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CONTEXTUAL CONTROL IN VISUOSPATIAL PERSPECTIVE-TAKING SKILLS IN ADULTS WITH INTELLECTUAL DISABILITIES

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The aim of this study was to teach left/right (Experiment 1) and near/far (Experiment 2) discrimination with reference both to self and to another person. The procedures used involved teaching discrimination in expressive language (speaker behavior) and then testing the transfer of learning into receptive language (listener behavior). A total of six intellectually disabled adults took part in the study, four in Experiment 1 and two in Experiment 2. The results showed that the subjects learned the target behavior in expressive language and performed correctly in tests to confirm the transfer of learning to receptive language. Experiments to analyze the function of the stimuli involved in receptive language share a certain amount of common ground with research into conditional discrimination under contextual control. The procedures used in such experiments may additionally enhance the teaching of visuospatial perspective-taking skills. Copyright © 2015 John Wiley & Sons, Ltd.

Depending on the number of elements (stimuli, responses, and consequences) involved, Sidman (1986) distinguishes four types of contingency. A two-term contingency specifies the relation between a response and its consequence. A three-term or simple-discrimination contingency introduces a stimulus with a discriminative function. A four-term or first-order conditional-discrimination contingency describes an interaction, in which the response to a discriminative stimulus is reinforced only if another (conditional) stimulus is present (Saunders & Spradlin, 1989). A standard example is that of a child asked to point to one of two objects (B1 and B2) on hearing its name (A1 and A2), giving rise to the stimulus relation (A1B1 and A2B2). A second-order conditional-discrimination or contextual-control task would be a five-term contingency comprising three stimuli (contextual, conditional, and discriminative), a response and a consequence. Essentially, in these procedures, correct stimulus

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relations (conditional and discriminative) are determined by contextual stimuli (X1 and X2). For example, in the presence of contextual stimulus X1, the correct stimulus relationship is A1B1, while in the presence of contextual stimulus X2, the correct stimulus relationship is A1B2. Four possible relationships may therefore exist for the three stimuli (contextual, conditional, and discriminative): X1A1-B1, X1A2-B2, X2A1-B2, and X2A2-B1. Contextual control of conditional discriminations in basic research has been widely documented (Bush, Sidman, & de Rose, 1989; Lynch & Green, 1991; Pérez-González & Martínez, 2007; Serna & Pérez-González, 2003).

Conditional discrimination research has shown that people with intellectual disabilities or autism who do not readily acquire conditional discrimination can be taught a wide range of complex discriminations. With specific regard to first-order conditional discrimination, a number of papers report success in color discrimination (e.g., Williams, Pérez-González, & Queiroz, 2005), the scheduling of activities (e.g., Miguel, Yang, Finn, & Ahearn, 2009), basic mathematical and geographic skills (e.g., Hall, DeBernardis, & Reiss, 2006), dealing with money (e.g., Keintz, Miguel, Kao, & Finn, 2011; Savona, 2009), training in reading and spelling (e.g., de Souza, de Rose, & Domeniconi, 2009), and musical skills (e.g., Arntzen, Halstadtro, Bjerke, & Halstadtro, 2010). However, there has been less research in the area of second-order or contextual-control conditional discriminations. Studies have hitherto addressed same number/different number discrimination (Alós & Lora, 2007) and discrimination between symmetry and asymmetry using drawings (O'Connor, Barnes-Holmes, & Barnes-Holmes, 2011).

Alós, Sánchez and Moriana (2008) reported on a procedure for teaching a specific visuospatial task to a visually impaired child with intellectual disability: left/right discrimination with reference to self. Simple discrimination was taught explicitly, and transfer to first-order conditional discrimination was subsequently tested. Simple discrimination gave rise to a three-term contingency: a discriminative stimulus (the spatial location of the object), a verbal response by the child ('left' or 'right'), and a social consequence (what was the consequence?). Conditional discrimination gave rise to a four-term contingency comprising: a conditional stimulus, one of two possible words right (A1) or left (A2) presented by the experimenter; a discriminative stimulus, the spatial location of the object, position 1 (B1) or position 2 (B2); a selection response; and a social consequence. The teaching procedure used prompted the transfer of learning to conditional discriminations without the need for explicit training. This visuospatial task thus involves two kinds of contingencies: simple discrimination and conditional discrimination. However, the experimenter could also say to the child: 'Point to the one which is to my (X1) or your (X2) right (A1) or left (A2)'. This would give rise to the following possible stimulus relations: my right and point to position 1 (X1A1-B1), my left and point to position 2 (X1A2-B2), your right and

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point to position 2 (X2A1-B2), or your left and point to position 1 (X2A2-B1). In this example, left/right discrimination is required with reference either to self or to the other. The autoclitics my and your would thus appear to function as contextual stimuli. The teaching of this discrimination may be a skill related to perspective taking.

