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Brief Note

Acquisition of Mands Through a Behavior Chain Interruption Strategy: Task Preference and Occurrence of Verbal Requests by a Child With Autistic Spectrum Disorders

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The purposes of the present study were to use behavior chain interruption strategy to teach mands to a boy with autistic spectrum disorders and intellectual disability, and to examine whether the occurrence of mands and their antecedent stimuli would change depending on the boy’s task preference. First, the boy’s task preference was assessed using his on-task behavior as an index, and second, the occurrence of verbal requests in both preferred and non-preferred tasks was studied. The desired objects were the tools necessary to complete each task; this was arranged so that the topography of the mands would be the same for both tasks. The results showed that verbal requests occurred as a result of vicarious reinforcement in his preferred task; they did not occur in the non-preferred task. The results were discussed in terms of the necessity of the assessment of preference when teaching mands.

Key Words: mand, antecedent stimuli, preference, behavioral assessment, child with autistic spectrum disorder

Introduction

Mand is a verbal operant in which the response is mainly controlled by an establishing operation (Michael, 1982, 1988, 1993) and reinforced by a characteristic consequence. Since, by definition, the reinforcer for a mand is receipt of the item requested, something that directly benefits the speaker, researchers are increasingly recommending that mand-making should be the starting point of training for learners with limited verbal repertoires (Hall & Sundberg, 1987).

Techniques used to teach mands include incidental teaching procedures (Deguchi & Yamamoto, 1985; Hart & Risley, 1975), mand-model (Rogers-Warren & Warren, 1980), and time delay (Halle, Marshall, & Spradlin, 1979). These were later combined into milieu teaching (Kaiser, Yoder, & Keetz, 1992).

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These techniques employ stimuli such as participants' preferred food and activities as desired objects. Because the desired objects are shown to the participants in order to enhance their motivation for the objects, some studies have suggested that the mand being acquired might be controlled by variables other than the establishing operation (Brady, Saunders, & Spradlin, 1994; Fujikane, 2001; Shafer, 1994).

Fujikane (1992) showed that a child could not use mand when the desired object were removed from the training setting. According to Fujikane (1992), this was because the discriminative stimulus (presence of the desired object) controlled the mands. To test this, Fujikane (1992) faded out the desired object gradually; after that procedure, the child could mand without the presence of the object. In this sense, the traditional techniques are not using solely establishing operations, and for this reason, the acquired response is more likely an "impure mand" than a "pure mand" (Skinner, 1957).

On account of the above, new techniques, such as a behavior chain interruption strategy (BCIS), have been developed. The behavior chain interruption strategy involves situations such as when there is toothpaste but no toothbrush when one is supposed to brush one's teeth, and when there is paper but no crayons when one is to draw a picture (Fujikane, 2001). The behavior chain interruption strategy facilitates the child's request for the missing item, in order to complete the behavior chain.

Sundberg (1993) characterized the behavior chain interruption strategy as a technique that "contrives" an establishing operation. It manipulates an event in order to enhance the effectiveness of another event as a reinforcer. For example, Hall and Sundberg (1987) presented instant soup without hot water. The instant soup increased the value of hot water, a cup, and a spoon, and thereby evoked behavior that had been followed by hot water in the past.

There are several advantages to using a behavior chain interruption strategy. One is that because the behavior chain interruption strategy sets the missing item as a desired object, the intervention can be done without presenting the desired object in front of the participant. Another is that because the chains of behavior the participants complete as a part of their daily routine can be exploited for teaching, training opportunities can be arranged throughout the day. Traditional techniques, although employing stimuli such as participants' preferred food and activities as desired objects, basically must wait until participants verbally/nonverbally request the desired objects. In contrast, the behavior chain interruption strategy sets a situation that enhances the likelihood that receipt of the missing item would function as a reinforcer.

Kondo and Fujiwara (1995), in an examination of the conditions of acquisition of mands for a missing item, pointed out that teaching mands in such a situation essentially requires the child to select reliably a necessary object for completing the behavior chain. They additionally suggested that mands for a missing item occur when the child likes the activity.

