

BRIEF REPORT

## Emerging Tacts and Selections from Previous Learned Skills: A Comparison between Two Types of Naming

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**Abstract** Naming consists of tacting an object and selecting it upon hearing its name as a result of emergence. After acquiring naming, children learn object–name relations more quickly and, hence, it is an important achievement in development. We studied the acquisition of the two skills that define naming, using two procedures, in seven typically developing 4-year-old children. The tact-selection procedure consisted of (a) teaching tacts of objects (or pictures) and probing for object selection upon hearing the objects’ names, and (b) teaching object selection and probing tacts. The pairing procedure consisted of presenting objects (or pictures) at the same time that an adult said their names, without requiring from the child other response than attending. Of the seven children, five showed emergence of selection responses and tacts. Children showed more instances of emergence with the tact-selection procedure than with the pairing procedure and with three-dimensional (3-D) objects than with pictures. The results have important implications for teaching preschool children and children with learning disabilities.

**Keywords** Naming · Pairing · Tacts · Selection · Emergence

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### Introduction

Naming consists of tacting an object and selecting it upon hearing its name derived from previous exposure to the object and the name (Horne and Lowe 1996). Naming is demonstrated by a child when, with several distinct objects, (a) after being explicitly taught to tact an object, the operant consisting of selecting it upon hearing its name emerges or (b) the tact emerges after learning to select the object upon hearing its name. The emergence of the untaught skills has been widely demonstrated with these procedures (Horne et al. 2004, 2006, 2007; Lipkens et al. 1993; Lowe et al. 2002; Lowe et al. 2005; Mahoney et al. 2011; Miguel et al. 2008; Pérez-González and Williams 2000); we will refer to them here collectively as a *tact-selection procedure*.

Recently, Greer and collaborators have demonstrated the emergence of tacts and selections after teaching identity matching to sample, object selection, pure tacts, and intraverbal tacts with other stimuli (see the description in Greer and Ross 2008, p. 63; see demonstrations in Fiorile and Greer 2007; Gilic 2005; Gilic and Greer 2011; Greer et al. 2005, 2007; Hawkins et al. 2009; Longano 2008). Another group of researchers has demonstrated the emergence of tacts and selections with a procedure that consists of presenting the child with a number of pictures while saying the pictures names, one by one, without requiring any response from the child other than attending (e.g., Carnerero and Pérez-González *in press*; Pérez-González et al. 2011); we will refer to this procedure as a *pairing procedure*.

In summary, three procedures (the tact-selection procedure, the procedure described by Greer and Ross 2008, and the pairing procedure) have been reported to

result in the emergence of object selection and tacts. The processes involved in the emergence of these skills with each procedure may be, however, different. The goal of the present study was to investigate whether children's demonstration of the emergence of the two naming skills (tacts and selections) with the tact-selection teaching procedure, resulted in the emergence of these skills with the pairing procedure.

The studies conducted so far have used three-dimensional (3-D) stimuli (Gilic 2005) and two-dimensional (2-D) stimuli (Greer et al. 2005, 2007). The results suggest that it may be easier to obtain naming with 3-D than with 2-D stimuli, but none of the studies analyzed the impact of stimulus dimensionality on naming. Thus, a second goal of the present study was to compare the performances in the tact and object selection probes obtained by the children after being exposed to the pairing procedure with three- and two-dimensional stimuli.

## Methods

### Participants

The participants were seven typically developing Spanish-speaking children from a public school in Oviedo, Spain. They were randomly selected and assigned to two conditions as described below. Isabel (female, 4 years, 7 months), Ángel (male, 4 years, 5 months), and Simón (male, 4 years, 1 month) were assigned to Condition A, and Gemma (female, 4 years, 9 months), Gonzalo (male, 4 years, 7 months), Loreto (female, 4 years, 5 months), and Carmen (female, 4 years, 2 months) were assigned to Condition B.

