Practical Research

Analysis of Factors that Affect Generalization of Mand for Instruction in Child With Autism

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The objective of this study was to examine which factors affect the generalization of mand for instruction. A boy with autism (7 years old) participated in this study. First, the participant was taught a mand for instruction in a "labeling photo cards" task. After successful acquisition of the mand, a generalization test was conducted. In this test, the participant was presented with various tasks (e.g., "labeling illustration cards," "classifying cards," "labeling objects," and "matching"). These tasks were divided into four types on the basis of the three-term contingency. Tasks of type A had similar discriminative stimuli and response to the trained task, tasks of type B had similar discriminative stimuli to the trained task but response was dissimilar, and tasks of type C had a similar response to the trained task but discriminative stimuli was dissimilar. Tasks of type D had neither similar discriminative stimulus nor response. The results showed that mand for instruction generalized to tasks of types A and C. Thus, the primary factor for the generalization of mand for instruction is the similarity of the required task response.

Key Words: mand for instruction, generalization, autism

Introduction

Researchers have taught “mand for instruction” to children with autism (Ingvarsson & Hollobaugh, 2010; Isawa, 2002; Satake & Kobayashi, 1994). A mand for instruction is defined as a method for obtaining unknown information (Lee & Kobayashi, 1997), for example, saying “please tell me.”

Several studies have examined the generalization of mand for instruction. For example, some studies have taught children with autism to ask “where?” when an item is not found (Endicott & Higbee, 2007; Sundberg, Loeb, Hale, & Eigenheer, 2002). After the successful acquisition of this initial mand for instruction, they provided a generalization test to participants. This generalization test was carried out in a situation where the participant had not been trained on the test items. The results showed that participants could indeed say “where?” as appropriate in the generalization test.

The more the trained stimulus and the untrained stimulus are similar, the more generalization occurs (Mednick & Freedman, 1960). In study of mand for instruction, Yamamoto (1987) reported that mand generalized to similar stimuli, but not to dissimilar stimuli. This result suggests that the similarity between a trained stimulus and an untrained stimulus is important in the generalization of mand for instruction.

As described above, similarity between a trained stimulus and an untrained stimulus is needed to establish generalization. Many studies have pointed out that the physical similarity of stimuli (e.g., the shape of the object, the position of the object, the intensity of the light, or the loudness of the sound) is important for generalization. However, in the case of the generalization of mand for instruction, the influence of other factors besides the physical similarity of the stimuli may need to be considered. For example, some use mand for instruction to ask about the location of tools, while others use them to ask how to use the tools. “Asking about the location” and “asking about use” are not similar in terms of the physical similarity of the discriminative stimuli, because the discriminative stimulus of the former is the situation where the tools are not found, and the discriminative

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stimulus of the latter is tools that you don't know how to use.

Related to the generalization of mand for instruction, Isawa (2002) carried out a generalization test using various tasks after a child with autism acquired a mand for instruction. First, the participant was taught to use the mand for instruction “please tell me” to a question of common knowledge (e.g., “What color is an apple?”). Later, he was presented with a generalization test. In the generalization test, he was asked to use the mand for instruction on previously untrained task stimuli such as filling in a printed sheet about numerical calculation, or inserting batteries into a machine. The results showed that the participant could generalize the mand for instruction across many stimuli, which definitely were not physically similar. These data mean that a mand for instruction can generalize across stimuli with dissimilar physical characteristics; thus, other factors in the generalization of mand for instruction exist besides the physical similarity of the stimuli. Therefore, the examination of what factors besides the similarity of the stimuli affect generalization of mand for instruction is required.