Robert-Pennell and Sigafoos (1999) examined whether three young children with developmental disabilities and limited language behavior could be taught to request
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(mand) by using a behavior chain interruption strategy. Their results revealed that two of the three children were able to learn to make requests, but one child was not. According to Robert-Pennell and Sigafos (1999), one possible explanation for that child’s lack of acquisition was that the activities selected for him were not sufficiently motivating to accommodate an interruption. These results suggest that activity preference, that is, the tendency to engage or not to engage in an activity, is critical to the effectiveness of the behavior chain interruption strategy.

For the behavior chain interruption strategy to function, it is necessary to assess first whether the participants would engage in the activity and whether access to the item necessary to complete the chain of behavior could be limited. However, many of the studies applying the behavior chain interruption strategy used food intake as the behavior chain for the participants to complete (e.g., Sigafos, Doss, & Reichle, 1989; Sigafos, Reichle, Doss, Hall, & Pettitt, 1990), and their preference for that activity was not necessarily assessed.

The purposes of the present study were to teach mands by using a behavior chain interruption strategy, and to examine whether the occurrence of mands and their antecedent stimuli would change, depending on child’s task preference.

Method

Participant

Taro, a 4 years 10 months old boy who had been diagnosed with autistic spectrum disorders and intellectual disability at a public hospital, participated in this study. He has been under educational counseling at the university since June 200x; the present study started in July 200x.

Assessment for Selection of Target Behavior

Results from a standardized test. According to Taro’s parents’ answers on a developmental test, when Taro’s chronological age was 4 years 10 months, his developmental ages were as follows: motor age, 4 years; exploratory age, 3 years; social age, 3 years; self-help age, 4 years; and language age, 3 years.

His behavior at home and his parents’ request. Taro liked watching videos of his favorite cartoon characters and writing their names. His parents hoped that his communication behavior would improve.

Behavior observations at kindergarten. Behavior observations were made using a checklist prepared by the present authors. The observations revealed that it was difficult for Taro to pay attention to his teachers’ instructions. He hardly paid attention to nor imitated the behavior of his classmates. For this reason, Taro needed support from some other person when participating in group activities. In free play situations, Taro mostly played by himself, with very little interaction with his classmates or attention to classmates’ play.

Behavior observations in the playroom at the university. A brief functional assessment (Harding, Wacker, Cooper, Millard, & Jensen-Kovalan, 1994) was conducted to
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assess Taro’s repertoires of verbal and social behaviors and their antecedent stimuli, and his favorite activities. Verbal and social behaviors assessed did not occur spontaneously. For the assessment, various kinds of prompting (e.g., pointing and physical guidance) were presented, and the rate of behavior after each was recorded. To determine his favorite activities, the on-task rate and the degree of positive/negative emotion (Kennedy & Haring, 1993) was recorded for each activity.

The brief functional assessment showed that Taro was able to establish eye contact when the trainer said his name. In addition, he could follow some simple instructions, such as “Bring your chair,” or “Sit down.” If he needed help in opening a package of candy, he would guide another person’s hand to the object. He would also reach for desired objects and push away non-preferred objects. While liking gross motor activity, such as playing with a physioball and swinging in sheets, Taro expressed great interest in specific cartoon characters and in numbers. For example, he spontaneously said the name of the character when shown a book with pictures of the character, and he wrote and read the names of the characters and also numbers on the whiteboard. Although Taro had various speech repertoires, these were not used for functional communication. In the main, he appeared to use prelinguistic actions to regulate the behavior of others. However, to request objects, Taro often imitated a word spoken by a trainer in that situation.

Selection of Target Behavior

Although Taro had various speech repertoires and sometimes expressing them spontaneously, he did not use them for functional communication. Still, he was able to imitate what the trainer said. This suggested the possibility of establishing functional communication behavior, such as mands. We selected “requesting an object necessary to complete a task” as the target behavior.

Duration and Site of Training

Eighteen training sessions were carried out between July 200x and April 200x+1, in a playroom at the university. In principle, 20 minutes of the weekly 60-minute training sessions was allocated for the present research. The remaining time was spent on discrimination tasks, an art project, and gross-motor-based free play.