### Materials and Relations

Four stimulus sets were used (see Fig. 1). Each set consisted of meaningless, three- to four-letter words and their corresponding objects or pictures. Stimuli B, D, and F, of Parts 1 and 2 were objects; stimuli H of Part 3 were pictures of objects. The objects were not familiar to the children. In object/picture selection, the dictated words (A, C, E, or G) were the samples and the objects/pictures (B, D, F, or H) were the comparisons. In the tact probes, the objects/pictures were the stimuli and their arbitrary names (corresponding to A, C, E, or G) were the responses.

## Setting and Sessions

Sessions were conducted in a classroom containing a table and two chairs at the children's school. The experimenter and the child were seated face to face. Each child was exposed to three sessions per week lasting approximately 20 min. The child received two stickers for their participation in the experiment, regardless of his/her performance.

## Procedure

### Overview


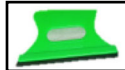

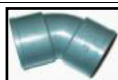
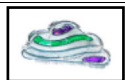







The experiment consisted of three parts. In Part 1, we taught participants to tact objects and select other objects upon hearing their names and probed the untaught skill. In Parts 2 and 3, we exposed participants to the pairing procedure with either objects or pictures and assessed the emergence of both tact and selection skills.

### *Part 1. Tact-Selection Procedure with Objects*

Children in Condition A learned first to select objects upon hearing their names—object selection, explained below—with stimuli A and B, and then they were probed for the emergence of tacts with these stimuli. Thereafter, they learned new tacts with stimuli C and D and were probed for the emergence of object selection. Children in Condition B first learned to tact stimuli A and B and were probed for the emergence of the object selection. Thereafter, they learned object selection with stimuli C and D and were probed for the emergence of the tacts. The components of Condition A are described below. The components of Condition B were identical to those of Condition A, except that the stimuli used in each component as well as the sequence of Condition B were the ones indicated above.

*Teaching Object Selection* The goal was to teach a conditional discrimination in which the child had to match names to objects. The teaching was conducted in six phases with a variation of the blocking procedure, which is effective for teaching conditional discriminations to 4-year-old children (Pérez-González and Williams 2002; Rodríguez-Mori and Pérez-González 2005; Williams et al. 2005).

**Fig. 1** Stimuli used in each part of the study and their alphanumerical notation. Stimuli B, D, and F were objects. Stimuli H were pictures. Stimuli A, C, E, and G were dictated words

<b>Part 1. Tact-selection teaching procedure with objects</b>		
Condition A		
A1 TAN	A2 SIMA	A3 PIL
B1 	B2 	B3 
Condition B		
C1 COS	C2 LOPA	C3 TUN
D1 	D2 	D3 
<b>Part 2. Pairing procedure with objects</b>		
E1 LOE	E2 TUMO	E3 PAS
F1 	F2 	F3 
<b>Part 3. Pairing procedure with pictures</b>		
G1 ENI	G2 PULE	G3 UTE
H1 	H2 	H3 

In Phase 1, the experimenter told the child, “We are going to learn some strange objects. Okay?” Then, the experimenter placed objects B1, B2, and B3 left to right on the table in front of the child and told her/him (in Spanish), “I am going to say the name of an object and you should point to it; starting now, every time I tell you ‘TAN’ (A1), the correct response is to select this object” and the experimenter pointed to B1 (a prompt). Correct responses were followed by praise, such as “that’s right,” “very good.” Trial 2 was as Trial 1, except that the experimenter said just “TAN” and pointed to B1. On Trial 3, the experimenter said “TAN” and waited 3 s for the correct response (i.e., she did not present the prompt). If the child did not respond within 3 s, or responded incorrectly, the experimenter said, “no, TAN” and pointed to the correct object (a correction);

selections of the child after a correction were not followed by differential consequences. The experimenter continued presenting trials with the objects in the same location and asking for the object “TAN.” When the child made three consecutive correct responses with no prompt, the experimenter continued to Phase 2. This phase was identical to Phase 1, except that the experimenter said the word “SIMA” (A2) and the correct object was B2. In Phase 3, the experimenter said either A1 or A2, randomly across trials. The objects remained in the same locations. When the child made eight consecutive correct responses, the experimenter moved to Phase 4. Phase 4 was identical to Phase 1, except that the experimenter said the word “PIL” (A3) and the correct object was B3. In Phase 5, the experimenter said A1, A2, or A3, randomly across trials. The objects remained

in the same locations. When the child made nine consecutive correct responses, the experimenter moved to Phase 6. Phase 6 was as Phase 5, except that the locations of the objects were random across trials, with the constraint that each object was presented four times in each location (left, center, or right) every 12 trials. Object selection was considered acquired when the child reached a criterion of nine consecutive correct responses.