Satake and Kobayashi (1994) stated two functions of mand for instruction: “mand for instruction about the name (what is this?)” and “mand for instruction about the procedure (please tell me).” “Mand for instruction about the name” refers to asking an object’s name, and “mand for instruction about the procedure” refers to asking how to solve a current problem. The authors taught children with autism to choose a mand for instruction to suit many tasks. In brief, they were taught to use the “mand for instruction about the name” for unknown objects or pictures (e.g., when they were presented with a novel food picture) and the “mand for instruction about the procedure” for unknown processes of work (e.g., when they were asked to thread a needle). Later, the authors conducted a generalization test. The results showed that the “mand for instruction about the name” generalized to tasks that asked for the object’s name, but didn’t generalize to tasks that asked how to resolve a current problem. The “mand for instruction about the procedure” also generalized to tasks that asked how to resolve a current problem, but did not generalize to tasks that asked the object’s name. It is possible that these generalizations were influenced by the similarity of required task response (“saying the name” and “resolving a current problem”) rather than the physical similarity of the stimuli presented in the tasks. Hence, this result highlights the importance of the similarity of required task response regarding the generalization of mand for instruction.

Isawa (2002) and Satake and Kobayashi (1994) showed that a factor that affects the generalization of mand for instruction is the similarity of required task response. However, in Satake and Kobayashi (1994), the participant was required to discriminate both stimuli and the selection of responses because he was taught different responses according to the task. Therefore, it is possible that a difference in response topography influenced generalization. This problem may be solved by teaching only one topography to participants (for example, “please tell me” is useful to teach in training because it is appropriate in various situations, compared with “what’s that?” or “how old are you?”). In addition, tasks used in the generalization test in Satake and Kobayashi (1994) were not controlled in terms of systematic manipulation of discriminative stimuli. So, this study was not able to examine the influence of similarity of discriminative stimuli. Thus, this kind of examination is necessary to obtain more information on the generalization of mand for instruction.

Given the above studies, we should examine the influence of similarity of required task response and the physical similarity of stimuli on the generalization of mand for instruction. To investigate this matter, the following procedure should be used. First, participants are taught a mand for instruction in one task. For example, when the participants are asked to label an object’s name, they are taught to use a mand for instruction if they are presented with unknown objects. Next, they take a generalization test with a systematic selection of tasks. On the basis of the results of this procedure, factors affecting generalization and non-generalization can be examined. To determine which tasks should be used in the generalization test, a three-term contingency can be used. A three-term contingency consists of a “discriminative stimulus,” a “response,” and a “consequence.” For example, reading the text of a book consists of “discriminative stimulus: text of the book,” “response: reading,” and “consequence: obtaining information from the book.” In a concrete procedure with the task of “reading text,” the participant is at first presented with the task of reading text to acquire a mand for
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Next, the participant is presented with “untrained tasks A” of the same discriminative stimulus (text of the book) and a different response (e.g., textual) as the trained task, and is also presented with “untrained tasks B” consisting of the same response (reading) and a different discriminative stimulus (e.g., the text of a newspaper) as the trained task. Both of the consequences of the untrained tasks is “generalized reinforcer.” If the participant generalized “untrained tasks A,” then the similarity of the discriminative stimuli is important for the generalization of mand for instruction. If the participant generalized “untrained tasks B,” then the required task response is important for the generalization of mand for instruction. Such an experiment should uncover useful factors that contribute to the generalization of mand for instruction.

This study examined whether the similarity of required task response or the physical similarity of the discriminative stimulus presented in the tasks had a stronger influence on the generalization of mand for instruction. We presented training and generalization tests for a child with autism, and compared the contingency of generalized tasks with the contingency of non-generalized tasks.

Method

Participant

The participant was a 7-year-old boy with autism who had been receiving behavioral intervention since the age of 5. He spoke one word as a mand (e.g., “chocolate” or “potato”). Aside from this, he spoke two or three words if someone presented him with a verbal prompt. Furthermore, he spoke three words as delayed imitation (e.g., a song from a TV commercial or a proverb), but his delayed imitation was incoherent. The participant tacted household articles (e.g., table and cup). During the training, if the participant could not respond to the task correctly, he cried and rose from his chair. In some cases, he ran away from the training room.

Setting

Training was conducted every two weeks.

The study was conducted in a training room at the university. One table and two chairs were placed in the training room. The participant and trainer 1 sat facing each other. Trainer 2 sat behind the participant to prompt him to response correctly.

Before the study began, we explained the purpose, procedure, benefit to the participant, and period of study to the participant’s father and mother.

