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Teaching the First Component of Social Referencing to Preschoolers with Autism; Reacting to New and Missing Objects in the Environment

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Abstract

Deficits in social referencing have been associated with autism spectrum disorder. It may lead to deficits in language, symbolic abilities, and other social-cognitive behaviors. When deficits in social referencing are detected, teaching such behaviors should be a priority, but effective teaching procedures are lacking. We consider social referencing as a behavior chain and suggest teaching each component in the chain in sequence. We introduce a program to teach the initial component of social referencing, reacting to new and missing objects in the environment through initiating interaction with another present person. Six children with autism spectrum disorder participated. All children acquired the skill within six months and generalized it to new people and materials. Future research could aim to replicate these findings and to develop effective procedures to teach other component skills of social referencing.

Keywords:

Social Referencing, ASD, Behavior Chain.

Introduction

Social impairments are addressed in most comprehensive intervention approaches, but it has proven difficult to produce substantial improvements (Kasari & Patterson, 2012). Social referencing is described as "a process in which one person utilizes another person's interpretation of the situation to formulate his or her own interpretation of it" (Feinman, 1992). In other words, this includes obtaining information about how to react in an ambiguous novel situation and adjusting one's behavior accordingly. Lubomirska et al. (2021) found that typically developing children, when exposed to three emotional scenarios (fear, pain, and joy), look at the other person for cues before taking any action. Children with ASD, in contrast, were found to show little or no social referencing behavior when exposed to the same three scenarios (Lubomirska et al., 2021).

In behavior analytic terms, social referencing behavior can be considered a behavioral cusp as it has importance for many aspects of development, such as creating

secure attachment (Feinman, 1992), learning how to communicate with tone of voice, gestures, eye contact and facial expressions (Every Child a Talker; ECAT, National Strategies). Social referencing may be viewed as a behavior chain (Gewirtz & Peláez-Nogueras, 1992). Each link or component in the chain is both a conditioned reinforcer for the previous response and a discriminative stimulus for the next response (DeQuinzio et al., 2016). The chain starts when a child is exposed to an ambiguous novel stimulus (e.g., an unfamiliar adult or situation). This is a discriminative stimulus for referencing another present person. This in turn becomes a discriminative stimulus for a response from the referenced person. The response from the other person is the presentation of a verbal and /or non-verbal cue to the child. This serves as a discriminative stimulus for a child's next response, approaching or avoiding the ambiguous stimulus, depending on the cue from the other person.

Teaching social skills such as responding to and initiating joint attention, which is the „simultaneous engagement of two or more individuals in mental focus on one and the same external thing" (Holth, 2005; Kasari & Patterson, 2012) is often part of early intervention programs. There are also studies focused on teaching some components of social referencing, for example, responding to the affective behavior of others (Argott et al., 2017), discriminating facial expressions (DeQuinzio et al., 2020) and learning empathy skills (Sivaraman, 2017). We found only one study where an attempt was made to teach the whole chain of social referencing to children with ASD (Brim et al., 2009).

Looking more closely at social referencing, we can say that the chain consists of two links, in which there are two primary responses of the child: observing in the first link and either an approach or avoidance in the second link. An entire social referencing sequence begins when a child is exposed to an ambiguous novel stimulus (e.g., an unfamiliar adult or a new object). This is a stimulus evoking an observing response in the child (the child looks at the other present person, e.g., the mother). The discriminative stimulus for the child's response is the cue/affective display presented by the other present person (e.g., smiling, frowning, head nodding, head shaking), which begins the second link of the chain. The cue is both the conditioned reinforcer (learned in the past through pairing with primary reinforcer) for the observing response as well as the discriminative stimulus evoking the subsequent response of the child (approach or avoidance; in this case to interact or not with the stranger). Observing is reinforced only in the presence of ambiguous stimuli, while in the presence of unambiguous or standard stimuli it is not reinforced. Thus, observing will occur more frequently in the presence of ambiguous stimuli and less frequently in the presence of non-ambiguous stimuli. Certain classes of cues/affective stimuli (smiling, head nodding, and pointing) signal approach, frowning, fearful expressions, or head shaking signal avoidance (Gewirtz & Peláez-Nogueras, 1992).

