transferencia intra y extramodal, antes, durante y después del entrenamiento. En general todos los sujetos calificaron alto en sinominia; los niños calificaron bajo tanto en adquisición como en transferencia intramodal, mientras que los adultos mostraron puntajes elevados para las igualaciones semánticas; la transferencia extramodal fue nula en los niños, y alta para los adultos en sinominia. La elección de las relaciones generó las calificaciones más elevadas en igualación física, tanto en niños cómo en adultos. El orden de exposición no afectó significativamente la ejecución de los niños, mientras que los adultos calificaron mejor con exposiciones iniciales a la elección de instancias de comparación. Los niños prefirieron la igualación física a pesar de calificar mejor en sinonimia; por otro lado, los adultos prefirieron la sinonimia. Las latencias más cortas de los adultos fueron para sinonimia, mientras que los niños no mostraron latencias diferenciales. Se discuten los tipos de mediación en términos de las diferencias entre los procedimientos, el nivel de desligamiento implícito en el aprendizaje de igualaciones físicas y semánticas, y las diferencias en competencia verbal.

DESCRIPTORES: mediación, discriminación de segundo orden, palabras, color, inclusión semántica, tamaño, equivalencia semántica, adultos, niños.

Conditional discrimination has been singled out as an ideal procedure to evaluate learning abilities, specially equivalence classes (Sidman & Talby 1982). There are several variants of the basic conditional procedure. These variants include 1) Training of different relations such as matching, oddity, symbolic matching and symbolic oddity; 2) Temporal differences in presentation of stimuli as in the case of simultaneous, zero delay, or delayed presentation, and 3) First and second order procedures (Fujita 1983; Ribes, Ibáñez & Hernández-Pozo 1986). First order discrimination procedures are characterized by training only one condition at a time, be it a relation (matching, oddity, symbolic matching, etc.) or a dimension (matching colors, semantic equivalences, sizes). Second order conditional procedures differ from regular first order ones, in that several relations are trained simultaneously within a session. In order to specify which of the available conditions is in operation, this procedure introduces a sign for the relation, the second order stimulus (Ssor); this stimulus could be a symbol, or a couple of stimuli representing the relation itself. There is not agreement on the terminology for this kind of stimulus, sometimes it is called 'selector stimuli' (Ribes & López 1985), or 'establishing stimulus' (McPherson & Osborne 1986) or 'contingency-specifying stimulus' (Schlinger & Blakely 1987). Second order procedures have on their own several variants; first of all, relations or dimensions could be trained one at a time or concurrently during a given trial; sequential training also could adopt a variety of presentations, for example the subject could be required to choose among

comparative instances (Scom), or among multiple second order stimuli (Ssor), or among different sample instances (Ss). Some authors have investigated whether these variants in training procedures yield important differences in what is learned (Thomas & Goldberg 1985; Hernández-Pozo 1986; Espinosa & Hernández-Pozo 1987).

Ribes (1986) and Ribes and López (1985) have distinguished between verbal factors as morphological and functional elements. The use of verbal stimuli or the emission of verbal responses in conditional discrimination tasks are not sufficient to claim for the occurence of "thinking" type processes. These processes occur only when the matching tas, requires the participation of extrasituational or transituational factors in the form of contingency substitution.

This study was designed to assess the functional role of morphologically verbal stimuli and responses in a second order conditional discriminative situation. Matching was possible through physical or semantic properties of words. The use of three different procedures, as well as the presentation of intra and extramodal transference tests should allow to identify the occurrence of substitutional mediaton in the performance of children and adults.

METHOD

Three second order sequential procedures were used during training: 1) Choice of a correct example, which consisted of the election of a Scom given specific Ss and Ssor; 2) Choice of the correct relation, that is, choice of a Ssor given a particular Ss and a Scom; and 3) Choice of an appropriate Ss provided a Ssor and a Scom.

SUBJECTS

Nine adults and nine children were used in the study. Adults were undergraduate students of Psychology, from 19 to 22 years old. The children who participated came from a public elementary school, coursing 4th to 6th grades and their ages were from 9 to 11 years old. Subjects attended on a voluntary basis, from monday to friday for two consecutive sessions of fifteen minutes each. Subjects from each age group were assigned randomly to three different sequences of exposure to the training procedures.

APPARATUS AND MATERIALS

A Commodore 64k microcomputer provided with a chromatic monitor of eleven inches was used during this study. Simon's basic language was used to program the experiment (Smith 1984). Subjects responded by pres-

sing numbered keys on the computer keyboard; responses, latencies, and specific displays presented were recorded during trials. Training and intramodal transference sessions involved presentation of words written in capital and non-capital letters, in blue, yellow, red or green; sample and comparison words were selected from a pool of fifty nine words. During extramodal transference sessions purple, pink, grey and brown were used, and words from a different pool of sixty four were presented as comparison and sample stimuli. Both lists are shown in appendix 1, including pairs of words used as second order examples.

Figure 1 illustrates the procedures used during training: position 1 (P1) shows choice of Scom; position 2 (P2) gives an example of choice of Ssor and position 3 (P3) represents choice of Ss. Training was done in terms of four criteria, matching color of worlds, type of letters, type of letters (capital or non capital), semantic equivalences, and semantic inclusion. In semantic inclusion the sample was a member of the semantic class presented as a comparison stimulus.

Words appeared with different colors in the monitor. In position 1 words in blue were 'chicken' and 'female'; word in yellow were 'WOMAN' and 'apple'; 'sky' and 'human' appeared in red, while 'PEN' was green. In the example of position 2, 'FOREST', 'SKY' and 'watch' were blue; 'CHICKEN' and 'tall' were yellow; 'liter', 'MIRROR' and 'CLOCK' were red; 'tree' and 'HIGH' were green. In position 3, 'TREE' and 'home' were written in blue; 'forest', 'book' and 'HOUSE' were red; 'room' was yellow and 'SEA' was green. There is only one correct choice for each example of figure 1. Correct choice in position 1 is number '3', 'chicken' (in blue) equals 'sky' (in red) in the same way that 'WOMAN' (in yellow) equals 'PEN' (in green), this illustrates matching for size of letters; number '2' is the correct choice in position 2, exemplifying matching based on semantic equivalence, 'HIGH' (in green) equals 'tall' (in yellow) in the same way that 'CLOCK' (in red) equals 'watch' (in blue); and number '4' is the correct response in position 3, where 'TREE' (in blue) relates to 'forest' (in red) in the same way that 'room' (in yellow) relates to 'HOUSE' (in red), this case illustrates semantic inclusion.