Tasks

Various tasks were used for examining the factors affecting generalization in this study. Tasks were classified as being one of four types with differing three-term contingency. Fig. 1 shows the four types of tasks.

The contingencies for task type A consisted of “discriminative stimulus: card,” “response: speech,” and “consequence: generalized reinforcer.” Tasks of type A were “labeling photo cards,” “labeling illustration cards,” and “labeling cards with a drawn geometric pattern.” “Labeling photo cards” was first used for teaching the participant the mand for instruction. Procedures for each task are shown below. In “labeling photo cards,” the participant labeled photo cards presented by trainer 1. In “labeling illustration cards,” the participant labeled illustration cards presented by trainer 1. In “labeling cards with a drawn geometric pattern,” the participant labeled cards with a drawn geometric pattern (e.g., a triangle and a quadrilateral) presented by trainer 1.

The contingencies for task type B consisted of “discriminative stimulus: card,” “response: handling,” and “consequence: generalized reinforcer.” The discriminative stimuli for tasks of types A and B were the same, but the response required in each task was different. Tasks of type B were “classifying cards” and “filling in a blank in a sequence of numbers.” Procedures for each task are shown below. In “classifying cards,” the participant classified cards as belonging to a certain group (e.g., animal or food). The participant

![Fig. 1 Three-Term Contingency of this Study’s Tasks](image)

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classified cards into two boxes separately. In “filling in a blank in a sequence of numbers,” the participant used number cards to fill in a blank in a sequence of numbers. The sequence of numbers was written on paper.

The contingencies for task type C consisted of “discriminative stimulus: object (e.g., pencil, cup, or clock),” “response: speech,” and “consequence: generalized reinforcer.” The response required for tasks of types A and C was the same, but their discriminative stimuli were different. Tasks of type C were “labeling objects” and “labeling objects in a box.” Procedures for each task are shown below. In “labeling objects,” the participant labeled an object presented by trainer 1. In “labeling objects in a box,” trainer 1 put an object into a box with holes on the side. Next, trainer 1 presented the box to the participant. The participant put his hands in the holes, touched the object, and labeled it. Objects in task type C were different from objects drawn on cards to increase the difference between the discriminative stimuli of types A and C.

The contingencies for task type D consisted of “discriminative stimulus: instruction by trainer,” “response: handling,” and “consequence: generalized reinforcer.” Tasks of type D had neither similarity of discriminative stimulus nor similarity of response required to tasks of type A. Tasks of type D were “matching” and “selecting numbers.” Procedures for each task are shown below. In the “matching” task, the participant selected an object from three objects according to the trainer’s instruction. In the “selecting numbers” task, trainer 1 placed nine pieces of paper with the numbers one to nine written on them on a table. The participant selected and put the pieces of paper in order according to the trainer’s instruction. For example, if trainer 1 gave the instruction “1, 7,” the participant selected and ordered the paper with “1” written on it and the paper with “7” written on it.

All tasks had been previously practiced by the participant, so he could respond correctly when he was presented with the discriminative stimulus in each task.

**Design**

First, “training 1” was conducted to acquire a mand for instruction in “labeling photo cards.” Next, “generalization test 1” was presented to assess the generalization of this mand for instruction in untrained tasks of types A, B, C, and D. Then, “training 2” was conducted to acquire a mand for instruction in “labeling illustration cards.” Then, “generalization test 2” was conducted to assess the generalization of the mand for instruction in untrained tasks of types A, B, C, and D.

We analyzed the contingency of the generalized and non-generalized tasks whenever a generalization test was conducted.

**Targeted Behavior and Response Measurement**

The targeted behavior in this study was a mand for instruction. A mand for instruction was defined as the vocal response “please tell me” that the participant emitted when he was presented with an unknown stimulus.

A correct response was defined as when the participant emitted a mand for instruction without any trainer’s prompt. A correct response with prompt was defined as when the participant emitted a mand for instruction after verbal prompting by trainer 2. When the participant emitted a correct response or a correct response with prompt, trainer 1 gave information on the unknown stimulus. An incorrect response was defined as when the participant displayed other behaviors than a mand for instruction after the trainer presented the prompt, and when the participant emitted a mand for instruction in the presence of a known stimulus.