Brim et al. (2009) perceives social referencing as "seeking out discriminative stimuli provided by others about contingencies in an ambiguous context in order to respond in a manner that produces reinforcement". These "discriminative stimuli provided by others" are affective displays, presented by the present familiar person (Gewirtz & Peláez-Nogueras, 1992).

The social referencing chain consists of several skills: the ability to recognize ambiguous stimulus, the ability to focus on the face of the other person, the ability to discriminate facial expressions, and the ability to adjust one's behavior based on what was observed. Brim et al. (2009) targeted the entire social referencing chain, teaching their participants an observing response and discriminative control of ambiguous situations using adult affective reactions to children's responses. To teach the ability to differentiate between usual and unusual ambiguous stimuli, the children were faced with multiple sets of stimuli. In Brim's study (2009) these stimuli were variants of standard task materials (e.g., paper bag as a writing surface, word to imitate presented with a cough and a model wearing an animal mask in a motor imitation task). The presence of the ambiguous stimuli was followed by one of two affective discriminative stimuli: a smile and head nod or a frown and head shake. In the presence of the smile and head nod, task completion was reinforced. In the presence of the frown and head shake, termination of the task was reinforced. All four participants learned to complete or terminate the task depending on the affective display of the experimenter. However, only one of the participants learned to discriminate between ambiguous and non-ambiguous situations.

The difference between social referencing and joint attention is that initiations are only reinforced in the presence of ambiguous, such as novel or missing objects or people. In the present study we wanted to expand on the very first steps of Brim's study and teach children to react to ambiguous stimuli by initiating interaction with another person present.

Method

Participants

The participants were five boys and one girl with autism, aged between 3 and 5 years (see Table 1 for more details). The diagnosis of autism was based on ICD-10 criteria (World Health Organization, 1996) and was made by a multidisciplinary team of independent specialists (psychologist, special educator, and child psychiatrist). All the children presented persistent deficits in social communication

and social interaction across multiple contexts and restricted, repetitive patterns of behavior, interests, and/or activities (American Psychiatric Association, 2013). Their developmental age, based on the Psycho-Educational Profile-Revised (PEP-R; Schopler et al., 1990), varied from 1 year and 3 months to 4 years and 5 months (see Table 1).

Table 1
Description of Participants

	Gender	Chronological age	Developmental age	Language level
Participant 1	Boy	5:0	4:5	Sentences
Participant 2	Girl	3:0	2:0	Single words
Participant 3	Boy	3:8	3:1	Sentences
Participant 4	Boy	3:8	1:5	Single words
Participant 5	Boy	4:8	2:8	Single words
Participants 6	Boy	4:2	1:3	Single words

Generally, the most significant deficits were in the areas of imitation, receptive language, expressive language, and fine motor skills. All participants demonstrated limitations in spontaneous language and social initiation.

Setting

The present intervention was conducted across four locations: (1) in a typical classroom furnished with desks, chairs and bookcases with toys and books; (2) in a corridor with bookcases, desks with computers and toys; (3) in a school bathroom; (4) in a lunchroom furnished with tables and chairs and with a row of sinks on one of the walls. During teaching, other children and teachers were at times present in the classroom, corridor, or lunchroom.