For intra and extramodal transference tests a three by three matrix was used, with three alternatives for each kind of functional stimuli, that is: three Ssor, three Ss, and three Scom. Figure 2 illustrates trials of both tests.

The upper matrix is an example of a intramodal transference trial. Words written in purple are 'FROG', 'august' and 'nationality'; words in pink are 'amphibious', 'mirror' and 'BOOK'; 'TREE', 'JAPANESE' and 'organ' appeared in grey, while 'FACTORY', 'BLADDER' AND 'MONTH' were in brown. In concurrect choices, three numbers had to be chosen for each trial, all from different rows. In this example there were ten correct combinations: '148', '159', '167', '257', '249', '258', '268., '349', '357', and '368'.

The lower matrix is an example of an extramodal transference trial. In this trial 'DOG' appears written in blue; words written in yellow are 'DOG',

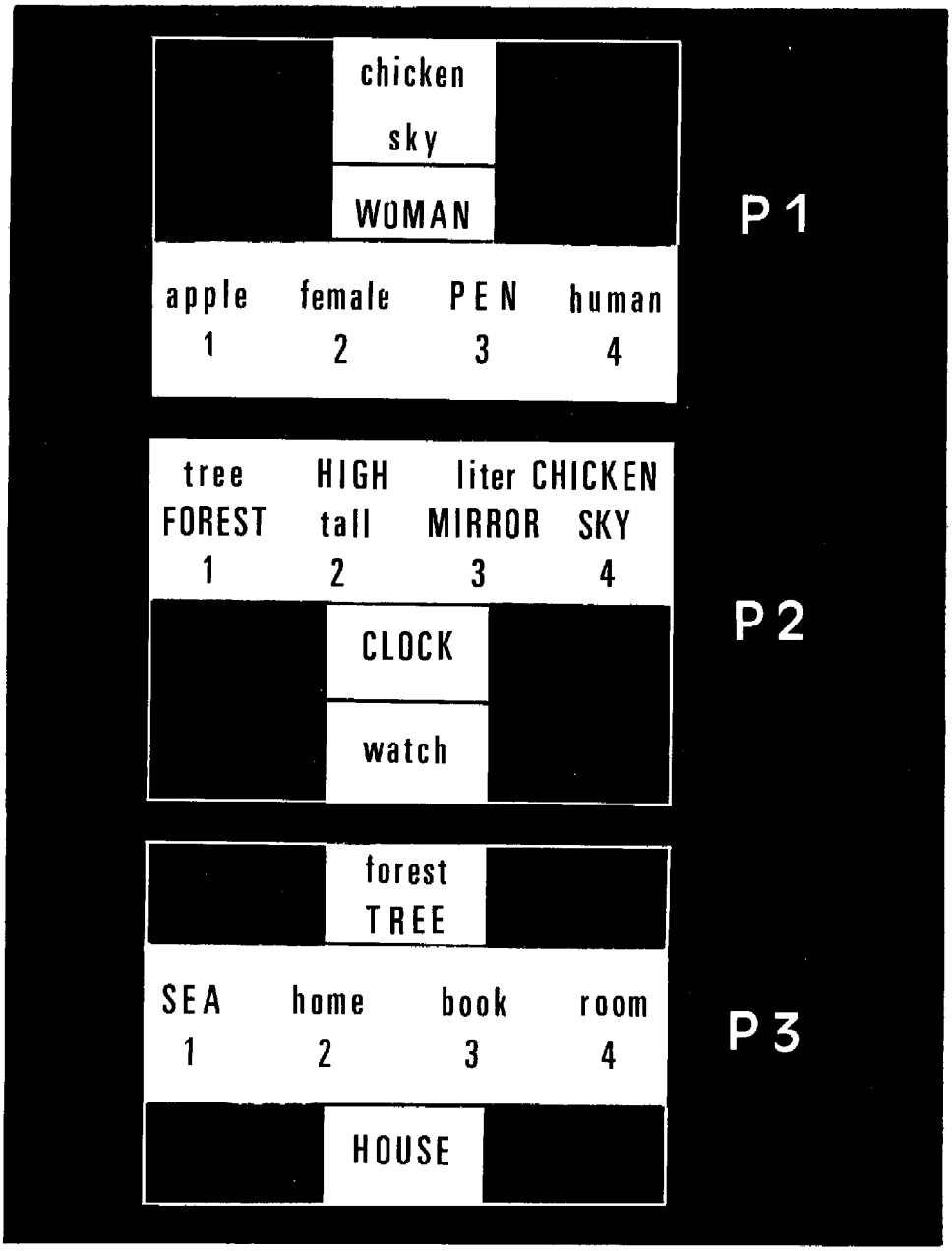

Figure 1. Examples of three techniques of sequential second order contidional training.

'QUALITY' and 'poor'; words in red are 'cold', 'hot', 'praise' and 'rich'; while 'SALARY', 'DEFECT' 'wage' and 'insult' appeared in green. In concurrect choices, three numbers had to be chosen for each trial, all from different

FROG amphibious 1	TREE FACTORY 2	mirror BOOK 3
august 4	JAPANESE 5	BLADDER 6
organ 7	MONTH 8	nationa Lity 9

cold hot 1	DOG DOG 2	SALARY wage 3
DEFECT 4	praise 5	poor 6
rich 7	QUALITY 8	insult 9

Figure 2. Intramodal and extramodal transference using a matrix display in concurrent second order conditional training.

rows. In this example there were thirteen correct combinations: '148', '159', '167', '247', '248', '258' '259', '267', '269', '347', '349', '358' and '368'.