**Tact Probe** The experimenter told the child, “Now, I am going to show you the objects we have seen before and I wish you to tell me their names. I will not tell you whether you do it right or not. Okay?” The objects were placed on the table randomly across trials, with the constraint that every object was presented once every three trials in a 12-trial block. In each trial, the object was left on the table for 3 s for the child to respond. No differential consequences were provided for either correct or incorrect responses. If the child reached a criterion of ten or more correct responses, the experiment continued to Part 2 (Pairing Procedure with Objects, described below). If the child did not reach this criterion, the experimenter reviewed Phase 6 of the object selection and repeated the tact probe; then the child was exposed to Part 2.

**Teaching Tacts** Tacts were taught in five phases. In Phase 1, the experimenter told the child, “Now, we are going to learn the names of other objects. I will show you an object and you have to say the name.” The experimenter placed object D1 on the table in front of the child and told the child, “Starting now, every time you see this object, the correct response is ‘COS’ [C1]” (a prompt). When the child repeated the name, the experimenter said “that’s right.” Trial 2 was the same as Trial 1, except that the experimenter just said “COS.” If the child responded before the experimenter provided the prompt, the consequences were as in Trial 3. Starting on Trial 3, the experimenter placed the object on the table, but she did not say its name. If the child said the correct name, the experimenter said “that’s right,” “very good,” or a similar expression. If the child did not respond within 3 s, or responded incorrectly, the experimenter told the participant “no; COS” (a correction). When the child repeated the name, the next trial started. When the child made three consecutive correct responses with no prompt, the experimenter continued to Phase 2. Phase 2 was identical to Phase 1, except that the experimenter presented the object D2 and the correct response was to say “LOPA” (C2). In Phase 3, the

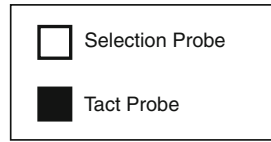
experimenter presented objects D1 or D2 randomly across trials. When the child made eight consecutive correct responses, the experimenter moved to Phase 4. Phase 4 was identical to Phase 1, except that the experimenter presented the object D3 and the correct response was to say “TUN” (C3). In Phase 5, the experimenter presented objects D1, D2, or D3 randomly across trials. The tacts were considered acquired when the child reached a criterion of 12 consecutive correct responses.

**Object Selection Probe** The experimenter told the participant, “Now, I am going to place the objects on the table and I wish you to select the correct object when I tell you the name. I will not tell you whether you do it right or not. OK?” The experimenter placed the objects and said the object names as in Phase 6 of teaching object selection. No differential consequences were provided for either correct or incorrect responses. The experimenter presented 12 trials. If the child reached a criterion of ten or more correct responses in the first probe, he or she was exposed to Part 2 (Pairing Procedure with Objects). If the child did not reach the criterion in the first probe, the experimenter reviewed Phase 5 of the tacts and repeated the object selection probe; then the child was exposed to Part 2.