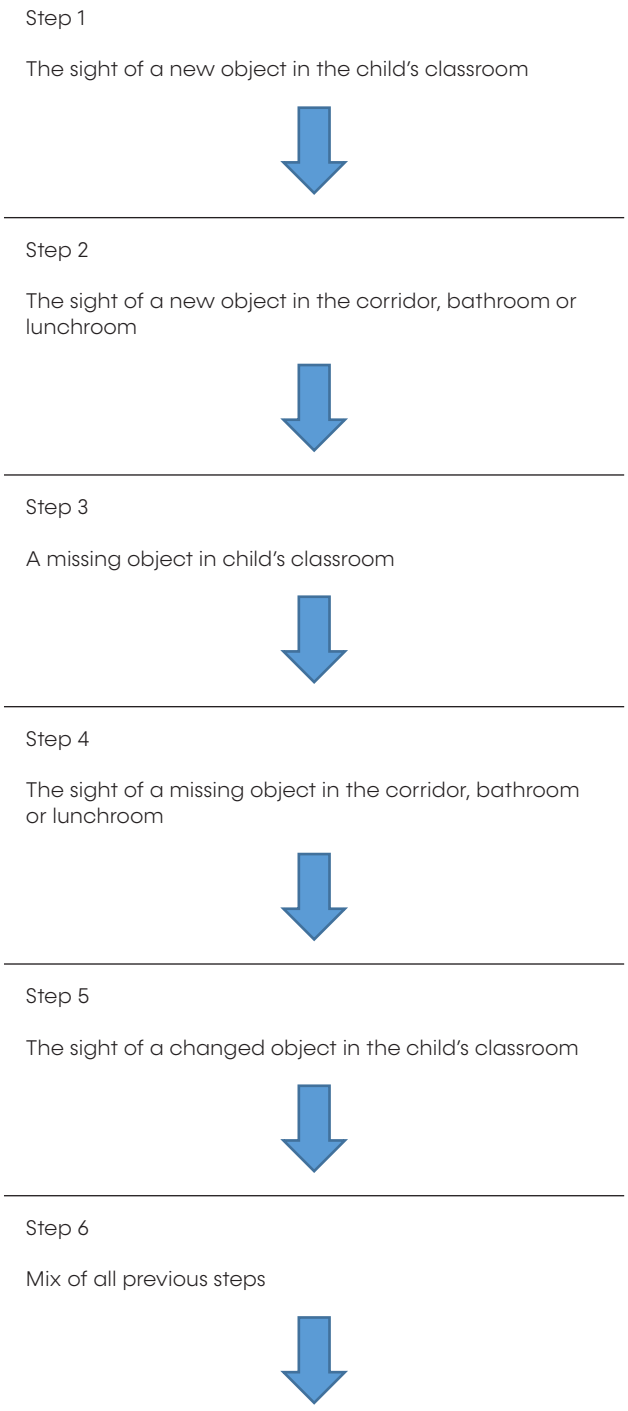
Response definition

Response definition. Initiation was defined as saying "look" to another person while having eye contact, at the sight of a novel or missing object. This statement had to be separated from previous vocalizations by a change of topic or change of person to whom the interaction was directed. The child's statement was followed by teacher's explaining the situation and providing an opportunity to touch the object if it was a novel object in the environment.

Procedure

Social referencing teaching steps. The intervention was divided into several steps, and each step had to be mastered before the child was moved on to the next. There were six steps in the program (see Figure 1).

Figure 1



Step 1 was to initiate interaction by saying "look" while having eye contact with the teacher at the sight of a new object in the child's classroom; step 2 was the same but it was conducted in the corridor, bathroom and lunchroom; step 3 and 4 was identical to steps 1 and 2 except that the object now was removed; step 5 was identical to steps 1 and 2 except that the object was changed and step 6 was a mix of all the previous steps. We did not teach discriminating between initiating at the sight of a novel or missing object and initiating at the sight of objects that were already in the environment. The reason was that if

a child with ASD initiates interaction at the sight of the known object in the environment, it would be a desirable behavior (initiating joint attention). However, our records show that none of the participants did this during the project.

Generalization. Generalization sessions were held in all settings where teaching was conducted, but with teachers who did not take part in teaching and with materials that where not used during teaching. During generalization trials prompts, feedback and rewards were not provided.