After each response, a message on the monitor informed the subject whether his or her responses were correct or not, and the number of points accumulated so far. Each session had thirty six trials. The highest latency allowed was 20 seconds during training, and 30 seconds during transference tests. If the subject did not respond in that time, or if he or she made a mistake, he or she passed to the next trial, and no point was earned. At the end of the session subjects were informed about the total amount of points earned.

PROCEDURE

Pretest phase was divided in two parts, in the first one subjects passed through a paper and pencil test, in which they described twenty items —each item was a colored word written in capital or non capital letters—, without differential consequences for their performance. The second part of the pretest consisted of two computarized sessions with concurrent displays of stimuli, with no consequences programmed after each trial. In the first test session, subjects had to match in terms of color, of size of letters, of semantic equivalence and semantic inclusion. In the second test, choice depended on differences of color, differences of size of letters, antonyms or absence of semantical relation. Training in cach of the three procedures were given in blocks of six sessions, following a latin square design. For both age groups three individuals received one sequences of procedures. Group 1 received positions 1, 2 and 3; group 2 had positions 2, 3 and 1; and group 3 was trained with position, 3, 1 and 2. After each training block, intramodal transference and extramodal transference tests were presented. At the end of the experiment a second paper and pencil test was given, which was identical as the one presented at the beginning of the pretest phase.

RESULTS

Performance of both age groups was analyzed in terms of correct responses in all experimental phases, relational preferences and latencies of responses during concurrent tests of intra and extramodal transference. Table 1 presents medians of correct responses, preferences and latencies for all experimental subjects, and for different age groups.

TABLE 1

Number of correct responses, elections, and latencies associated to four relations in conditional training

CHILDREN AND ADULTS

	MEDIANS			
	R1	R2	R3	R4
CORRECT RESPONSES	6.0	5.0	14.0	8.0
PREFERENCES	11.0	9.0	12.0	8.0
LATENCIES	9.0	9.5	7.0	7.0

CHILDREN

	R1	R2	R3	R4
CORRECT RESPONSES	6.0	6.0	9.0	5.0
PREFERENCES	12.0	10.5	8.0	6.5
LATENCIES	9.2	9.5	8.7	6.5

ADULTS

	R1	R2	R3	R4
CORRECT RESPONSES	7.0	4.0	15.5	16.0
PREFERENCES	10.0	9.0	14.0	10.5
LATENCIES	9.0	9.0	6.0	7.5

Results showed that in general all subjects exhibited high performance in matching for synonyms ($p < .0001$). Table 2 presents the non parametric analysis performed for these data.

TABLE 2

Friedman non parametric test for differences in performance level, preferences and latencies associated to four relations in conditional discrimination

CHILDREN AND ADULTS

	FRIEDMAN'S MEAN RANKS				CHI SQUARE	SIGNIFICANCE LEVEL
	R1	R2	R3	R4		
CORRECT RESPONSES	2.4	2.2	3.16	2.25	90.7494	< .0001
PREFERENCES	2.72	2.58	2.73	1.98	41.7941	< .0001
LATENCIES	2.63	2.76	2.11	2.51	7.9661	.0467
CHILDREN						
	R1	R2	R3	R4		
CORRECT RESPONSES	2.5	2.43	2.94	2.13	27.4096	< .0001
PREFERENCES	2.92	2.85	2.34	1.89	41.5740	< .0001
LATENCIES	2.66	2.72	2.41	2.21	7.9661	.4046
ADULTS						
	R1	R2	R3	R4		
CORRECT RESPONSES	2.29	1.92	3.41	2.38	85.0693	< .0001
PREFERENCES	2.47	2.26	3.19	2.08	36.1729	< .0001
LATENCIES	2.59	2.80	1.78	2.83	11.8110	.0081

Tables 3 to 6 present data and non parametric analysis of performance level and preferences for each relation during matrix intra and extramodal transference tests respectively.

Comparison of correct responses for children and adults along the experimental phases revealed that children scored low in all phases. In general children performance was close to chance level during training except for matching synonyms. According to the trial structure, subjects could get three correct responses by chance, for each relation, since nine trials per relation were presented during a session, and there were three options available at each trial.

TABLE 3

Performance during intramodal transference following each training phase

CHILDREN AND ADULTS

	MEDIANS			
	R1	R2	R3	R4
CORRECT RESPONSES	3.0	2.0	9.0	8.0
PREFERENCES	10.0	7.0	10.0	10.0

CHILDREN

	R1	R2	R3	R4
CORRECT RESPONSES	6.0	4.0	3.0	3.0
PREFERENCES	14.0	9.0	7.0	5.5

ADULTS

	R1	R2	R3	R4
CORRECT RESPONSES	1.0	1.0	12.0	15.0
PREFERENCES	4.0	4.0	13.0	15.5

TABLE 4

Friedman non parametric test for assessing differences in performance and relational preferences during intramodal transference

CHILDREN AND ADULTS

	FRIEDMAN'S MEAN RANKS				CHI SQUARE	SIGNIFICANCE LEVEL
	R1	R2	R3	R4		
CORRECT RESPONSES	2.35	2.2	2.79	2.66	6.3065	.0976
PREFERENCES	2.76	2.36	2.51	2.36	41.7941	.3897