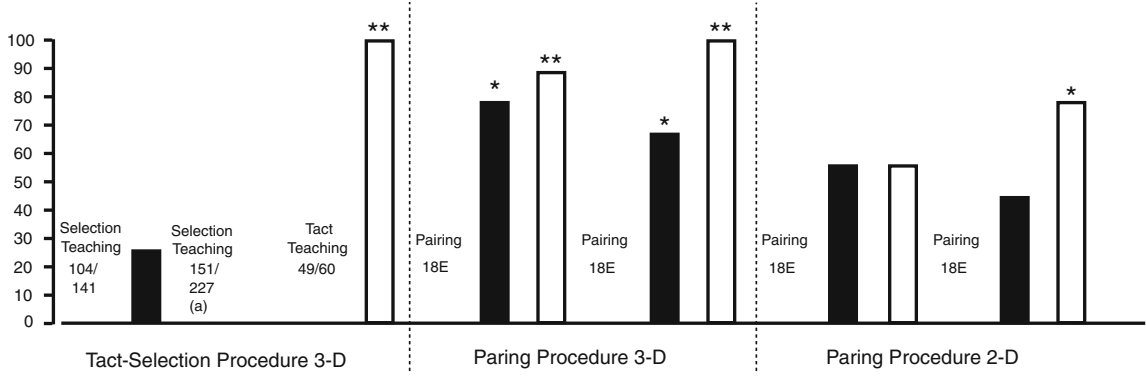
### Part 2. Pairing Procedure with Objects

All participants were exposed to this part (regardless of the condition, A or B, that they had been exposed to in Part 1). It was conducted with stimuli E and F. The children were first exposed to the pairing phase; then they were probed for the emergence of tacts and object selection with these stimuli.

**Fig. 2** Percentage of correct responses (of a total of 12 responses in the tact-selection procedure and nine responses in the pairing procedure) obtained by each child in the selection and tact probes in each part of Condition A. Left to each bar is the number of correct and total responses required to meet criterion in the tact-selection teaching procedure, or the number of nonrequired responses emitted by the child in the 18 presentations of the pairing procedure: “A” indicates that the child anticipated the word spoken by the experimenter; “E” indicates that the child repeated the word; “S” indicates that the child pointed to the picture on the screen. *Two asterisks above a bar* indicate that the child met criterion with three stimuli; *one asterisk* indicates that the child responded correctly to all trials corresponding to two of the three stimuli of the set. **(a)** indicates that after 227 trials without reaching criterion with this child, the experimenter finished this phase and went on with Part 2. **(b)** indicates that 1 response (first or third passes) or two responses (second pass) were incorrect