We measured the amount of cards that the participant learned to label during training 1. If the participant labeled the unknown card without a mand for instruction, we recorded that he learned labeling of the card.

**Procedure**

**Assessment of known or unknown cards.** In this assessment, we assessed known or unknown cards for the “labeling photo cards” task.

First, trainer 1 presented a photo card to the participant. Next, the participant labeled it. One card was presented three times. If the participant labeled a card correctly three times, the card was defined as known card. If the participant never labeled a card, the card was defined as unknown card. If the participant labeled a card only once or twice, the card was not used in this study.

**Training 1.** Training 1 was conducted to teach the participant a mand for instruction.
First, trainer 1 presented a photo card to the participant. If the participant labeled the photo card, trainer 1 praised him. If the participant emitted a mand for instruction to unknown stimulus presented, trainer 1 taught him the name of the photo card. If the participant did nothing for a fixed time according to the time delay procedure (see the following paragraph for details), trainer 2 provided the prompt, “please tell me.” And, if a fixed time passed after the participant had incorrectly labeled a photo card, trainer 2 provided the prompt, “please tell me.” However, trainer 1 and trainer 2 never present the prompt to participant’s response in baseline.

In training 1, we used a time-delay procedure (Halle, Marshall, & Spradlin, 1979) to teach mand for instruction. In phase 1, trainer 2 presented the prompt after the participant did nothing for one second. In phase 2, trainer 2 presented the prompt after the participant did nothing for three seconds. In phase 3, trainer 2 presented the prompt after the participant did nothing for five seconds.

Ten known cards and ten unknown cards were presented as a stimulus set each session. If the participant labeled the unknown card correctly, it was noted that the participant had learned to label the card. The card that the participant could label correctly was removed from the stimulus set, and a novel unknown card was added. If the participant learned to label an unknown card during a session, trials with a novel unknown card were conducted addition to twenty trials that was scheduled. So, part of the sessions was conducted more than ten trials. (although the participant was identified as having learned to label a card after one correct response during training to shorten the session to decrease burdens to the participant).

Generalization test 1. Generalization test 1 was conducted to examine the generalization of a mand for instruction to untrained tasks.

Trainer 1 presented all tasks of types A, B, C, and D to the participant. Tasks were presented in random order in the generalization test. 15 trials were conducted per task. These trials consisted of ten known stimuli and five unknown stimuli.

In the generalization test, if the participant emitted a mand for instruction, trainer 1 taught the correct response. If the participant did not emit the correct response for five seconds, the trial was ended. Trainer 2 never prompted in the generalization test.

Training 2. The purpose of training 2 was for the participant to acquire a mand for instruction in “labeling illustration cards.” The procedure was the same as in training 1. However, illustration cards were used instead of photo cards.

Generalization test 2. Generalization test 2 was conducted to examine the generalization of a mand for instruction to untrained tasks because the participant had learned to emit a mand for instruction in two tasks (“labeling photo cards” and “labeling illustration cards”).

The procedure was same as in generalization test 1.

Generalization to home and school. We examined the generalization of a mand for instruction to home and school.

We gave the participant’s mother a “generalization check sheet” after every session. The “generalization check sheet” consisted of the date, a scene, the person toward whom the participant issued his mand for instruction, and a task. The participant’s mother was asked to fill in the “generalization check sheet” and his mother asked his teacher to fill in the sheet also, returning them to the trainer at the next session. Afterwards, mand for instruction recorded by the mother and the teacher were categorized into types A, B, C, or D.

Interobserver agreement. The data for each mand for instruction were recorded separately by the trainer and an observer by watching a video recorded in each session. Agreement was assessed on 25% of the training and generalization test and computed by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. The mean agreement was 100%.

Results

Training and Generalization Test

According to the results of the assessment of known and unknown cards, known cards for the participant were “portable telephone,” “Ramen,” “owl,” “orange,” “beetle,” “rabbit,” “motor bicycle,” “snowman,” “DVD,” and “eraser.” Unknown cards were “guitar,” “bean sprout,” “megaphone,” “chameleon,” “garlic,” “screw,” “lotus root,” “sea urchin egg,” “moon,” and “peacock.”