Perspective taking has traditionally been studied as part of the Theory of Mind. Advocates of this theory conceptualize perspective taking as a system of cognitive mechanisms enabling people to attribute mental states to others (Ozonoff & Miller, 1995). Howlin, Baron-Cohen, and Hadwin (1999) distinguish five levels of perspective taking. Level 1 involves the awareness that different people can see different things. Level 2 concerns the awareness that people can see the same things differently. Individuals at Level 3 come to understand that 'seeing leads to knowing'. Level 4 in the development of informational states involves true beliefs and predicting actions on the basis of a person's knowledge. Finally, Level 5 involves the understanding of false belief and predicting actions on the basis of beliefs that are false rather than true. Specifically, it should be noted that in studies of visual perspective taking, both near/far discrimination and left/right discrimination are deemed to belong to Level 2 (Brunyé et al., 2012; Davis, 1983; Howlin et al., 1999). This issue is also currently being addressed from the standpoint of behavior analysis. Some progress has been made in analyzing the skills required for perspective taking (Barnes-Holmes, Rodríguez, & Whelan, 2005; García-Asenjo, 2012; Gómez-Becerra, Martín, Chavez-Brown, & Greer, 2007; McHugh, Barnes, & Barnes, 2004; Naranjo, 2010; Rehfeldt, Dillen, Ziomec, & Kowalchuk, 2007; Spradlin & Brady, 2008), and procedures are being designed for the teaching of those skills (Charlop-Christy & Daneshvar, 2003; Gould, Tarbox, O'Hora, Noone, & Bergstrom, 2011; LeBlanc et al., 2003; Martín-García, Gómez-Becerra, & Garro-Espín, 2012). Proponents of Relational Frame Theory see perspective taking as a form of response involving deictic frames; contextual control of these frames is considered essential in teaching (Barnes-Holmes et al., 2005). The three relational frames that appear to be fundamental to the development of perspective-taking skills are as follows: I/you, here/there, and now/then; these deictic relations are believed to emerge through a history of responding to questions. Such relational frames must clearly be taken into account when teaching skills of this kind.

The aim of this study was to teach subjects with intellectual disabilities to distinguish between left and right (Experiment 1) and between near and far (Experiment 2). Discrimination was taught using expressive language (speaker behavior), and the transfer of learning to receptive language (listener behavior) was tested. Receptive language procedures include conditional discriminations under contextual control.

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EXPERIMENT 1

Method

Participants

The first experiment involved four adults (two men and two women) with intellectual disabilities, at a day care unit offering occupational therapy. The intelligence quotient (IQ) of all four subjects was measured using the Kaufman Brief Intelligence Test: Juan, aged 28, also diagnosed with Asperger's syndrome, scored 52 and had a verbal IQ of 67; Pablo, aged 31, scored below 40 and had a verbal IQ of 40; Ana, aged 40, scored 48 and had a verbal IQ of 55; and Maria, aged 41, scored below 40 and had a verbal IQ of 40.

Setting and Materials

The experiment was carried out in a soundproof room measuring 5 × 10 m and containing a 1 × 1 m wooden table and two chairs facing each other. An external observer sat in a chair placed 2 m behind the subject. Two identical rectangular red cards measuring 13 × 10 cm were used to indicate spatial locations. As a reward for having taken part in the experiment subjects were allowed to play with a touch-screen computer outside the room following experimental sessions.

Response Definitions and Experimental Design

Depending on the phase of the procedure, subjects could give two kinds of discrete responses: selection responses in which the subject was required to point to one of two possible positions and vocal responses in which the subject was required to utter the words left or right. The subject was given roughly 5 s to answer each question; where no answer or the wrong answer was given, the trial was recorded as incorrect.