Evaluators. The teachers conducted all the teaching sessions and evaluated the children's interactions and did all the probes. There were six teachers, four psychologists and two special educators, all of whom had at least two years of training in behavior analysis and worked daily under the supervision of an Ph.D. level behavior analyst with 15 years of experience working with people with ASD.

Intervention

To teach initiating interaction with the teacher, we used manual prompts (Cooper et al., 2020) and a script-fading procedure (McClannahan & Krantz, 2005). Manual prompts were used to teach children to point to the new object in the environment or to the place where an object was missing. Manual prompts were defined as manual assistance to display the desired response. Prompts were faded in frequency and intensity as rapidly as possible. For some participants we begun with hand-over-hand prompts, then moved to spatial fading and increased the distance to the child. The fading of prompts depended on previous experience with the individual child in other tasks.

We used a one-word script in the form of auditory prompts on a recording device (Mini Me; Krantz & McClannahan, 1993, 1998) that modeled the appropriate language. During fading, we first removed the recording and only the sight of the device served as a prompt; then we removed the device entirely.

During intervention for step 1, the teacher went with the child outside his classroom and left him for a while under the supervision of another adult. She then returned to the classroom and placed a big, colorful object on the child's chair or desk. There were three objects prepared beforehand and hidden during the day for this purpose. In step 2 these objects were placed on the floor in the corridor, in the sink in the bathroom and on a desk or chair in the lunchroom. After placing the object, the teacher walked with the child to this place, so that the child could easily notice it and then used manual prompts to have the child point to the object and say "look". A correct initiation was reinforced with praise and snack and access to the object. When an object was missing, the correct initiation was reinforced with praise and snack only. Additionally, the teacher commented and explained the situation.

During the teaching the child was prevented from making incorrect responses through prompts that were provided when the child did not initiate the interaction or tried to initiate it with an inappropriate script.

Data collection

Baseline. Baseline consisted of testing all steps in the intervention. During baseline no reinforcements, prompts or feedback were provided.

Pretest. Before each step was introduced, a pretest specific to that step was conducted. The pretest for each step was the same as that conducted in baseline, including the test for generalization. Generalization sessions were held across all settings, with different objects and with people who had not participated in the intervention. Data were collected every 10 days and graphed as a percentage of correct responses. During data collection the conditions were identical to teaching sessions, except that no prompts were delivered. A step was considered mastered if the child responded correctly in at least 80% of the trials either in the pretest or during consecutive data collection.

Inter-rater agreement

The inter-rater agreement was calculated using unweighted kappa (Landis & Koch, 1977) and assessed at least twice for each of the participants, during the pretest and during the end of the intervention. Inter-rater agreement ranged between 0.8 and 1.0 (considered high).

Results

All participants scored 0% correct for all steps in baseline. All the participants mastered steps 1 through 6 (i.e., reacting to new and missing objects in the environment) within seven months of training. All of them learned to initiate appropriately in response to missing objects and novel objects across whole variety of settings. There were variations in how much training was required (see Table 2 – 7).

Participant 1 scored 0% correct in the pretest and in the generalization test in step 1. After 30 days he achieved mastery of step 1. In step 2 his scores in the pretest and the generalization test were 30% correct and 20% correct, respectively. He met the mastery criterion after 20 days. In step 3 he started off with 70% correct in the pretest and mastery in the generalization test. He mastered the step after 10 days of teaching. Steps 4 and 5 and 6 were all mastered in the pretest.