CHILDREN

	R1	R2	R3	R4		
CORRECT RESPONSES	2.71	2.64	2.41	2.23	2.4536	.4837
PREFERENCES	3.23	2.75	2.09	1.93	18.3750	.0004

ADULTS

	R1	R2	R3	R4		
CORRECT RESPONSES	1.78	1.50	3.39	3.33	32.0125	< .0001
PREFERENCES	2.10	1.83	3.10	2.97	14.4150	.0024

TABLE 5

Performance during extramodal transference following each training phase

CHILDREN AND ADULTS

	MEDIANS			
	R1	R2	R3	R4
CORRECT RESPONSES	5.0	2.5	11.0	2.0
PREFERENCES	8.0	7.0	12.0	6.0

CHILDREN

	R1	R2	R3	R4
CORRECT RESPONSES	3.0	2.5	5.0	1.5
PREFERENCES	8.0	7.5	8.0	6.0

ADULTS

	R1	R2	R3	R4
CORRECT RESPONSES	6.0	2.5	13.0	2.0
PREFERENCES	9.0	7.0	13.0	5.0

TABLE 6

Friedman non parametric analysis of differences in levels of performance and relational preferences during extramodal transference

CHILDREN AND ADULTS

	FRIEDMAN'S MEAN RANKS				CHI SQUARE	SIGNIFICANCE LEVEL
	R1	R2	R3	R4		
CORRECT RESPONSES	2.64	2.04	3.51	1.81	55.7834	< .0001
PREFERENCES	2.61	2.62	2.99	1.78	25.8273	< .0001

CHILDREN

	R1	R2	R3	R4		
CORRECT RESPONSES	2.63	2.29	3.23	1.86	16.9822	.0007
PREFERENCES	2.62	2.81	2.64	1.93	41.5740	.0483

ADULTS

	R1	R2	R3	R4		
CORRECT RESPONSES	2.65	1.77	3.81	1.77	43.7077	< .0001
PREFERENCES	2.60	2.40	3.38	1.62	24.7039	.0000

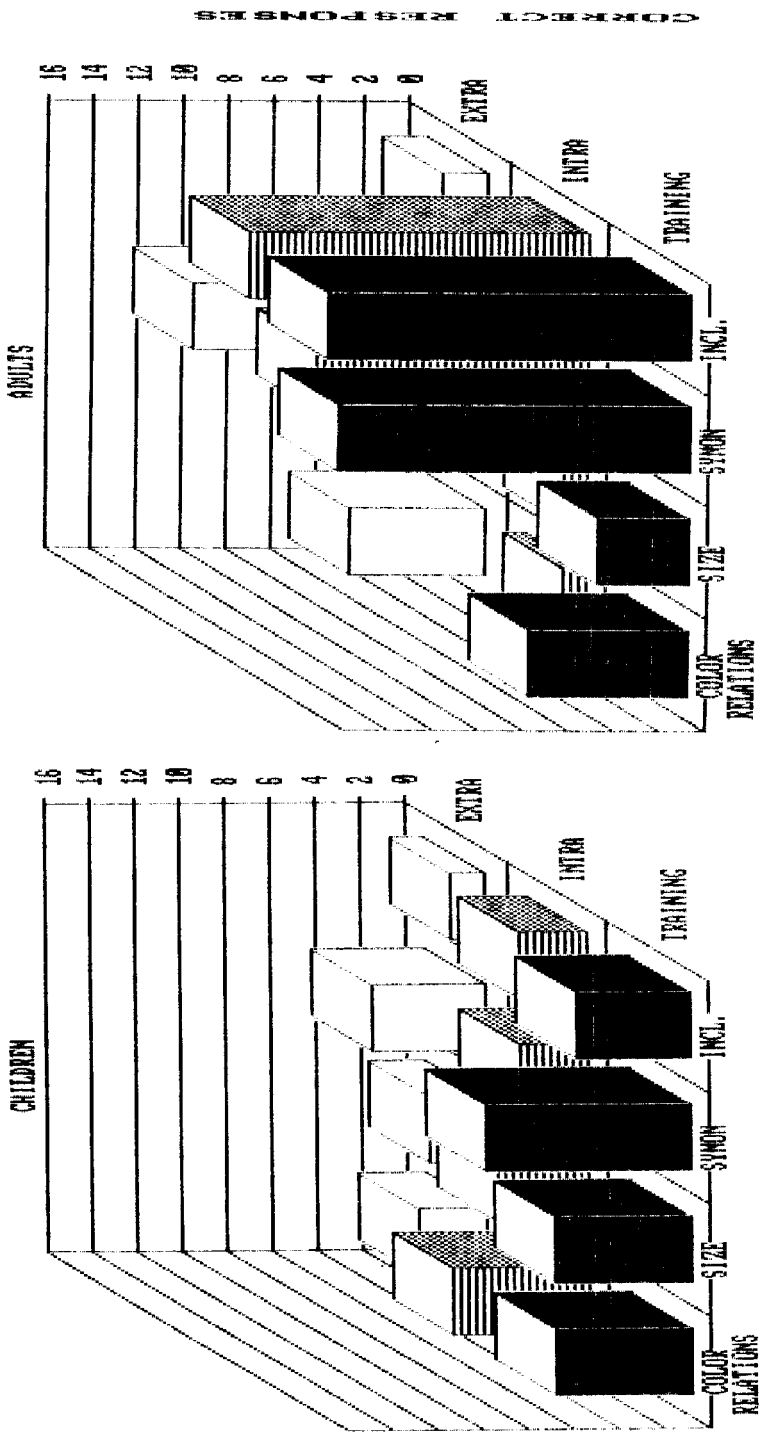

Figure 3. Performance level of children and adults in training, intramodal and extramodal transference.

Children's transference for colored based matches was slightly above chance level, and for the rest of the relations it was below chance level. Extramodal transference was poor for all relations, and slightly above chance level for antonyms. Figure 3 shows performance of children and adults for all three phases of the experiment.

Children exhibited chance level performance for most of the relations, while adults scored high for matches based on semantical properties of words. Adults could not learn to match words in terms of their physical properties, they were particularly unable to do so for size matches. Intra modal transferences was high for synonymity and semantic inclusion, and well below chance level for color and size matches. Extra modal transference was high for antonyms, close to chance level for color oddity, and well bellow chance for size oddity and abscence of semantic relation.