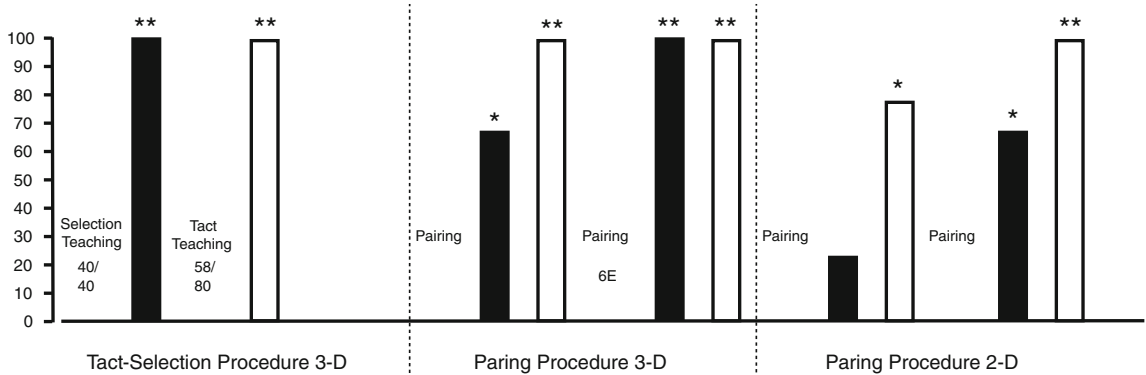


Isabel

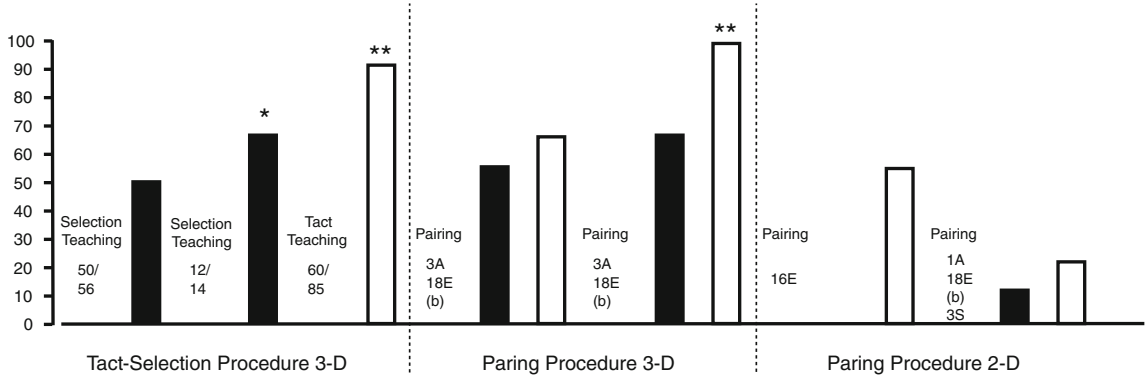


Ángel

% Correct Responses



Simón



**Pairing Phase** The experimenter told the child, “Now, we are going to see some objects and I wish you to pay close attention. OK?” Then, the experimenter placed an object on the table (F1, F2, or F3), waited for the child to look at it, and said the corresponding dictated word (E1, E2, or E3); if the child did not look at the object within a few seconds, then the experimenter moved the object on the table to call it to the child’s attention. Thereafter, the experimenter waited for 3 s, and presented the next object. She presented each object six times in an 18-trial block, randomly but with the constraint that each object was presented twice every six trials. If the child said something, the response was ignored. The experimenter, however, recorded if the child said the name before the experimenter did, repeated the name, or pointed to the object, for further analysis.

**Tact and Object Selection Probes** These probes were identical to the tact and object selection probes conducted in Part 1, except that nine trials were presented in each probe. If the child did not reach at least eight correct responses in one probe, the experimenter reviewed the pairing phase and repeated the tacts and the object selection probes. If the child reached the response criterion in both probes the first time, or after conducting the probes for the second time, the experiment continued to Part 3.

### Part 3. Pairing Procedure with Pictures

This part was identical to Part 2, except that it was conducted with stimuli G and H, which were pictures instead of objects. After the criterion was reached or after the second probe, the experiment was concluded.