A pretest–posttest design was used (Green & Saunders, 1998; Groskreutz, Karsina, Miguel, & Groskreutz, 2010). The experimenter pretested all participants on the XB-RA and XA-B relations. Teaching is performed for the XB-RA relationship. The experimenter repeated these tests immediately following training.

Interobserver Agreement

All trials of the phases (pretest, training, and posttest) conducted in this experiment were recorded by an independent observer, who could not see the data obtained by the experimenter during the session. Percentage agreement was calculated using the formula: agreements divided by agreements plus disagreements multiplied by 100. Interobserver agreement was 100% for all tests.

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Procedure

Two types of stimulus were used: words (right, left, 'my', and 'your') and spatial locations (P1 and P2). Each separate stimulus was identified by a capital letter and a number. Capital letters denoted stimulus groups. The alphanumeric notation used here was similar to that reported by Pérez-González and Martínez (2007). A capital letter and a number identified each separate stimulus. The letter X was used to indicate contextual stimuli, to which a number was added corresponding to either your (X1) or my (X2). The letter A was used to denote conditional stimuli: the added number corresponding to right (A1) and left (A2). The letter B indicated discriminative stimuli; 'position 1' was identified as B1, and 'position 2' as B2. The letter R was added to indicate that the subject was required to give a vocal response, rather than a selective response (Table 1 and Figure 1).

The spatial positions (P1 or P2) were indicated by two rectangular red cards placed 50 cm on either side of an imaginary straight line between the experimenter and the subject. The position to the right of the subject was designated P1 and the position to the left P2.

At the start of the experiment, subjects were given the following instruction: 'Thank you for taking part in this game. In this game, you have to point to the red card, or say where it is. Try to do your best'. At the beginning of each stage in the experiment the subject was told how he/she should respond, i.e., by speaking or by pointing, and was given the possible response options. For the pretest and posttest, the experimenter told the subject: 'From now on, I won't tell you if you have done it right or wrong; just do the best you can'. However, at the beginning of the training phase, the experimenter said: 'From now on, I'll tell you if you have done it right or wrong'. After the experiment, the subject was thanked for taking part and congratulated on his/her performance.

There were no deliberate pretest or posttest consequences. In the training phase, verbal consequences such as 'Excellent', 'Very good', and 'Well done' were contingent on the correct response being given, while incorrect responses resulted in a neutrally stated '*No*' and the experimenter turned to present the same stimulus. After each session, subjects were allowed to spend 15 min using the Paint program on a touch-screen computer.

To facilitate learning, the following prompting was provided. During the training phases (except phase 8), the experimenter presented the stimulus relation and after a 2-s interval gave the correct answer itself. This was done once for each of the

Table 1. Stimuli.

	X	A	B
1	Your	Right	P1
2	My	Left	P2

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First-order conditional discriminations: types of essays and examples of task

A1		A2	
B1	B2	B1	B2
+			+
Right		Left	
P1	P2	P1	P2
+			+

Second-order conditional discriminations: types of essays and examples of task

X1		X1		X2		X2	
A1		A2		A1		A2	
B1	B2	B1	B2	B1	B2	B1	B2
+			+		+	+	
Your		Your		My		My	
Right		Left		Right		Left	
P1	P2	P1	P2	P1	P2	P1	P2
+			+		+	+	

Figure 1. Discriminations participating in the example of contextual control. The letters accompanied by numbers shown in the preceding texts are descriptive labels that the girl was never able to see. The plus sign that appears underneath of the comparisons indicates the choice that was reinforced in the stages of the learning process. On the other hand, the interrogative sign shown at the bottom of the comparisons indicates the stimulus that should have been selected on the tests to consider the choice as the correct one.

discriminations tested. Trial runs ended with a response from the subject and the application of the consequence by the experimenter.

The procedure comprised the phases described in the succeeding texts, grouped as the following: evaluation of prerequisite behavior (phases 0a and 0b), pretest (phases 1 and 2), training (between phases 3 and 8), and posttest (phases 9 and 10). Evaluation of prerequisite behavior was carried out in one session, and the remaining phases in a new session the following day.

Prerequisite assessments

Phase 0a For this and the following phase, an evaluation block of 10 trials was included; the subjects were asked to point to different body parts (e.g., mouth, ear, and nose). The instruction included the name of the body part plus the possessive adjectives

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my or your. Performance was deemed correct when eight or more responses were correct.
Phase 0b The subjects were asked randomly to raise their right or left hand. No comment was made on the subjects' performance in either phase. The criterion for correct performance and the number of trials was the same as for the previous test.

