

## Enabling a Prelinguistic Communicator with Autism to Use Picture Card as a Strategy for Repairing Listener Misunderstandings: A Case Study

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*Abstract: The purpose of this case study was to examine the effects of a time-delay prompting procedure on the acquisition of skills for repairing multiple listener misunderstandings. A prelinguistic student with autism was taught to use picture cards as a strategy to repair listener misunderstandings in a setting where the student had to ask the listener to pick up a pen to paint a TV logo that was one of his preoccupations. The listener intentionally provided the student a pen with non-preferred attributions (brand, color, or size) to provide the student opportunities to repair the communication breakdown. The type and number of attributions misunderstood by the listener in a communication episode changed as the student met the predetermined criterion. Results of a changing-criterion design demonstrated that the intervention was effective in enabling the student to use picture cards in a way that took into consideration which attributions the listener misunderstood.*

Individuals with autism who exclusively rely on prelinguistic communication modes (i.e., vocalization and gesture) face frequent communication breakdowns due to the ambiguity in nature in sending a message (Brady & Halle, 2002; Halle, Brady, & Drasgow, 2004; Keen, 2005). When prelinguistic communicators with autism face communication breakdowns, the occasion calls for repair (Wetherby, Alexander, & Prizant, 1998). Communication repair is referred to as a perseverative communication act that is emitted when the communication initiation is not followed by the desired outcome within a reasonable amount of time (Halle et al.). If they repair communication breakdown by repeating the original communication forms or modifying them in ways that promote listener's under-

standings in socially acceptable manner, the probability of obtaining the desired outcome increases, which in turn may contribute to enhancing their self-determination (Brown, Gothelf, Guess, & Lehr, 1998; Wehmeyer, Agnan, & Hughes, 1998).

Recent studies (Keen, 2005; Meadan, Halle, Watkins, & Chadsey, 2006; Ohtake et al., 2005) have revealed that prelinguistic communicators with autism can repair a variety of communication breakdowns when (a) the requesting behaviors were not attended to, (b) the respondent asked for clarification vocally or gesturally, or (c) the communication breakdown was followed by a wrong response by the listener. In addition, it was found that prelinguistic communicators with autism used various types of repair strategies, including repeating the first communication forms, adding new forms, recasting the original forms and using new forms instead, and reducing the part of the original forms.

Furthermore, when they modified their communication forms in response to a com-

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munication breakdown, prelinguistic communicators with autism were able to do so in a way that added information that was not part of the original communication initiation (Ohtake et al., 2005). To illustrate, suppose that an individual with autism exhibited an open-palm gesture that led to a communication initiation. Faced with the communication breakdown, as communication repair, she then grabbed the listener's hand and led the listener to the item she wanted. The first communication form sends a message that the individual wants something but does not send a message about what she wants. In contrast, the second communication form (i.e., communication repair) sends a specific message about what the individual wants.

Research has also revealed that prelinguistic communicators with autism are likely to choose more rudimental communication forms (e.g., direct touch to the listener) or increase the intensity of the original communication forms (e.g., banging objects or screaming) when they attempt to repair communication breakdowns (Keen, 2005; Meadan et al., 2006; Ohtake et al., 2005; Sigafoos, Drasgow et al., 2004). Without being taught alternative communication forms, these communicators could continue to resort to more rudimental and intensified forms, which occasionally would lead to challenging behaviors (Keen, 2003). On the other hand, if we systematically teach them in ways that replace the rudimental and intensified forms of communication repair with functionally equivalent but more symbolic forms (e.g., manual sign, picture cards, voice output communication system: hereafter referred to as VOCA), it is possible for them to use the alternative forms as a repair strategy (Halle et al., 2004).