Task

In the light of Taro’s chronological age and the request from his parents, the following tasks were selected: (1) sticking on stickers (putting colored stickers on matching-color circles on a piece of cardboard); (2) drawings 1 and 2 (drawing pictures and writing letters on blank paper freely); (3) an art project (completing a picture by gluing pieces of paper onto it); and (4) playing house (pretending to eat and drink with tableware and food replicas). Drawing 2, the art project, and playing house were the generalization and maintenance tasks.


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**TABLE 1** Desired Objects, Target Vocal Responses, and Materials Provided by the Trainer for Each Task

<table>
<thead>
<tr>
<th>Task</th>
<th>Desired objects</th>
<th>Target vocal responses</th>
<th>Materials provided by the trainer</th>
</tr>
</thead>
<tbody>
<tr>
<td>sticking on stickers</td>
<td>red and yellow or blue and green stickers</td>
<td>red, yellow blue, green</td>
<td>a piece of cardboard with either red and yellow or blue and green circles drawn on it</td>
</tr>
<tr>
<td>drawing 1</td>
<td>red and yellow or blue and green pen</td>
<td>red, yellow blue, green</td>
<td>a pen case not containing either red and yellow or blue and green pens</td>
</tr>
<tr>
<td>drawing 2</td>
<td>pens</td>
<td>blank paper</td>
<td>paper</td>
</tr>
<tr>
<td>art project</td>
<td>glue</td>
<td>paper</td>
<td>blank paper</td>
</tr>
<tr>
<td>playing house</td>
<td>a glass</td>
<td>pen</td>
<td>blank paper</td>
</tr>
<tr>
<td></td>
<td></td>
<td>glass</td>
<td>a pot</td>
</tr>
</tbody>
</table>

*Notes.* One requesting opportunity was allowed for each stimulus per session. After the 11th session on drawing 1, blank paper was the only desired object.

**Stimulus (Desired Object)**

The tools necessary to complete the tasks were the desired objects. The desired objects, the target vocal responses, and the materials provided to Taro at the beginning of each task are shown in Table 1. Taro was able to match the materials and tools necessary for each task.

**Setting**

A trainer playing the role of a peer model did the same tasks as Taro. The tasks were placed on the table; Taro was seated next to the model, across from the trainer.

**Procedure**

*Assessment of task preference.* Taro and the model engaged in sticking on stickers and drawing 1 for 3 sessions each. Then, on-task behavior on both tasks was calculated. The task with higher on-task responding was considered to be the preferred task and the one with lower on-task responding, non-preferred. After Taro and the model sat down, the trainer gave them the tools and materials for the task. In principle, the trainer did not take any action to encourage them to engage in the task, nor to stop Taro’s escaping from doing the task, other than to prevent him from leaving his seat. The task was terminated either 5 minutes after beginning, or when it was completed.

*Examination of occurrence of mands and antecedent stimuli.* Taro and the model engaged in both the non-preferred and preferred tasks. The desired objects were the tools necessary to complete each task. They were chosen so that the topography of the mand would be the same for the both tasks.

During the non-preferred task, Taro and the model stuck on stickers. When Taro and the model had sat down, the trainer gave each of them a piece of cardboard
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with either red and yellow or blue and green circles drawn on it. If Taro made no response for 3 sec after that, the trainer applied vicarious reinforcement (the model emitted the target behavior, "Red," and the trainer gave the model red stickers). If Taro made no response for 3 sec after that, the trainer presented the desired object in front of him, saying to him, "How about you, Taro?" If Taro made no response for 3 sec after the trainer approaching vocally and presenting the desired object, the trainer gave Taro the tool necessary to complete the non-preferred task, i.e., colored stickers.

During the preferred task, Taro and the model engaged in drawing 1. The materials provided to Taro and the model were a pen case not containing either red and yellow or blue and green pens. After pen case was given to them, the procedures were the same as for the non-preferred task. After the 11th session, red and yellow or blue and green pens were deleted from the list of desired objects, but the blank paper was still a desired object.

Generalization probe. During the generalization probe, Taro and the model engaged in the same tasks as before, but with different objects, or they engaged in a different task and requested a different object. The procedures were the same as for the non-preferred task.