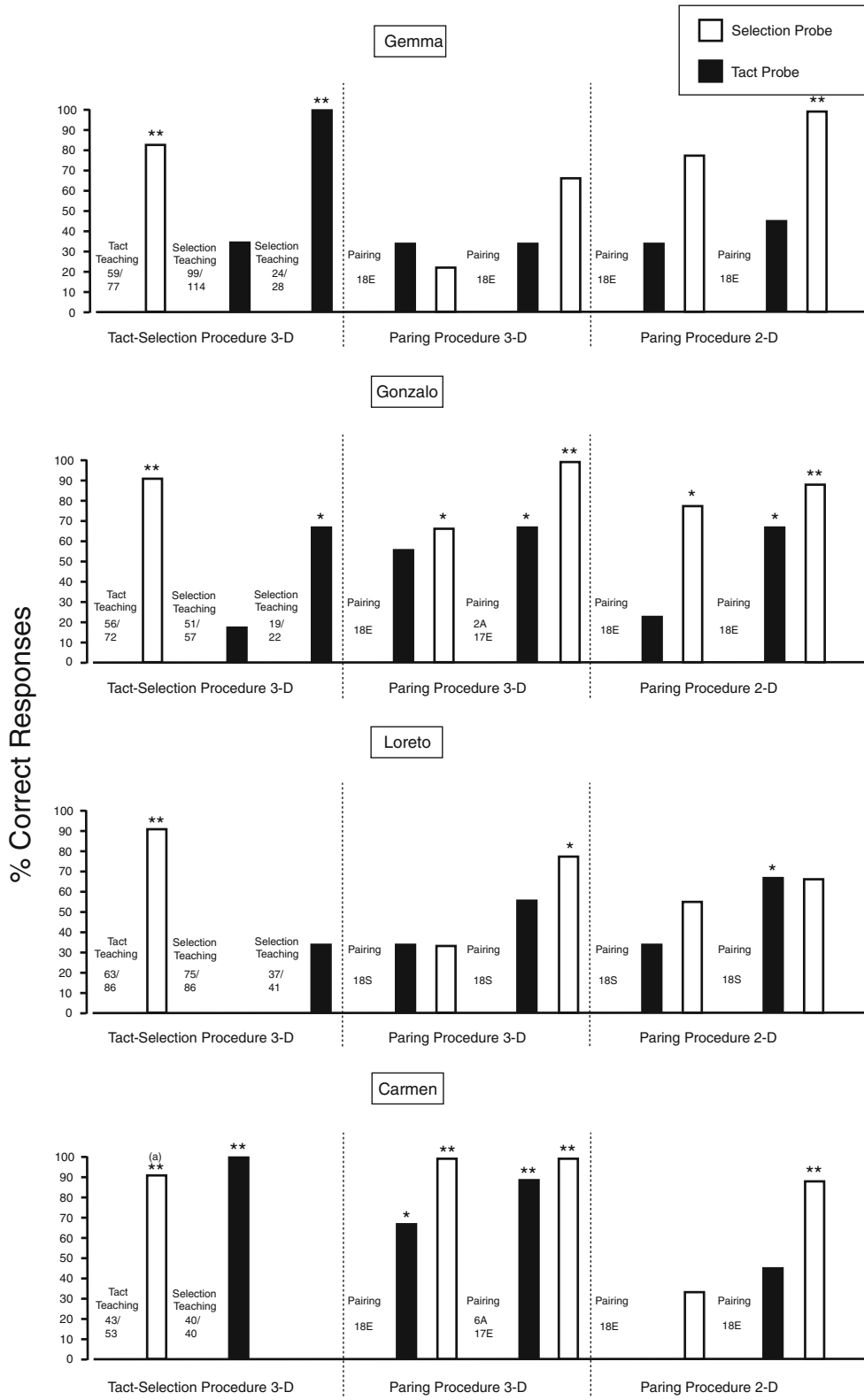
**Response Definitions and Interobserver Agreement** The experimenter recorded all vocal and pointing responses made throughout the experiment (that included anticipations to the word spoken by the experimenter). A correct tact response was defined as correctly pronouncing at least three quarters of the sounds of the word (e.g., say “sina” instead of “sima” was considered correct). Responses in selection tasks were defined as touching the object (or pictures) with a finger. Correct responses were defined as touching the specified object. A second observer recorded children’s responses independently, on 682 of a total 2,099 trials. Interobserver agreement [ $\{\text{agreements}/(\text{agreements} + \text{disagreements})\} \times 100$ ] averaged 98.1 % (range across participants 97.2–100 %).

## Results and Discussion

The results appear in Fig. 2 (Condition A) and Fig. 3 (Condition B). In Part 1 (tact-selection procedure with objects), three of the seven children (Ángel, Gemma, and Carmen) met criterion in the tacts and in the object selection probes. Ángel was exposed to Condition A, and Gemma and Carmen to Condition B. In Part 2 (pairing procedure with objects), two children (Ángel and Carmen) demonstrated naming for all three stimuli. In Part 3 (pairing procedure with pictures), no child demonstrated naming for all three stimuli. Because some children did not meet criterion, but had a considerable number of correct responses, we considered data from the probes in which the children did not meet criterion but responded with 100 % accuracy for two of the three stimuli in a set (see bars with one star in Figs. 2 and 3). According to this learning criterion, in Part 1, two additional children (Simón and Gonzalo) demonstrated naming. In Part 2, two additional children (Isabel and Gonzalo) demonstrated naming. In Part 3, two children (Ángel and Gonzalo) met criterion for two of the three stimuli. The results of the pairing procedure with 4-year-old children indirectly replicate the results obtained by Camerero and Pérez-González (*in press*) and by Pérez-González et al. (2011) with 6-year-old children.