Table 2

Number of days in which mastery of each step was achieved - Participant 1

														Day
Step 6	Mix steps 1-5											100*	100	
Step 5	Initiating interaction at sight of changed object in the child's classroom									100*	100			
Step 4	Initiating interaction at sight of the missing object in the corridor, toilet or lunchroom							100*	100					
Step 3	Initiating interaction at sight of the missing object in child's classroom					100*	90							60
						70	80							
Step 2	Initiating interaction at sight of the new object in the corridor, toilet or lunchroom			100*	100									50
				70										40
				30	20									
Step 1	Initiating interaction at sight of new object classroom	80*	90											30
		50												20
		40												10
		0	0											0
	Baseline all steps	0	0	0	0	0	0	0	0	0	0	0	0	3
		0	0	0	0	0	0	0	0	0	0	0	0	2
		0	0	0	0	0	0	0	0	0	0	0	0	1
		Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.	

Note. *Criterion for mastery met, Gen: = Generalization probes across people and material.

Table 3

Number of days in which mastery of each step was achieved - Participant 2

														Day
Step 6	Mix steps 1-5											90*	90	
Step 5	Initiating interaction at sight of changed object in the child's classroom									90*	100			
Step 4	Initiating interaction at sight of the missing object in the corridor, toilet or lunchroom							100*	100					70
								70	70					
Step 3	Initiating interaction at sight of the missing object in child's classroom					100*	100							60
						60	70							
Step 2	Initiating interaction at sight of the new object in the corridor, toilet or lunchroom			100*	90									50
				70										40
				50	40									
Step 1	Initiating interaction at sight of new object classroom	100*	100											30
		60												20
		30												10
		30	20											0
	Baseline all steps	0	0	0	0	0	0	0	0	0	0	0	0	3
		0	0	0	0	0	0	0	0	0	0	0	0	2
		0	0	0	0	0	0	0	0	0	0	0	0	1
		Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.	

Note. *Criterion for mastery met, Gen: = Generalization probes across people and material.

Table 4

Number of days in which mastery of each step was achieved - Participant 3

																Day
Step 6	Mix steps 1-5													100*	100	
Step 5	Initiating interaction at sight of changed object in the child's classroom											90*	90			90
Step 4	Initiating interaction at sight of the missing object in the corridor, toilet or lunchroom							80*	90							80
Step 3	Initiating interaction at sight of the missing object in child's classroom					100*	100									70
						50	60									
Step 2	Initiating interaction at sight of the new object in the corridor, toilet or lunchroom			90*	90											60
				60												50
				30	30											
Step 1	Initiating interaction at sight of new object classroom	100*	90													40
		70														30
		50														20
		20														10
		10	10													0
	Baseline all steps	0	0	0	0	0	0	0	0	0	0	0	0			3
		0	0	0	0	0	0	0	0	0	0	0	0			2
		0	0	0	0	0	0	0	0	0	0	0	0			1
		Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.			

Note. *Criterion for mastery met, Gen: = Generalization probes across people and material.

Table 5

Number of days in which mastery of each step was achieved - Participant 4

																Day
Step 6	Mix steps 1-5													90*	80	
Step 5	Initiating interaction at sight of changed object in the child's classroom											90*	90			140
												60				130
												50	60			
Step 4	Initiating interaction at sight of the missing object in the corridor, toilet or lunchroom							100*	100							120
								70								110
								50								100
								30	30							
Step 3	Initiating interaction at sight of the missing object in child's classroom					100*	90									90
						70										80
						40										70
						30	20									
Step 2	Initiating interaction at sight of the new object in the corridor, toilet or lunchroom			100*	80											30
				60												50
				40												40
				10	10											
Step 1	Initiating interaction at sight of new object classroom	90*	90													30
		60														20
		30														10
		0	0													0
	Baseline all steps	0	0	0	0	0	0	0	0	0	0	0	0			3
		0	0	0	0	0	0	0	0	0	0	0	0			2
		0	0	0	0	0	0	0	0	0	0	0	0			1
		Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.			

Note. *Criterion for mastery met, Gen: = Generalization probes across people and material.