Pretest and posttest

Phase 1 Test XB-RA. For this and the following phase, an evaluation block of 12 trials was included. At the start of this phase, subjects were given the following instruction: 'You must tell me whether the card is to the right or to the left'. The experimenter presented the stimulus relationship (XB) formed by the verbal stimulus (your or my) and the spatial position (P1 or P2). The experimenter stated 'It is to your…' (X1), or 'It is to my…' (X2), pointing to one of the spatial positions (B), to which the subject was required to say one word (RA): left or right. There was no consequence at this stage. A total of four discriminations were possible: X1B1-RA1, X1B2-RA2, X2B1-RA2, and X2B2-RA1. The criterion performance was 10 out of 12 trials correct. Once a subject had performed this or the following test correctly, his/her participation in the study came to an end.

Phase 2 Test XA-B. At the start of this phase, subjects were given the following instruction: 'You must point to the appropriate card.' The experimenter presented the stimulus relations (XA) formed by the verbal stimulus X (your or my) and the verbal stimulus A (left or right). As appropriate, the experimenter stated 'Point to the one on your right/on my right/on your left/on my left', at which the subject was required to point to the spatial position (B): P1 or P2. A total of four discriminations were thus possible: X1A1-B1, X1A2-B2, X2A1-B2, and X2A2-B1. In this phase, the experimenter and the subject changed places. The criterion for correct performance was the same as in the previous phase.

Posttest evaluation was performed in phases 9 and 10 using the same tests employed in the pretest evaluation. The criterion for correct performance was 10 out of 12 trials correct.

Training

Training comprised a total of six different phases. Subjects were allowed to move on to the next phase once a 100% correct performance had been recorded (10 out of 10 trials in phases 3, 4, 5, and 6; and 12 out of 12 trials in phases 7 and 8). If the subject made a mistake, a new block of trials was started. The phases are outlined in the succeeding texts:

Phase 3 Training X1B-RA. The experimenter stated It is to your… (X1), pointing to one of the spatial positions (B), to which the subject was required to say one word (A):

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left or right. The possible stimulus relations were therefore: X1B1-RA1 and X1B2-RA2. At the start of this phase, two trial prompts were conducted for each stimulus relation.

Phase 4 Training X2B-RA. The experimenter stated 'It is to my…' (X2), pointing to one of the spatial positions (B), to which the subject was required to say one of the two words (A). The possible stimulus relations were therefore X2B1-RA2 and X2B2-RA1. At the start of this phase, only two trial prompts were conducted for each stimulus relation.

Phase 5 Training XB1-RA. The experimenter stated either: It is to your… (X1) or It is to my… (X2), pointing to one of the spatial positions (B1), to which the subject was required to say one of the two words (A). The possible stimulus relations were therefore X1B1-RA1 and X2B1-RA2. At the start of this phase, only two trial prompts were conducted for each stimulus relation.

Phase 6 Training XB2-RA. The experimenter stated either: It is to your… (X1) or It is to my… (X2), pointing to one of the spatial positions (B2), to which the subject was required to say one of the two words (A). The possible stimulus relations were therefore X1B2-RA2 and X2B2-RA1. At the start of this phase, only two trial prompts were conducted for each stimulus relation.

Phase 7 Training XB-RA. The experimenter stated either It is to your… (X1) or It is to my… (X2), pointing to one of the spatial positions (B1 or B2), to which the subject was required to say one of the two words (A). The possible stimulus relations were therefore X1B1-RA1, X1B2-RA2, X2B1-RA2, and X2B2-RA1. At the start of this phase, only one trial prompt was conducted for each stimulus relation.

Phase 8 Training XB-RA. Stimulus relations were the same as for the previous phase. In this phase, the experimenter and the subject changed places. Moreover, the response–reinforcement probability was 0.5, meaning that deliberate consequences were applied in only half the trials. The subject was told 'From now on, I won't always tell you if you have done it right or not, but you should go on doing it just as you have been up till now'.