During the probe with the same task but different objects, Taro and the model engaged in drawing 2. The material provided to them was blank paper; the desired object was a pen. During the probe with a different task and different objects, Taro and the model engaged in an art project. The materials provided to them were pieces of paper; the desired object was glue. During the probe with a different task and different objects, Taro and the model engaged in playing house. The material provided to them was a pot; the desired object was a glass.

Maintenance probe. Drawings 1 and 2 were repeated 3 months after the generalization probe. The procedures were the same as for the generalization probe.

Observation Procedures

Definitions of behavior. Observational categories were on-task behavior, the response topography of his mands, and antecedent stimuli required for emitting mands. On-task behavior consisted of (1) attention to the trainer, including looking at the tools and/or materials for more than 1 sec when the trainer showed them; (2) a request to the trainer: asking the trainer for necessary tools and receiving them; (3) attention to the model: looking at the model for more than 1 sec just before starting the task or while engaging in the task; (4) performance of the task: completing the task by manipulating the tools and materials. The topography of the mands was defined as (1) spoken language: vocalized words such as "red" and "yellow"; (2) reaching: reaching for the desired object when it was presented to him; (3) no response: showing no response. Antecedent stimuli required for emitting mands were categorized as (1) handing: desired object being given to Taro by the trainer; (2) vocal approach and presentation: Taro's mands that occurred during the trainer's vocal approach and presentation of the desired object; (3) vicarious reinforcement: Taro's
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mands that occurred after the model received the desired object; (4) imitation: Taro's mands that occurred after the model emitted the target behavior and before she received the desired object; (5) spontaneous: Taro's mands that occurred after the trainer's gave him the material (e.g., cardboard and pen case), and before vicarious reinforcement;

Data collection. The entire task was videotaped for the analysis. The following were analyzed: (1) On-task behavior: using interval recording with one interval per 5 sec, the percentage of on-task behavior while sticking on stickers and doing drawing 1 was calculated; (2) Topography of mands and their antecedent stimuli: for each manding opportunity, the topography of the mands and their antecedent stimuli were recorded using an event recording procedure.

Interobserver Agreement

Interobserver agreement was calculated for 45% of the sessions, using data from two observers on on-task behavior, topography of mands, and their antecedent stimuli. Percentage agreement was calculated by dividing the number of agreements by the number of agreement plus disagreements, and multiplying by 100. Interobserver agreement was 95%.

Results

On-Task Behavior

During drawing 1, Taro's average on-task behavior was 98.9%, whereas when sticking on stickers, he was on task an average of 63.9% of the time (see Fig. 1). These results suggest that Taro preferred drawing 1 to sticking on stickers.

Occurrence of Verbal Requests and Antecedent Stimuli

Verbal responses that occurred at manding opportunities were considered to be mands. Figure 2 shows the occurrence of verbal requests and the controlling stimuli during drawing 1 and sticking on stickers. In drawing 1 with blank paper as the desired object, a verbal request ("paper") occurred following vicarious reinforcement from the first session. In the task of sticking on stickers, in which red and yellow stickers were the desired objects, however, verbal requests did not occur. Instead, Taro reached for the desired object after being spoken to and shown it, or was given it by the trainer. Nevertheless, during drawing 1, where red and yellow pens were the desired objects, verbal requests ("red," "yellow") occurred after vicarious reinforcement. With blue and green (stickers or pens) as desired objects, Taro showed a similar tendency.

The antecedent stimuli controlling his verbal requests tended to shift from vicarious reinforcement, where verbal requests occurred after the model received the desired object, to imitation, where Taro immediately imitated the model's words before the model received the desired object. This shift took place at almost the same time with paper, red pen, and yellow pen.
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In drawing 1, Taro would often smile and begin to draw pictures when he received pens, but when the task was sticking on stickers, he sometimes did not engage in the task.