Numerous studies have investigated the effectiveness of teaching picture cards, VOCA, or sign language as an initiation strategy for prelinguistic communicators with autism (Brady, 2000; Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002; Frea, Arnold, & Vitimberga, 2001; Ganz & Simpson, 2004; Richman, Wacker, & Winborn, 2001; Sigafoos, O'Reilly, Seely-York, & Edrisinha, 2004; Son, Sigafoos, O'Reilly, & Lancioni, 2006; Tincani, 2004). However, few studies have explored effective strategies for teaching communication repair to prelinguistic communicators

with autism. The exception is Sigafoos, Drasgow et al. (2004) that attempted to teach VOCA use as a repair strategy for two prelinguistic students with autism. They taught the repair skills in a setting where highly preferred food was shown outside the student's reach. Using a time-delay procedure, the researchers attempted to enable the students to use VOCA within 10 s when the listener did not attend to the communication initiation (e.g., pointing, reaching, touching bowl). Both students acquired the use of VOCA as a repair strategy in a condition where they wanted their preferred food.

Thus, Sigafoos, Drasgow et al. (2004) demonstrated that it is possible to teach students with autism to use VOCA when they meet a communication breakdown in which their first prelinguistic forms of request were not attended to by the listener. However, it is unknown if a systematic prompting procedure in highly motivating request contexts enables prelinguistic communicators with autism to repair other types of communication breakdowns (e.g., misunderstanding, spoken or gestural request for clarification). Additionally, it is unclear if the same intervention strategy enables prelinguistic communicators with autism to repair multiple breakdowns (e.g., two or more consecutive breakdowns).

Communication breakdowns in instances where the listener misunderstands what the individual wants and, therefore, provides a wrong item are likely to encourage prelinguistic communicators with autism to use communication repairs that specify what exactly they want. Such situations can be excellent teachable moments at which prelinguistic communicators with autism could efficiently acquire alternative forms (e.g., picture cards) as a repair strategy that are functionally equivalent to but more effective at specifying what they want than the rudiment forms they typically use (Horner & Day, 1991; Keen, Sigafoos, & Woodyatt, 2001).

The purpose of this study was to extend Sigafoos, Drasgow et al.'s research (2004) by investigating the effects of using a systematic prompting procedure in a highly motivating request context on enabling a prelinguistic communicator with autism to touch the picture card that corresponds to a misunder-

stood attribution when two consecutive misunderstandings occur.

## Method

### *Participant*

The study participant was Takao, a 12-year-old boy who was diagnosed with autism by a neuropsychiatrist according to the DSM-IV (APA, 1994). The child's hearing, vision, and motor development were within the normal range. According to the Kyoto Scale of Psychological Development (Ikusawa, Matsushita, & Nakase, 2002), his overall development was equivalent to 2:3. He could follow one-step spoken directions used in the routine. When he wanted something, he exclusively relied on prelinguistic communication modes, including vocalization, open palms, reaching, or pointing. When a written word was shown to him, he did not emit the correct corresponding sounds. However, the vocalization synchronized with pointing to each syllable. Further, he was able to write a few words, but did not use letters in functional ways.

At the beginning of the study, Takao had never been taught to use picture cards as a mode of requesting behavior. According to the repair assessment, which followed procedures proposed by Ohtake et al. (2005), in free-play situations, Takao exhibited persistent requests when he faced with any types of communication breakdowns (i.e., asking for clarification vocally or gesturally, not attending and not responding, misunderstandings) in all breakdown opportunities across play activities (e.g., trampoline, swing, bike riding). In addition, he frequently used communication forms that specified what he wanted (e.g., pointing to, reaching for, or leading listener's hand toward the object) in response to the listener's misunderstandings. For example, in situation where his teacher presented a shovel and said "You want to play shovel?" in response to his open palm used for requesting "pushing swing," Takao threw the shovel and led his teacher's hand toward the chain of the swing.

### *Settings and Materials*

Takao attended a special school affiliated with a university, where he was educated with two

other students with autism in a self-contained classroom led by two teachers. All sessions were conducted at a table using a one-to-one format during a highly structured teaching period when communication skills were targeted. The room was divided into three spaces by partitions and lockers. Each of the spaces (2 × 3 m) was assigned to a different activity to help Takao predict what activity he was assigned to do. During the sessions, only Takao and his teacher were in the room.