Table 6

Number of days in which mastery of each step was achieved - Participant 5

															Day
Step 6	Mix steps 1-5												90*	90	
Step 5	Initiating interaction at sight of changed object in the child's classroom									100*	100				170
										70					160
										70	70				
Step 4	Initiating interaction at sight of the missing object in the corridor, toilet or lunchroom							100*	90						150
								70							140
								60	50						
Step 3	Initiating interaction at sight of the missing object in child's classroom					90*	90								130
						70									120
						60									110
						60									100
						40	40								
Step 2	Initiating interaction at the sight of the new object in corridor, toilet or lunchroom			80*	80										90
				70											80
				50											70
				30											60
				10	10										
Step 1	Initiating interaction at sight of the new object classroom	90*	80												50
		70													40
		50													30
		40													20
		20													10
		0	0												0
	Baseline all steps	0	0	0	0	0	0	0	0	0	0	0	0		3
		0	0	0	0	0	0	0	0	0	0	0	0		2
		0	0	0	0	0	0	0	0	0	0	0	0		1
*Criterion for mastery met		Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.		

Note. *Criterion for mastery met, Gen: = Generalization probes across people and material.

Table 7

Number of days in which mastery of each step was achieved - Participant 6

															Day
Step 6	Mix steps 1-5												80*	90	
Step 5	Initiating interaction at sight of changed object in the child's classroom									100*	100				180
										70					170
										60	70				
Step 4	Initiating interaction at sight of the missing object in the corridor, toilet or lunchroom							100*	100						160
								70							150
								50							140
								40	40						
Step 3	Initiating interaction at sight of the missing object in child's classroom					100*	90								130
						70									120
						60									110
						40									100
						20	10								
Step 2	Initiating interaction at the sight of the new object in corridor, toilet or lunchroom			80*	90										90
				70											80
				50											70
				30											60
				0	0										
Step 1	Initiating interaction at sight of the new object classroom	90*	80												50
		70													40
		50													30
		40													20
		20													10
		0	0												0
	Baseline all steps	0	0	0	0	0	0	0	0	0	0	0	0		3
		0	0	0	0	0	0	0	0	0	0	0	0		2
		0	0	0	0	0	0	0	0	0	0	0	0		1
		Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.	Probes	Gen.		

Note. *Criterion for mastery met, Gen: = Generalization probes across people and material.

Participant 2 scored 30% correct in the pretest and 20% correct in the generalization test in step 1. He met the criterion for mastery after 30 days of teaching. In step 2 he started off with 50% correct in the pretest and 40% correct in the generalization test and mastered the step after 20 days of teaching. In step 3, he scored 60% correct in the pretest and 70% correct in the generalization test and met the criterion for mastery after 10 days. In step 4 he started off with 70% correct for both the pretest and the generalization test and needed 10 days to master the step. Both step 5 and 6 were mastered in the pretest.

Participant 3 started with 10% correct in the pretest and in the generalization test for step 1. He needed 40 days to master this step. In step 2 he scored 30% correct in both the pretest and the generalization test and mastered it within 20 days. In step 3 he scored 50% correct and 60% correct in the pretest and the generalization test, respectively, and met the criterion for mastery after 10 days. Steps 4, 5 and 6 were all mastered in the pretest.

Participant 4 scored 0% correct in the pretest and in the generalization test in step 1. He achieved mastery in 30 days. In step 2, he scored 10% correct in both the pretest and in the generalization test and achieved the criterion after 30 days. In step 3, he started off with 30% correct in the pretest and 20% correct in the generalization test and mastered the step after 30 days. In step 4 he scored 30% correct in both the pretest and in the generalization test and mastered the step after 30 days. In step 5 he started off with 50% correct and 60% correct in the pretest and in the generalization test, respectively. He mastered this step within 20 days of teaching. Step 6 was mastered in the pretest.

Participant 5 scored 0% correct in the pretest and in generalization test in step 1 and met the criterion for mastery after 50 days of teaching. In step 2 he started off with 10% correct for both the pretest and generalization test and mastered the step after 40 days. In step 3 he scored 40% correct in both the pretest and the generalization test and met the criterion after 40 days of teaching. Step 4 started with 60% correct in the pretest and 50% correct in the generalization test, and he needed 20 days to master the step. In step 5 he scored 70% correct in both the pretest and the generalization test and mastered the step within 10 days. Like all the other participants, he mastered step 6 in the pretest.