RESULTS

Maria, like the other three subjects, fulfilled the criterion for correct performance in both prerequisite behavior evaluations. She gave six correct answers in each of the trials conducted in the pretest stage (XB-RA and XB-A). It took her a total of 212 trials to complete discrimination training. At posttest evaluation, she fulfilled the correct-performance criterion of X for both discriminations.

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Ana also gave six correct answers in each of the trials conducted in the pretest stage (XB-RA and XB-A) and required 86 trials to complete discrimination training. At posttest evaluation, she fulfilled the correct-performance criterion for both discriminations.

Pablo also gave six correct answers in each of the pretest trials. It took him a total of 195 trials to complete discrimination training. At posttest evaluation, Pablo fulfilled the correct-performance criterion for both discriminations.

Juan gave five correct answers in the XB-RA test and six in the XB-A test. He required 253 trials to complete discrimination training. At posttest evaluation, he fulfilled the correct-performance criterion for both discriminations. The results are shown in Table 2. This table shows the results for each subject, by phase, expressed as a fraction (number of correct trials over total number of trials). Correct response rates in the pretest, training, and posttest sections are shown in Figure 2.

DISCUSSION

This procedure proved effective in teaching left/right discrimination with reference to self and to another person. Moreover, the findings confirmed effective transfer of learning from expressive to receptive language with no need for explicit training. In a review of the literature on instructions, Petursdottir and Carr (2011) suggested that it might be more effective to give instructions in expressive language (as speakers) before giving them in receptive language (as listeners), rather than the reverse. It should be noted, however, that to judge by the findings of the research mentioned in that review, neither sequence can yet be identified as more effective. In the present study, the teaching of discrimination using expressive language was sufficient to ensure the appearance of this discrimination in receptive language.

Alós et al. (2008) demonstrated the transfer of learning to receptive language in the case of left/right discrimination with reference to self. The present findings confirm the learning transfer of left/right discrimination with reference both to self and to another person. This is a more complex skill, requiring subjects to deal with two new stimuli: my and your. Most studies in the field consider this type of discrimination a form of Level 2 visual perspective taking (Brunyé et al., 2012; Davis, 1983; Howlin et al., 1999).

Analysis of the function of the autoclitics my and your approximates this type of visuospatial perspective-taking task to research conducted in the field of contextual control for tasks that participants do as listeners. In expressive language, the experimenter stated It is to your… (X1) or It is to my… (X2), pointing to one

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Table 2. Procedure overview and results of experiment.

Phase		Prompts	Consequences	Trials	Participant			
					María	Ana	Pablo	Juan
Pre-test								
1	XB-RA	No	Test	12	6/12	6/12	6/12	6/12
2	XA-B	No	Test	12	6/12	6/12	6/12	5/12
Training								
3	X1B-RA	Yes	1	10	13/14	12/12	13/14	12/12
4	X2B-RA	Yes	1	10	36/47	12/12	24/27	12/12
5	XB1-RA	Yes	1	10	45/57	12/12	17/20	12/12
6	XB2-RA	Yes	1	10	34/41	12/12	12/12	23/26
7	XB-RA	Yes	1	12	23/26	18/19	74/87	40/47
8	XB-RA	No	.5	12	25/27	18/19	32/35	120/144
Post-test								
9	XB-RA	No	Test	12	12/12	12/12	12/12	12/12
10	XA-B	No	Test	12	12/12	12/12	12/12	12/12

The following descriptors are shown in the first row: prompts, consequences, trials, and participant. Prompts are indicated as either yes or no. For reinforcement probability, tests included no deliberate consequences. In the training phases, consequences were either continuous (1) or intermittent (.5). Data on the number of trials needed to meet the criterion for correct performance are included.