Relational preferences during concurrent tests are presented in figure 4 for both age groups. Children tended to prefer color matches and physically based matches in general during intramodal transference, there was no preference during extramodal transference, while adults opted for semantically based relations during intramodal transference, and antonyms during extramodal transference ($p < .0001$). It is worth noting that children preferred physical matches, inspite of rating higher for Synonyms. Adults preferences on the other hand correlated with level of performance for different relations.

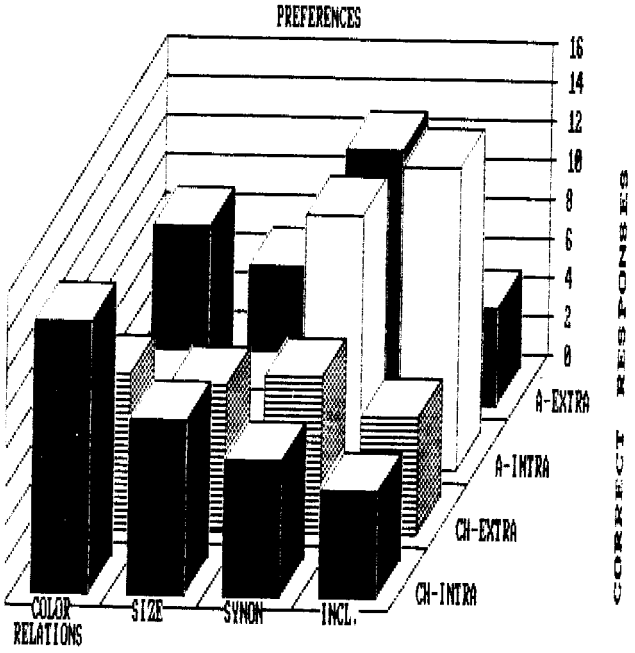

Figure 4. Relational preferences during concurrent intramodal and extramodal transference for children and adults.

In regard to latencies associated to each relation, they were even among children (p = .4046), while a slight tendency for shorter latencies for synonyms was recorded in adults (p = .0081), although significant differences were found in both groups. Figure 5 presents latencies associated to each relation for both age groups.

Table 7 and 8 present the data and non parametric analysis of correct responses and preferences of control groups, respectively. Control adults exhibited significant differences in performance and preferences for synonyms. (p = .0004 and p = .0053). Control children preferred physically based matches among other relations (p = .0188).

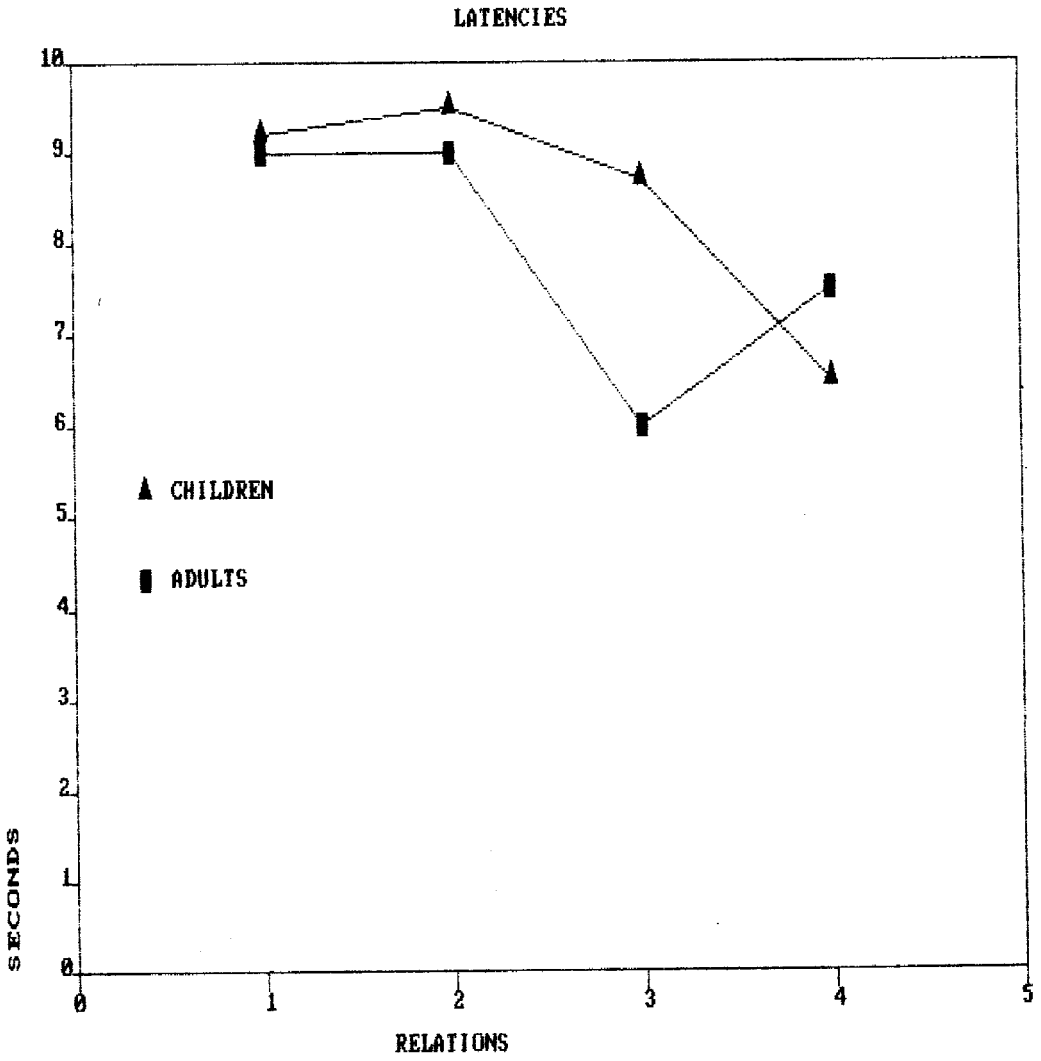

Figure 5. Comparison of children and adult latencies for different relations during tests.