Participant 6 started off with 0% correct in the pretest and generalization test for step 1 and needed 50 days to master this step. In step 2 he scored 0% correct in both the pretest and the generalization test and mastered it in 40 days. In step 3 he scored 20% correct and 10% correct in the pretest and generalization test, respectively, and met the criterion after 40 days. In step 4 he scored 40% correct in both the pretest and generalization test and mastered the step within 30 days. In step 5 he started off with 60% correct in the pretest and 70% correct in generalization test and mastered the step after 20 days of teaching. Step 6 was mastered in the pretest (see Tables 2 – 7).

Discussion

In this study we taught 6 children with ASD to react to ambiguous stimuli such as new and missing objects in the environment. All the participants learned to notice objects that were new or that were missing, and to initiate interaction with the teacher. The interaction consisted of pointing to the object or to where the missing objects were supposed to be, looking at the teacher and saying "look". This skill generalized across different materials and different people. It is important to note that all the participants had previously mastered how to make eye contact in different situations and react to their names.

These results show that it is possible to teach adequate reactions to ambiguity in the environment. Such a reaction is considered the first component of the social referencing behavior chain. However, for social referencing we need to add the next steps, focusing on the face of the other person, discriminating facial expressions, and adjusting one's behavior based on what is observed. Future studies will have to explore if these can also be taught.

While curricula for young children with ASD include teaching programs from many different domains (e.g., matching, imitating, receptive language, expressive language, etc.) there appears to be a lack of empirically supported programs for teaching social skills, which constitute probably the most complex and serious deficiency. However, several conceptual and empirical papers have been published on teaching social behaviors, including joint attention skills (Holth, 2005), responding to the affective behavior of others (Argott et al., 2017) and teaching empathy (Sivaraman, 2017; Sivaraman et al., 2022). Our results from evaluating typical children's social referencing skills with the SoROS suggest that typical children will look at the person displaying an emotion and act based on the cues provided. If this is the normal pattern of behavior, this can serve as a model for what should be taught.

This study has several limitations. The data represent only a small group of children. All of them were young, so we do not know if these results could be replicated with older children. During the intervention period, the participants were taught several other skills as part of their program. The impact of learning these otherskills is not known.

New objects to which the participants were taught to react, were attractive to them, and the consequence

of initiating the interaction after noticing this object was the possibility to play with it. We don't know if children would make initiations if the objects were less preferred. The range of places in which reacting to new objects was trained was also limited. Another limitation is the lack of experimental control. We collected data every 10 days of teaching, but the design does not allow us to rule out alternative explanations, such as maturity, or the child learning other language skills.

Because all teachers work under regular supervision, during which they are observed and assessed for procedural integrity, we did not measure this specifically for the procedures employed in the current study.

In future research, it will be important to test this program in a larger and more diverse group of children with autism, e.g., different ages, different levels of cognitive functioning and expressive language. It should also be evaluated if teaching more complex initiations affects the duration of the learning process.

One area for future research could also be to teach the steps using a sufficient exemplar training format. This may make it easier to individualize teaching and pinpoint exactly when a step is mastered,

Future studies should also focus on developing other components of social referencing, such as learning to focus on the face of the other person, learning to discriminate facial expressions and, finally, learning to adjust one's behavior to the cues provided. All these skills will need to be taught to children with ASD for them to properly reference other people.

Based on our research, we have some promising indications that the first component skill in social referencing can be taught, and that the skill may be generalized across persons and materials. This is a promising start for developing the entire sequence of social referencing behavior. With a clearly described program and sequence of introduction, one of the most important behavioral deficits in children with ASD may be addressed.

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