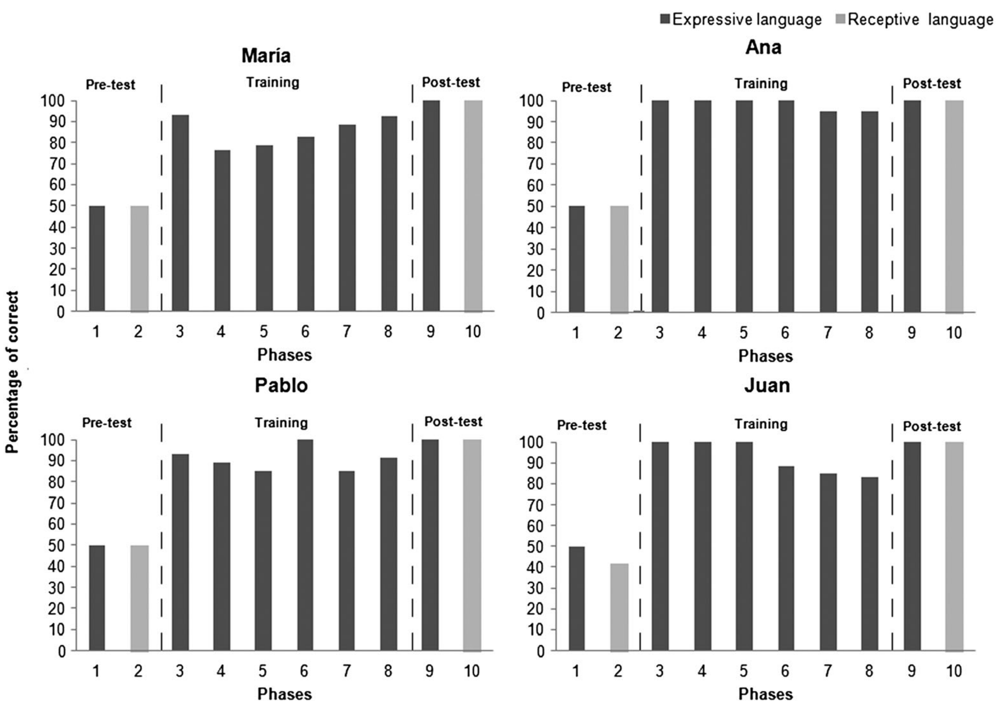

Figure 2. The percentage of correct responses in expressive language (pretest, training, and posttest) and receptive language (pretest and posttest) for participants.

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of two possible spatial positions (B1 or B2), to which the subject was required to respond with the appropriate word: right (A1) or left (A2). In receptive language, the experimenter instructed the subject to 'Point to the card that is to…' adding 'your right' (X1A1), 'my right' (X2A2), 'your left' (X1A2) or 'my left' (X2A2), and the subject was required to point to the appropriate spatial position: P1 or P2 (B1 or B2). This would suggest that a contextual control task was being performed.

This procedure enabled visuospatial perspective-taking skills to be taught to four intellectually disabled adults who had not displayed these target skills at pretest evaluation. The correct response percentage for each training phase was over 75%, indicating that this procedure produced a high success rate, thus favoring optimal subject motivation.

EXPERIMENT 2

Method

The second experiment was similar to the first one, except that it sought to teach near/far discrimination with reference both to self and to another person. In this case, spatial positions were either near to or far from the subject. In an early phase, the subject was instructed to 'Point to the card that is…' plus either 'near you' or 'far from you'. In a later phase, the experimenter stated 'For you, it is…' (X1) or 'For me, it is…' (X2), to which the subject was required to respond either 'near' or 'far'. New relevant information is provided, otherwise the procedures were the same as in Experiment 1.

Participants

Two intellectually disabled women took part in this experiment: Alba, aged 26, and Lara, aged 24, both attending a day care unit offering occupational therapy. Their IQ was not measurable using the Kaufman Brief Intelligence Test.

Setting, Materials, and Procedure

The venue, material, stimuli, and procedures were as described in Experiment 1, except that the stimuli (red cards) were placed horizontally on an imaginary straight line between the experimenter and the subject, 30 cm away from each other. The stimuli used are detailed in Table 3.

The various phases comprising the procedure are described in the succeeding texts, grouped as evaluation of prerequisite behavior (phases 0a and 0b), pretest (phases 1 and 2), training (from phase 3 to phase 8), and posttest (phases 9 and 10). Phases 0a

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Table 3. Stimuli.

	X	A	B
1	You	Near	P1
2	Me	Far	P2

and 0b were the same as in Experiment 1, except that in the latter the subject was asked to point to the red rectangular card placed in the near or far position. The remaining phases followed the same pattern as in Experiment 1, except that the whole procedure focussed on near/far discrimination.

RESULTS

Alba fulfilled the criterion for correct performance in both prerequisite behavior evaluations. She gave six correct answers in each of the trials conducted at the pretest stage (XB-RA and XB-A). It took her a total of 173 trials to complete discrimination training. At posttest evaluation, she fulfilled the correct performance criterion for both discriminations.