The results of training 1 are shown in Fig. 2. The participant never emitted a mand for instruction at
baseline. In phase 1, correct responses with a prompt increased to 100%, but a correct response without a prompt was never observed. In phase 2, correct responses and correct responses with a prompt increased to 100% in all, of which 20% were correct responses. In phase 3, correct responses increased to 100%. Therefore in training 1, the participant acquired a mand for instruction for “labeling photo cards.”

The number of cumulative responses the participant gave while learning to label the cards is shown in Fig. 3. At baseline, the participant never labeled unknown cards, but he gradually learned to label them during the six sessions. Finally, he learned to label six unknown cards in training 1. This learning effect was produced because the participant was taught the correct name of each card due to emitting an appropriate mand for instruction.

The percentage of correct responses in generalization test 1 is shown in Fig. 4. The percentage of correct response for “labeling illustration cards” was 20% and for “labeling objects in a box” was 20%, but the participant did not emit a mand for instruction in other tasks. In brief, generalization of the mand for instruction was hardly seen after the participant acquired a mand for instruction in “labeling photo cards.” When the participant did not emit a mand for instruction, he emitted incorrect response repeatedly.

The results of training 2 are shown in Fig. 5. Correct responses immediately increased to 100%. Additionally, the participant learned to label four unknown cards.

The percentage of correct responses in generalization test 2 is shown in Fig. 4. Correct responses were 100% for “labeling cards with a drawn geometric pattern,” 80% for “labeling objects in a box,” and 100% for “labeling objects.” In brief, mand for instruction generalized to tasks of types A and C in the training room. But, the participant never emitted a mand for instruction in tasks of types B and D. Thus, the mand for instruction did not generalize to tasks of types B and D in the training room.
A part of the “generalization check sheet” filled by the participant's mother and teacher is shown in Table 1. The first report of generalization at home and at school was after session 7. His mother and his teacher reported 20 episodes in all. There was 1 episode for tasks of type A, 18 for type C, and 2 for type D. There were no episodes for tasks of type B. Mand for instruction generalized to tasks of type A, type C and type D at home and at school.

Moreover, the participant’s mother reported that she became able to understand the reasons for the participant’s behavior.

**Discussion**

The purpose of this study was to examine the factors affecting the generalization of mand for instruction. First, the participant never emitted a mand for instruction in generalization test 1. At this point, “labeling photo cards” was the only task in which the participant could emit a mand for instruction.
In generalization test 2, mand for instruction generalized to all tasks of types A and C. Tasks of type A and type C both included "speech" as a required task response. This result shows that one factor in the generalization of mand for instruction is the similarity of the required task response. This finding supports Satake and Kobayashi (1994).

In past studies of mand for instruction, many researchers have reported successful generalization (Endicott & Higbee, 2007; Ingvarsson & Hollobaugh, 2010). But there have been very few studies on which factors affect generalization. Isawa (2002) explained that the generalization of mand for instruction occurred because a stimulus class was shaped by unknown stimuli used in training. However, his study did not examine what the common characteristics of stimulus class membership were. The current study found that the common characteristic of stimulus class membership to evoke a mand for instruction is the required task response. Therefore, this study supported and extended Isawa (2002).

It should be noted that a mand for instruction was not emitted even in tasks of types A and C after training 1. This fact shows that training with only one task does not promote generalization, even though tasks in the generalization test were similar to the tasks in training with respect to the required task response. Because mand for instruction generalized to other tasks after the participant learned to emit a mand for instruction in two tasks of type A ("labeling photo cards" and "labeling illustration cards"), generalization of mand for instruction may depend on training with at least two tasks.