At each session, Takao and the teacher sat at a desk. A few plates of pens were placed horizontally on a table in view of the student, but out of reach (i.e., approximately 2 m in front of him). The distance between each plate was approximately 30 cm. Picture cards (6 × 7 cm) were placed within easy reach (20–30 cm), at a distance of approximately 1 cm between each. The pens used in this study consisted of five brands (TOMBO™, MITSUBISHI™, UNI™, ZEBRA™, SAKURA™), four colors (red, black, blue, green), and two sizes (thick and thin).

Before starting the session, the teacher provided Takao an opportunity to access the table where the pens were placed to let him know what pens were available. Then the teacher invited him to sit at a desk where an A6 size of paper (10 × 15 cm) and picture cards were placed and waited for his communication initiation.

### *Assessment for Preoccupied Attributions*

In a one-hour interview with his special education teacher, Takao demonstrated a strong interest in painting the logo of a specific TV program ("Comedy Focus"). When he painted the logo, he persistently pointed to or reached for a pen of a specific brand (TOMBO or MITSUBISHI), a specific size (thin), and a specific combination of color (red and black). During all trials conducted in the study, we double-checked to see if he (a) accepted when a pen with these preferred attributions was provided and (b) rejected when a pen without these preferred attributions was provided. All of Takao's accepting and rejecting behaviors were consistent with the information on preoccupied attributions collected from the interview.

During the first baseline condition, Takao

demonstrated a specific pattern in coloring. For example, if red and black pens were available among several colors, he first asked his teacher to pick up a black pen to draw the outline of the logo. He then picked up a red pen to paint the inside of the outline for a while. He repeated the pattern of alternating the use of black and red pens whenever he drew the logo. This pattern informed the teacher which color Takao wanted in a given turn.

### *Session Schedule and Data Collection*

Data were collected during approximately 15-minute sessions twice a week during the regular class periods. Within each session, Takao requested his preferred pens in terms of brand name, color, and size, 8 to 10 times, to paint the logo in his favorite ways. Two types of opportunities, Standard Opportunities and Repair Probes (Sigafoos et al., 2004; described in detail below), occurred within the request opportunities. All sessions were videotaped and the videotaped communication behaviors were later analyzed to record the presence or absence of the target behaviors on an episode-by-episode basis. The video camera was inconspicuously placed on a tripod approximately 2 m from the table where the student and teacher were seated. The student never noticed the camera.

### *Response Definitions*

Three topographies were recorded; that is, Behavior Indication, Picture Use, and Combined Use. Behavior Indication was recorded if Takao attempted to obtain a pen by reaching for or pointing to the pen, moving toward the pen, or pushing out a non-preferred pen. Picture Use was recorded if Takao touched the picture card that corresponded to his preferred attribution. Finally, Combined Use was recorded if Takao simultaneously used both Behavior Indication and Picture Use in response to a communication breakdown.

These responses were further classified depending on whether each occurred as the Initiation, as the First Repair, or as the Second Repair. An Initiation was defined as the first communication behavior used to initiate a request when he needed a pen to draw his fa-

vorite TV logo. A First Repair was the communication behavior used to request his preferred pen when the first misunderstanding occurred (i.e., a non-preferred pen was presented). A Second Repair represented the communication behavior used to request his preferred pen when the second misunderstanding occurred.

On Standard Opportunities, all initiations were immediately reinforced by providing a preferred pen. On Repair Probes, all initiations were immediately followed by presenting a non-preferred pen to provide one or two opportunities to use a picture card as a repair strategy (see *Conditions*). A Correct Repair was recorded only when Picture Use or Combined Use occurred in all repair turns during a Repair Probe. Takao were allowed 5 s to make a correct repair (i.e., touching the picture card that corresponded to a misunderstood attribute). If he touched any card depicting non-preferred attributions even once, the response was classified as incorrect.

### *Conditions*

Two conditions (One Attribute Repair and Two Attribute Repair) were set up, each consisting of three phases, to enable Takao to repair multiple misunderstandings. Followings are detailed descriptions of each phase.

#### *One Attribute Repair*

In the first condition, Takao was required to repair one communication breakdown in which one attribution of a pen was misunderstood by the listener. This condition consisted of three phases, Brand, Color, and Size.