Lara also met the criterion for correct performance in both prerequisite behavior evaluations and gave six correct answers in each of the trials conducted at the pretest stage. She required 233 trials to complete discrimination training. At posttest evaluation, she fulfilled the correct performance criterion for both discriminations. The results, expressed as a fraction (number of correct trials over total number of trials), are shown in Table 4. Correct response rates for each phase and subject are shown in Figure 3.

DISCUSSION

This procedure proved effective in teaching near/far discrimination with reference to self and to another person. Alós, Lora and Moriana (2008) report teaching near/far discrimination with reference to self to an autistic boy. The procedure consisted of teaching simple discriminations (expressive language) and testing transfer to conditional discriminations (receptive language). The results confirmed effective transfer of learning from expressive to receptive language with no need for explicit training. In the present study, the procedures used enabled a more complex repertoire to be taught because subjects learned to select spatial positions with reference both to themselves and to another person using expressive language and performed correctly in posttest evaluations for receptive language. As in Experiment 1, correct response

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Table 4. Procedure overview and results of experiment 2.

Phases		Prompts	Consequences	Trials	Participants	
					Alba	Lara
Pretest						
1	XB-RA	No	Test	12	6/12	6/12
2	XA-B	No	Test	12	6/12	6/12
Training						
3	X1B-RA	Yes	1	10	15/16	24/26
4	X2B-RA	Yes	1	10	41/51	47/55
5	XB1-RA	Yes	1	10	32/40	19/22
6	XB2-RA	Yes	1	10	24/27	23/26
7	XB-RA	Yes	1	12	16/16	28/30
8	XB-RA	No	0.5	12	21/23	63/74
Postest						
9	XB-RA	No	Test	12	12/12	12/12
10	XA-B	No	Test	12	11/12	11/12

The following descriptors are shown in the first row: prompts, consequences, trials, and participants. Prompts are indicated as either yes or no. For reinforcement probability, tests included no deliberate consequences. In the training phases, consequences were either continuous (1) or intermittent (.5). Data on the number of trials needed to meet the criterion for correct performance are included.

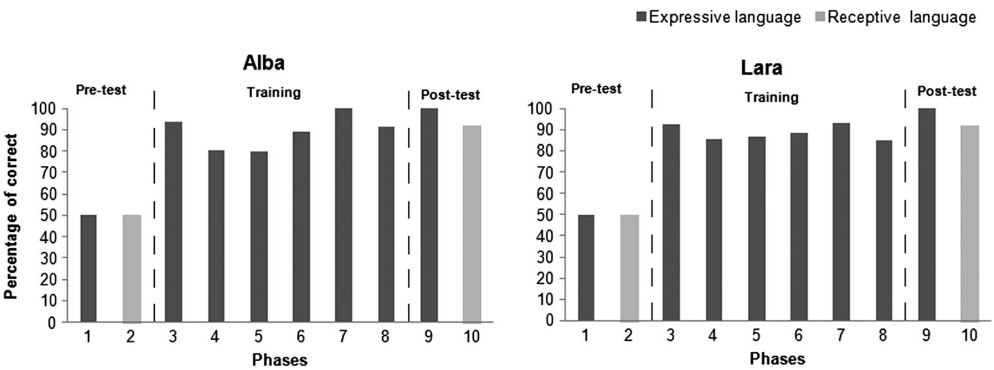

Figure 3. The percentage of correct in expressive language (pretest, training, and posttest) and receptive language (pretest and posttest) for two participants.

percentages in the training phases were very high. It should also be noted that this experiment was designed to teach a different kind of visuospatial discrimination, so that the positioning of the objects was different to that used in the earlier experiment. The scores obtained by these subjects on the Kaufman Brief Intelligence Test were lower than those recorded for the subjects in the earlier experiment. The procedure described would therefore appear to be effective for teaching subjects with a poorer verbal repertoire.