TABLE 7

Performance and relational preferences for control subjects during intramodal and extramodal transference tests

CHILDREN AND ADULTS

	MEDIANS			
	R1	R2	R3	R4
CORRECT RESPONSES	2.0	2.0	10.0	10.5
PREFERENCES	7.0	6.0	11.0	12.0

CHILDREN

	R1	R2	R3	R4
CORRECT RESPONSES	11.0	5.0	3.0	1.0
PREFERENCES	15.0	13.0	3.5	4.0

ADULTS

	R1	R2	R3	R4
CORRECT RESPONSES	0.5	1.0	11.0	12.0
PREFERENCES	4.0	5.0	13.0	14.0

TABLE 8

Non parametric analysis of performance and relational preferences for control subjects during test phases

CHILDREN AND ADULTS

	FRIEDMAN'S MEAN RANKS				CHI SQUARE	SIGNIFICANCE LEVEL
	R1	R2	R3	R4		
CORRECT RESPONSES	2.04	2.21	2.92	2.83	4.1750	.2432
PREFERENCES	2.29	2.29	2.79	2.63	1.3500	.7173

CHILDREN

	R1	R2	R3	R4		
CORRECT RESPONSES	3.13	3.50	2.00	1.38	6.9750	.0727

TABLE 8 (continuation)

PREFERENCES	3.63	3.38	1.75	1.25	9.9750	.0188
ADULTS						
	R1	R2	R3	R4		
CORRECT RESPONSES	1.50	1.56	3.38	3.56	18.1125	.0004
PREFERENCES	1.63	1.75	3.31	3.31	12.7125	.0053

Analyisis of the effect that different training techniques had over performance is presented in table 9, which gives medians of correct responses during blocks of training. Table 10 shows a non parametric analysis of these data; significant differences among relations are recorded for adults in choice of comparative instances (p =. 0063) and for both groups with this same tecnique (p=. 0004).

TABLE 9

Performance level during training with different techniques: choice of comparison instances (position 1), choice of relations (position 2) and choices of sample instances (position 3)

CHILDREN AND ADULTS

	MEDIANS			
	R1	R2	R3	R4
POSITION 1	10.5	13.0	32.5	23.5
POSITION 2	25.0	21.0	29.0	18.0
POSITION 3	13.0	10.5	22.0	20.5

CHILDREN

	R1	R2	R3	R4
POSITION 1	7.0	10.0	27.0	13.0
POSITION 2	20.0	19.0	29.0	13.0
POSITION 3	11.0	9.0	20.0	18.0

ADULTS

	R1	R2	R3	R4
POSITION 1	25.0	15.0	35.0	31.0
POSITION 2	35.0	23.0	29.0	28.0
POSITION 3	15.0	11.0	30.0	23.0

TABLE 10

Non parametric analysis of performance during different training procedures

CHILDREN AND ADULTS

	FRIEDMAN'S MEAN RANKS				CHI SQUARE	SIGNIFICANCE LEVEL
	R1	R2	R3	R4		
POSITION 1	2.16	1.66	3.53	2.66	18.4125	.0004
POSITION 2	2.32	2.94	2.71	2.03	4.9941	.1722
POSITION 3	2.22	1.89	2.94	2.94	9.1333	.276

CHILDREN

	R1	R2	R3	R4		
POSITION 1	1.93	1.93	3.50	2.64	7.0286	.0710
POSITION 2	2.06	3.19	2.88	1.88	41.5740	.1251
POSITION 3	2.33	1.67	3.11	2.89	7.9661	.0809

ADULTS

	R1	R2	R3	R4		
POSITION 1	2.33	1.44	3.56	2.67	12.3333	.0063
POSITION 2	2.56	2.72	2.56	2.17	0.9000	.8254
POSITION 3	2.11	2.11	2.78	3.00	3.4000	.3340

Figure 6 shows that choice of sample instances (position 3) and choice of comparison stimuli (position 1) produced slightly lower scores in children for physical matches, in comparison with choice of second order stimuli (position 2). On the other hand adults did not show significant differences among techniques for matches based on semantical properties. Choice of relations (position 2) produced higher scores for physical matches than the other two technics, both with children and adults.

Additionally an analysis of the effect that order of exposure to training techniques had over performance was performed. Table 11 presents medians of correct responses for each relation. Medians of overall performance reveal that initial exposure to choice of relations, produced slightly better scores in children than the rest of the procedures, while initial exposure to choice of comparison instances produced the highest scores with adults.

These data is represented graphically in figure 7 which shows performance level of children and adults during training, for groups with different se-

TABLE 11

Performance level of groups with different sequences in training

CHILDREN AND ADULTS

	MEDIANS				
	R1	R2	R3	R4	TOTAL
GROUP 123	16.0	17.0	26.5	21.5	19.00
GROUP 231	11.5	14.0	22.0	15.0	21.00
GROUP 312	15.0	17.0	29.0	27.0	14.50

CHILDREN

	R1	R2	R3	R4	TOTAL
GROUP 123	14.0	11.0	20.5	15.5	15.75
GROUP 231	11.0	14.0	12.0	13.5	20.50
GROUP 312	7.0	12.0	20.0	18.0	14.00

ADULTS

	R1	R2	R3	R4	TOTAL
GROUP 123	38.5	40.0	32.0	29.0	33.38
GROUP 231	12.0	11.0	25.0	19.0	24.25
GROUP 312	35.0	23.0	36.0	33.0	19.50

quences of training: the first group was trained first in 'position 1', then in 'position 2' and later in 'position 3' (gruup 123). The second group received training in the following sequence: 'position 2', position 3' and 'position 1' (group 231) and the last group was exposed to the sequence: 'position 3', 'position 1', and 'position 2' (group 312). Order of exposure did not seem to affect children's performance significatively. Adults exhibited slightly higher overall scores with initial exposure to choice of comparative instances.