At home and at school, mand for instruction generalized to tasks of type A, type C and type D. Almost all tasks were type C. The response required in tasks of type C was “speech.” At home and at school, mand for instruction generalized to tasks with a similar response required in the tasks. Although this result is anecdotal, it supports this study’s finding. On the other hand, a mand for instruction also generalized to tasks of type D that included “handling” as a response. This study cannot explain the reasons behind mand for instruction generalizing to tasks of type D, but one possibility is that the consequence stimulus influenced the emitting of a mand for instruction. The consequence stimulus of “cutting an eggplant” is access to food. Access to food might have strong reinforcement value for the participant; his father states that the participant willingly does various things to access foods. Future studies should examine the relationship between the consequence stimulus of tasks and the generalization of mand for instruction. To do so, the systematic manipulation of the consequence stimulus is required, in addition to the systematic manipulation of the stimulus presented in the tasks and response required in the tasks as in this study.

This study’s finding can explain Niu, Yasui, and Mochizuki (2005). They taught a student with aphasia a mand for instruction while “labeling cards.” After the participant acquired the mand for instruction, he was presented with a generalization test. In the generalization test, “writing an object’s name” and “cooking” were used. In “writing an object’s name,” the participant was required to write an object’s name drawn on the card. In “cooking,” he was required to seek cookware to cook a pancake. The results showed that he never emitted a mand for instruction. Authors considered that a mand for instruction did not generalize because the participant did not take an interest in the tasks. But the unsuccessful generalization is explained by our study’s finding. In our termi-

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<tr>
<th>Date</th>
<th>Type</th>
<th>Scene</th>
<th>Person</th>
<th>Situation</th>
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<tbody>
<tr>
<td>6/12</td>
<td>Type A</td>
<td>The participant and his mother read picture book of national flags</td>
<td>His mother</td>
<td>He looked at the flag of “Antigua and Barbuda” and emitted mand for instruction.</td>
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<td></td>
<td>(After session 7)</td>
<td>together in bed.</td>
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<tr>
<td>7/2</td>
<td>Type C</td>
<td>The participant attended a Japanese class.</td>
<td>His teacher</td>
<td>When his teacher asked him to read “ine,” he emitted mand for instruction.</td>
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<td></td>
<td>(After session 12)</td>
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<tr>
<td>7/8</td>
<td>Type D</td>
<td>The participant cooked dinner with his mother.</td>
<td>His mother</td>
<td>When he attempted to cut an eggplant, he emitted mand for instruction.</td>
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<td>(After session 14)</td>
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nology, “labeling cards” was a task of type A, “writing an object’s name” was a task of type B, and “cooking” was a task of type D. Because tasks of type B and type D were not similar to tasks of type A in terms of response (the response required in tasks of type B and type D was “handle,” and in type A was “speech”), mand for instruction may not generalize.

This study’s findings may orient the future training of mand for instruction. According to Stokes and Baer (1977), “multiple exemplars” is useful for generalization. If a factor in generalization of mand for instruction is the response required during the task, multiple exemplars including various responses should be used to promote generalization. In brief, both “speech” and “handling” should be included in exemplars as various responses required in tasks during training.

One limitation of the current study is lack of assessment of improvement of the participant’s, his family’s and his teacher’s quality of life. The pragmatic value of generalization should be associated with the change of standard of living in participants. Future studies should conduct not only the measurement of generalization but also the assessment of change of standard of living in participants.

Another limitation is the lack of examination of generalization within a task. In brief, generalization of mand for instruction to novel cards did not transfer in “labeling photo cards” and “labeling illustration cards.” Future study is required to examine the generalization within a task in addition to generalization across types of task.

It is difficult to determine whether this study’s result was generalization by required task response or functional transfer. However, Sidman (2000) stated that functional transfer explains nothing, and it is simply what we observe. On the other hand, the analysis of contingency has predictability and application possibility, and it postulates no additional explanatory process. So, it is reasonable that this study’s result is generalization by required task response.

Moreover, there may be differences between the actual contingency and the identified contingency in this study (Fig. 1). Future study was required more detailed analysis of contingency.

This study showed that the main factor affecting generalization of mand for instruction is the similarity of response required between trained and un-trained tasks. Future studies will require that multiple tasks include more responses in training and generalization tests to examine in detail what kind of influence the required task response has on the generalization of mand for instruction.

References