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GENERAL DISCUSSION

The procedures used proved effective for the teaching of left/right and near/far discrimination with reference to self and to another person. Moreover, the findings confirmed effective transfer of learning from expressive to receptive language with no need for explicit training. The findings of the present study support the suggestion by Alós et al. (2008), Alós et al. (2008), and Petursdottir and Carr (2011) that instructions given first in expressive language (speaker behavior) rather than receptive language (listener behavior) may lead to more effective learning. The teaching of left/right and near/far discrimination has hitherto been carried out only with reference to self, and a procedure was therefore required for teaching these discriminations with reference both to self and to another person. Analysis of the function of the terms used in the instructions shows that this type of visuospatial perspective-taking task approximates research conducted in the field of contextual control for tasks that participants do as listeners. A second-order discrimination or contextual-control task gives rise to an arbitrary relationship between three stimuli (contextual, conditional, and discriminative), a response, and a consequence (Sidman, 1986). In the present study, in receptive language, the stimuli 'you' or my (Experiment 1) and 'for me/for you' (Experiment 2) have a contextual function; the stimuli right and left (Experiment 1) and near or far (Experiment 2) have a conditional function, while the positions 1 and 2 have a discriminative function. Specifically, the procedures used here appear to favor perspective taking by giving functional form to the relational frame: I/you (Barnes-Holmes et al., 2005).

Two explanations may be adduced to account for the present findings: the existence of contextual stimuli in the conditional discriminations reported, or alternatively, the existence of compound or complex stimuli. This issue has been comprehensively reviewed in a number of papers by Debert, Huziwara, Faggiani, De Mathis, and McIlvane (2009), Michael, Palmer, and Sundberg (2011), and Pérez-González and Alonso-Álvarez (2008). Here, use of the terms 'my/your' (Experiment 1) and 'me/you' (Experiment 2) modified the relationship between the words (right/left and near/far) and the spatial positions. Moreover, evaluation of prerequisite and pretest behavior revealed that subjects discriminated between right/left and near/far only in tasks performed with reference to self. After training, the words my/your and me/you had a differential effect on the discrimination prompted between the words (right/left and near/far) and the spatial positions. The stimulus relations to which these experiments gave rise are thus similar to those occurring in conditional discriminations involving contextual stimuli (Lynch & Green, 1991; Pérez-González & Martínez, 2007; Serna & Pérez-González, 2003).

Howlin et al. (1999) classified perspective-taking tasks into five levels. Level 2 concerns the awareness that people can see the same things differently; left/right and

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near/far discrimination would appear to correspond to that level (Brunyé et al., 2012; Davis, 1983; Howlin et al.). Analysis of the function fulfilled by the stimuli and the responses involved in these experiments enabled these visuospatial perspective-taking tasks to be taught to intellectually disabled adults. However, correct performance of the posttest tasks may also be because of the fact that subjects had learnt oppositional frameworks. Although the inclusion of a trial phase, in which the experimenter and the subject switched places, renders this explanation less likely, given the procedure used, it cannot be wholly ruled out. In any event, to enhance the teaching of visuospatial perspective-taking skills, future research works should explicitly include the switching of places, together with variations in spatial positions and training with multiple examples. Additionally, the inclusion of a third person might favor discrimination between your right, my right, and 'his/her right'. Recent research in experimental and applied behavioral analysis has laid the foundations for the analytical teaching of perspective-taking tasks (Barnes-Holmes et al., 2005; Charlop-Christy & Daneshvar, 2003; García-Asenjo, 2012; Gómez-Becerra et al., 2007; Gould et al., 2011; LeBlanc et al., 2003; Martín-García et al., 2012; McHugh et al., 2004; Naranjo, 2010; Rehfeldt et al., 2007; Spradlin & Brady, 2008). This area of research has promise for furthering the field's understanding of teaching complex behavior. The data obtained here confirm that behavior analysis provides an effective approach with regard to complex behaviors.

Finally, it should be noted that one of the limitations of the study is that the maintenance and generalization of learning were not taken into account because the objective was the acquisition of this skill and demonstration of existing discrimination in this task. Therefore, in future applied work, promoting the maintenance and generalization of this skill is recommended (Rehfeldt et al., 2007). Moreover, future research into visuospatial perspective-taking skills should also focus on whether or not the subject behaves as speaker. The I/you distinction could also be used for this participant. This type of behavior was not examined here, and the analysis and design of a procedure for teaching it will be the subject of future research. However, the procedures reported on here proved effective for teaching visuospatial perspective-taking tasks to six intellectually disabled adults with reference to self (the subject) and another person (the experimenter). The procedure used guaranteed a high correct response rate for each training phase, thus increasing subject motivation.

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