Medians of categorial responses in pre and postests are presented in table 12. The highest frequency recorded of use of categories was 40. Both children and adults seldom employed color descriptions during this phase. Around 25% of the times both groups refered to sizes of letters, while about 75% and 50% of the times children and adults respectively employed synonyms. Adults used significatively more inclusive semantic categories than children, around 75% to 25%.

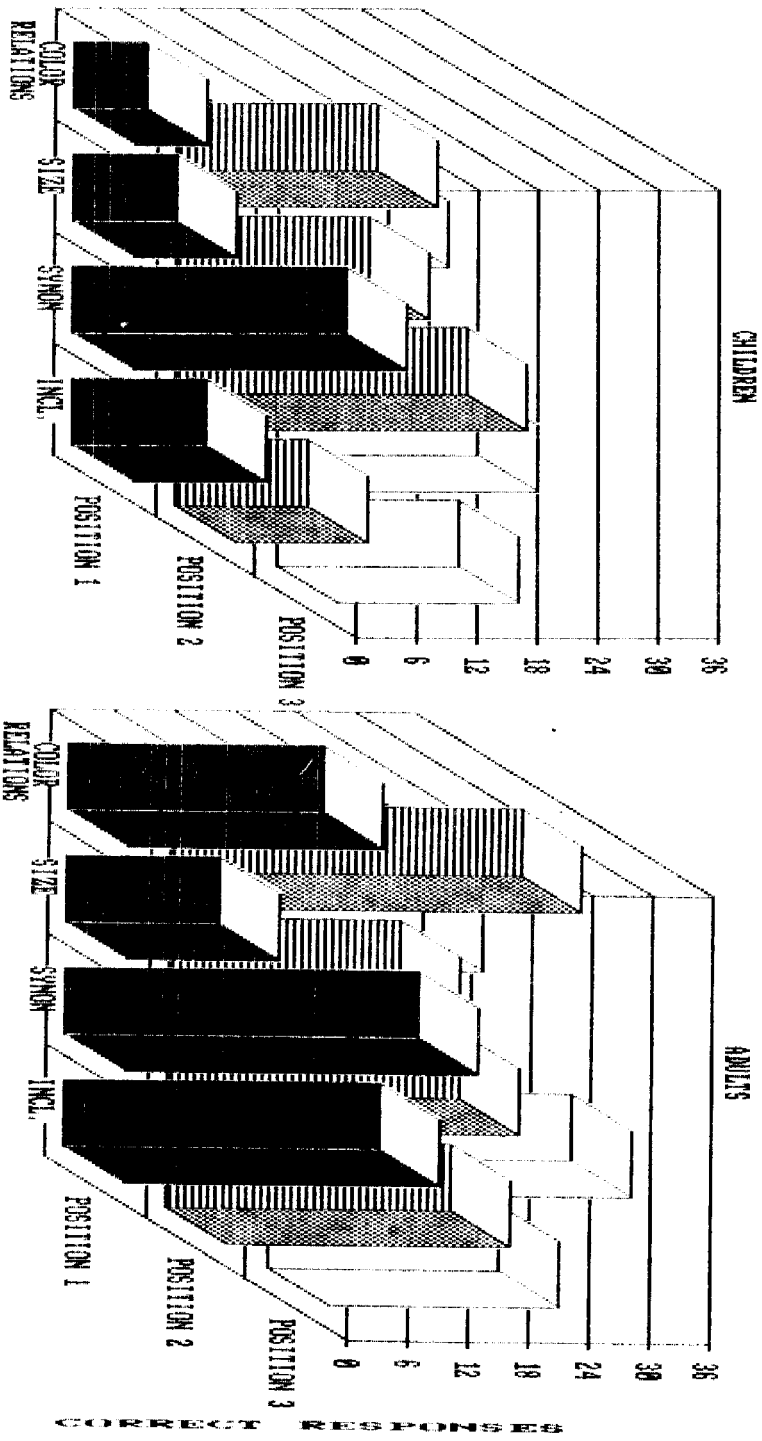

Figure 6. Performance level during training for children and adults with choice of comparison stimuli (position 1), choice of second order stimuli (position 2) and choice of sample stimuli (position 3).