Generalization and Maintenance Probes

The upper part of Fig. 2 presents the stimuli controlling his verbal requests in drawing 1 and the probe tests. In drawing 1, Taro’s verbal request for blank paper occurred spontaneously after the 11th session, and was maintained after 3 months (maintenance probe). In drawing 2, the art project, and playing house, verbal requests for pens, glue, and a glass occurred by imitation (generalization probe). The stimuli controlling his verbal requests were the same 3 months later (maintenance probe).

Anecdotal Data

One month after the generalization probe, we interviewed Taro’s parents about any changes that they might have observed in him. According to his parents, Taro was increasingly producing spontaneous mands, mainly for his preferred activities and meals, such as “drawing” and “seconds.” In addition, they reported that he imitated words said by parents as a model more often than before.

Discussion

Effect of Task Preference on the Occurrence of Verbal Requests

In drawing 1 with high on-task behavior, verbal requests occurred after vicarious reinforcement. In sticking on stickers, the task with low on-task behavior, verbal requests did not occur. In their review article about the behavior chain interruption strategy, Carter and Grunsell (2001) suggested that the attempt to complete the
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activity is one of the important components of this procedure. During drawing 1, when a pen case was given to Taro, he leaned out of his chair and reached his hand toward the trainer. These behaviors were looked upon as prelinguistic actions that represented his attempt to complete drawing 1. But such behavior did not occur when he was sticking on stickers. In summary, the results of the present study suggest that facilitation of children’s mands through a behavior chain interruption strategy requires the assessment of the children’s task preference.

**FIG. 2** Occurrence of Verbal Requests (Right Ordinate) and Antecedent Stimuli (Left Ordinate)
One requesting opportunity was counted for each stimulus per session.
Generalization and Maintenance of Verbal Requests

When Taro engaged in drawing 1, the stimuli controlling his verbal requests tended to shift from vicarious reinforcement to imitation, in which Taro immediately imitated the model's words before the model had received the desired object. Such immediate imitation also occurred in the generalization and maintenance probe. Although the generalization across tasks (i.e., the art project and playing house) and maintenance of responding (i.e., drawing 1 and drawing 2) were achieved was meaningful from a clinical point of view, the reason for this improvement is not obvious. One possible explanation is Taro's history of reinforcement for manding, and another is that the tasks in the generalization and maintenance probe were Taro's preferred tasks.

Function of Taro's Verbal Requests

By using a behavior chain interruption strategy in with Taro's preferred tasks, verbal requests began to occur. A limitation of the present study is that the function of Taro's verbal requests was not clear. Because his verbal request for blank paper occurred spontaneously after the 11th sessions, that acquired response is more likely a pure mand. Because the verbal requests for other desired objects such as "red" and "blue" occurred by imitation, and the controlling stimuli were the model's verbal responses, these responses may not have been mands, but rather echoic.

There are several possible reasons why Taro's verbal requests still needed the model's verbal responses. One is that the intervention period was shorter for those desired objects than for the blank paper.

A second possible reason is that the extent to which tools were necessary for completing the tasks differed between blank paper and pens. Although there were no red and yellow or blue and green pens in the pen case, other colors of pen were in it. Since these pens could substitute for the missing pens, the necessity of getting the missing ones might be low, with the result that Taro did not request them. In contrast, nothing could substitute for blank paper, so the necessity of obtaining the missing item was high. For the functioning of the behavior chain interruption strategy, it is necessary that participants engage in the activity and that access to the item is limited. In drawing 1, the former condition was met, but the latter was not.

A third reason why Taro's verbal requests still needed the model's verbal responses is that the way of prompting used in the present research was inappropriate. When Taro made no response for 3 sec after the materials were given, the model's verbal response (i.e., a prompt) was presented. Such a procedure was considered to be a time-delay procedure, used in order to transfer stimulus control over Taro's verbal responses. However, when employing a time-delay procedure initially, usually the controlling stimulus (i.e., the prompt) is paired with a target stimulus (0-s delay). Then, if participants obtain 100% correct responses for a determined number of sessions, over successive sessions, a delay is inserted between the target stimulus and the presentation of the controlling stimulus, allowing the participant the opportunity to perform the response independently. The model's verbal responses should have
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been presented immediately after the tools were given in the first several sessions. How to present and fade out the model's verbal responses require further research.

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