The first goal of the present study was to find out whether the children who showed emergence of tacts and selections after the tact-selection teaching procedure would also show the emergence of tacts and selections with the pairing procedure. With the tact-selection teaching procedure (Part 1, with 3-D stimuli), three children (Ángel, Gemma, and Carmen) demonstrated the emergence of tacts and selections with all three stimuli, and two more children (Simón and Gonzalo) demonstrated the emergence of these operants with two of the three stimuli. With the pairing procedure and 3-D

**Fig. 3** Percentage of correct responses obtained by each child in the selection and tact probes in each part of Condition B. Left to each bar is the number of correct and total responses required to meet criterion in the tact-selection teaching procedure, or the number of nonrequired responses emitted by the child in the 18 presentations of the pairing procedure: “A” indicates that the child anticipated the word spoken by the experimenter; “E” indicates that the child repeated the word; “S” indicates that the child pointed to the picture on the screen. *Two asterisks above a bar* indicate that the child met criterion with three stimuli; *one asterisk* indicates that the child responded correctly to all trials corresponding to two of the three stimuli of the set. **(a)** indicates that the child said the name in ten trials and then she made a correct selection





stimuli (Part 2), two children (Ángel and Carmen) demonstrated the emergence of tacts and selections with three stimuli, and two more children (Isabel and Gonzalo) demonstrated the emergence of these operants with two of the three stimuli. Thus, the results were mixed. For four children, the results obtained with the pairing procedure were virtually identical to the results in the tact-selection procedure (Ángel, Simón, Gonzalo, and Carmen). For two children, the results were different: Gemma showed the emergence of tacts and selections after the tact-selection procedure, but she did not show the emergence in either operant after the pairing procedure; Loreto met the emergence criterion in the selections after the tact-selection procedure and she had slightly lower scores in the selections after the pairing procedure. Thus, although some 4-year-old children had demonstrated the emergence of the naming skills with the tact-selection procedure and the pairing procedure at this age, the emergence of these skills with the tact-selection procedure does not imply this emergence with the pairing procedure, with 3-D stimuli. In our opinion, the different outcomes obtained with the two procedures indicate the existence of two different capabilities (as defined by Greer and Ross 2008, and Pérez-González *in press*). Moreover, the data of the present study are consistent with the hypothesis that the tact-selection naming capability is acquired before than the pairing naming capability.

The second goal of the present study was to compare emergence outcomes of the pairing procedure with 2-D and 3-D stimuli. With 3-D stimuli, two children (Ángel and Carmen) demonstrated the emergence of tacts and selections with the three stimuli, and two more children (Isabel and Gonzalo) demonstrated the emergence of both of these operants with two of the three stimuli. With 2-D stimuli, no child demonstrated the emergence of tacts and selections with the three stimuli, but two children (Ángel and Gonzalo) demonstrated the emergence with two of the three stimuli. The results suggest that tacts and selections emerge more easily in some children with 3-D stimuli than with 2-D stimuli. These results replicate those found in previous studies that also showed that naming occurred at an earlier age with 3-D stimuli than with 2-D stimuli (e.g., Gilic 2005; Greer et al. 2005, 2007). The present study, however, is the first one in which the same participants received the probes with both types of stimuli and the comparison was made with the pairing procedure.

Two sequences were used for studying naming with the tact-selection teaching procedure. In Condition A,

object selection was taught first and the tacts were probed; thereafter, with a second stimulus set, the tacts were taught and the object selection was probed. In Condition B, the order of the taught and the probed skills was reversed. The results indicate no differences between the two sequences.

When the pairing procedure was used, most children repeated the word spoken by the experimenter or even anticipated the word by saying the name before the experimenter. All children who did so also showed some instances of naming. The only child who did not repeat the word emitted by the experimenter during the pairing phase did not demonstrate naming (Loreto). Thus, these results suggest that having an echoic repertoire (repeating words) may play an important role in the emergence of the two naming skills with the pairing procedure. These results regarding echoics replicate those obtained by Hawkins et al. (2009) and Longano (2008).

Several variables should be analyzed in further research; for example, it is possible that the number of stimuli per set and the order in which the tact-selection and the pairing procedures is presented affect the emergence of tacts and object or picture selection. The present study may have important implications for research on naming and related applications, especially due to the great number of skills that are learned with procedures that involve observing two stimuli without making a specific response other than listening to the auditory stimulus and looking at the corresponding visual stimulus.

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