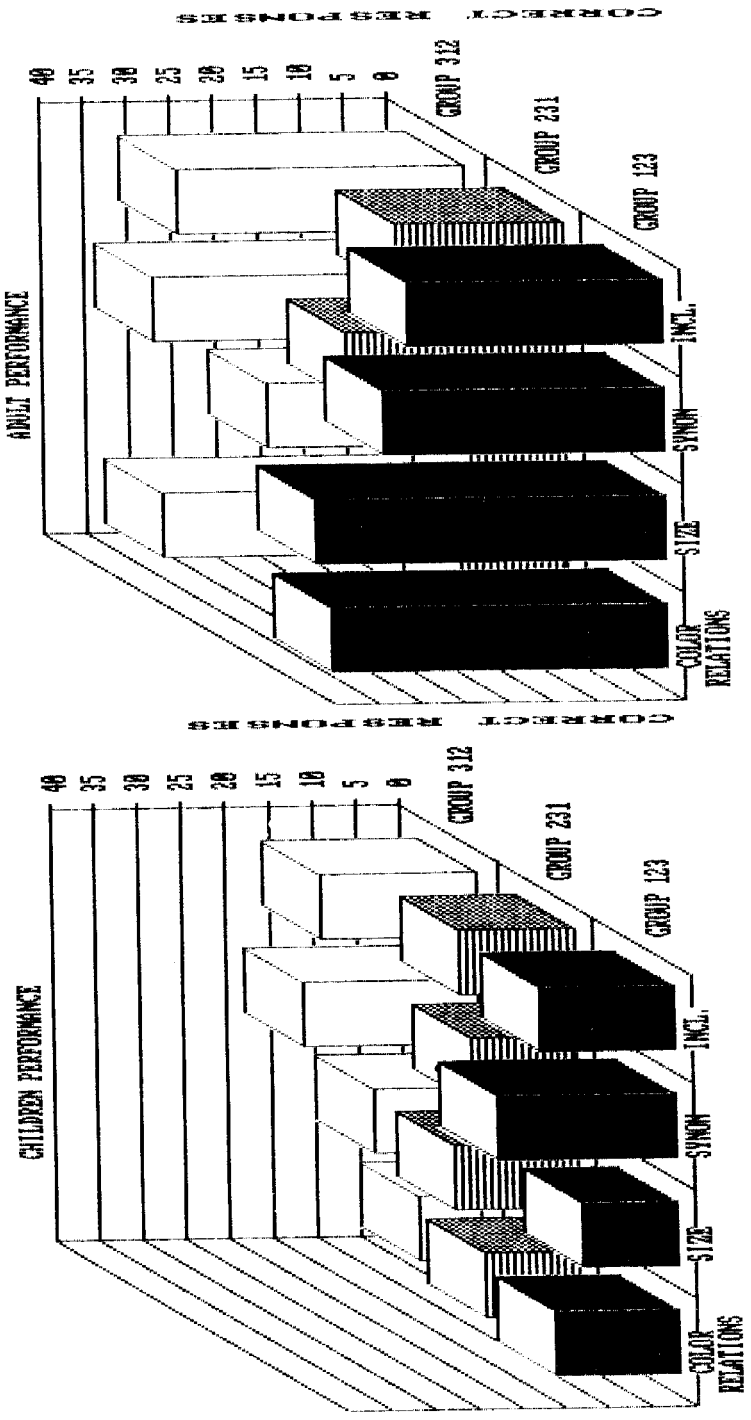

Figure 7. Performance level for groups with different sequences of exposure to training procedures.

TABLE 12

Categorial responses to descriptive questionnaires of colored words

MEDIANS

	R1	R2	R3	R4
CHILDREN AND ADULTS	2.5	12.0	25.0	17.0
CHILDREN	2.0	10.0	31.0	9.0
ADULTS	3.0	12.0	19.5	29.5

APPENDIX 1

TRAINING AND INTRAMODAL TRANSFERENCE

PAIRS OF WORDS USED AS SECOND ORDER STIMULI

mirror-liter	turtle-apricot	airship-airplane	frog-amphibious
chicken-sky	factory-tree	elder-old	tree-forest
book-mirror	pencil-coat	high-tall	dessert-cake

WORDS USED AS SAMPLE AND COMPARISON STIMULI

american	descent	husband	shield
august	flour	kayak	shark
air attendant	fish	juice	staircaise
assistant	foreing	man	step
buss	game	male	stewardess
ball	gasoline	mount	street
barrister	grandsons	nationality	star
bladder	german	organ	small
blazon	germanic	piece	substance
cornmeal	gulsh	progeny	sun
canoe	gun	prologue	spouse
city	helper	pupil	vessel
combustible	heraldry	revolver	veggy
container	hill	section	vegetable
disciple	higher	shark	yankee

EXTRAMODAL TRANSFERENCE

PAIRS OF WORDS USED AS SECOND ORDER STIMULI

dog-dog	Salary-wage	cold-hot	bucket-chalk

APPENDIX 1 (continuation)

WORDS USED AS SAMPLE AND COMPARISON STIMULI

acceptance	childish	impatient	rich
adult	day	inmovil	ruddeness
ancient	defect	insult	rubber
animal	duck	incomprehension	small
attribute	dummy	movil	structure
ailment	edifice	night	shirt
being	employ	nocturnal	sickness
bad word	flu	patience	stupid
building	fryer	quality	tall
bush	gastritis	old	thimble
bycicle	glacial	person	train
castle	health	poor	transport
commercial	home	praise	tropical
comprehension	homemade	people	unemployed
construction	house	receptacle	vehicle
child	human	relative	wealth

CONCLUSIONS

Krueger (1984) has argued that letters are more salient than any other visual stimulus, not solely due to their conceptual properties, but because of their physical features. In this study written words were used alternatively as physical and semantical stimuli, on a random basis. This procedure was particularly sound, because in this way, familirarity with letters was matched for both situations, words were physical objects or semantic stimulus, depending on an specific signal.

The unability of children to learn conditional relations in few sessions, compared with the performance of adults, might point to important differences in abstracting abilities associated to ontogenic development, with emphasis in categorial thinking (Simon & Ward 1981; Bornstein 1984; Markman 1984). On the other side, adults were not capable in the same period they learned semantic relations, to fall under control of words as physical objects, which suggest certain irreversible effect of using and seeing words solely as semantical objects. This suggest that adults were not capable of developing transituational mediation in the physical matching task, being controlled just by the extrasituational and even the linguistic-situational properties of words as stimuli. This is supported also by adults' poor performance in semantic inclusion during the extramodal transference tests.

Both effects were more evident in concurrent tests, when subjects were free to choose the relations they wanted to work with.

Research on relational preferences might promise to shed some light in the understanding of processes involved in relational thinking (Hernández-Pozo & Coronado 1987). Latencies in this study were not of particular interest, since they did not show systematic changes associated to learning levels in spite that other authors have emphazised their importance (Simon & Craft 1972; Baron, Menich & Perone 1983). A slight interaction was recorded also between methods and relations: choice of comparative instances favored semantic matches, while choice of relations favored physical ones. This latter finding suggest differences in learning resulting form emphasis in functionally different stimuli, that is, absolute (comparative instances) versus relative qualities (relational) of stimuli.

Conditional second order procedures have proved to be of some help to assess levels of deterioration of abstract thinking in disabled subjects (Datillo 1986; Devany, Hayes, & Nelson 1986; Greenfield & Scott 1986; González, Hernández-Pozo, Hermosillo, Ibanez, Moreno & Ribes in preparation). They might also provide some help in the understanding of processes involved in different semantical relations, and in this way they might contribute to the development of a theory of relation comprehension, which in these days is far from being settle (Herrmann 1987). The study of semantic relations will be the aim of further research on this line for the future.

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