*Brand.* In this phase, the attribution misunderstood by the listener was brand name. Three plates of pens were placed horizontally on the table behind the teacher. The three plates consisted of one preferred brand (i.e., TOMBO) and two non-preferred brands (i.e., SAKURA and ZEBRA). Each plate included four different colors of pens, two of which were preferred colors (i.e., black and red) and the remaining two non-preferred colors (i.e., blue and green). The size of all the pens was the preferred attribution (i.e., thin). Three picture cards, each of which depicted TOMBO, SAKURA, or ZEBRA, were placed

within easy reach. The instructional goal in the Brand phase was defined as follows:

When the communication initiation is misinterpreted and a plate of pens of a non-preferred brand (i.e., SAKURA or ZEBRA) is presented, Takao will touch the picture card symbolizing the preferred brand (i.e., TOMBO) within 5 s with 80% accuracy for three consecutive blocks.

In this study one block consisted of 5 Repair Probes.

*Color.* In this phase, the attribution misunderstood by the listener was color. Four TOMBO pens (preferred brand) were placed horizontally on the table behind the teacher. The colors were two preferred (i.e., red and black) and two non-preferred (i.e., blue and green). The size of the all pens was the preferred attribution (i.e., thin). Four picture cards, each of which depicted one of the colors of the pens, were placed within easy reach. The instructional goal in the Color phase was defined as follows:

When the communication initiation is misinterpreted by the listener and a pen of a non-preferred color (i.e., blue or green) is presented, Takao will touch the picture card depicting a preferred color (i.e., black or red) within 5 s with 80% accuracy for three consecutive blocks.

*Size.* In this phase, the attribution misunderstood by the listener was size. Two plates of TOMBO pens were placed horizontally on the table behind the teacher. One of the plates included thin pens and the other thick pens. Each case included four pens, two preferred (i.e., red and black) and two non-preferred (i.e., blue and green) colors. Two picture cards, depicting a symbol of thin or a symbol of thick, were placed within easy reach. The instructional goal in the Size phase was defined as follows:

When the communication initiation is misinterpreted and thick pens are presented, Takao will touch the picture card depicting a symbol of thin within 5 s with 80% accuracy for three consecutive blocks.

The order of the phases was determined by the teacher based on her intuition of the

Takao's degree of preoccupation with the attribution. The teacher perceived that brand name was the attribution that preoccupied Takao the most, followed by color and size in order. Therefore, these three phases were taught sequentially, starting with Brand, followed by Color and then Size. We included one or two non-preferred attribution cards as distractors from the first phase within the same attribution because Takao's ability to discriminate different shapes, colors, and logos was considered excellent by his special education teacher. In the Size phase, only one non-preferred attribution (thick) card was used as a distractor because no brand of pens included more than two dimensions of size (i.e., thin or thick).

#### *Two Attribute Repair*

The second condition required Takao to repair two consecutive communication breakdowns in which two attributions of a pen were misunderstood by the listener. This condition also consisted of three phases (i.e., Brand-Color, Color-Size, and Size-Brand), as described below.

*Brand-Color.* In this phase, attributions misunderstood by the listener were brand and color. Four plates of pens were placed on the table behind the teacher. The four plates consisted of two black pens (preferred color), two red pens (preferred color), two blue pens (non-preferred color), and two green pens (non-preferred color), respectively. Two pens on each plate consisted of a preferred brand (MITSUBISHI) and a non-preferred brand (UNI or ZEBRA). All pens on the four plates were the preferred size (i.e., thin). Three picture cards, each depicting MITSUBISHI, UNI, or ZEBRA, and four picture cards, each depicting red, black, blue, or green, were placed within easy reach. The instructional goal in the Brand-Color phase was defined as follows:

When the communication initiation is misinterpreted and a thin pen of a non-preferred brand (e.g., UNI) and a non-preferred color (e.g., blue) is presented, Takao will touch the picture card depicting the preferred brand (i.e., MITSUBISHI) or preferred color (i.e., red or black) within 5 s. In addition, when the first communication re-

pair is misinterpreted and a thin pen of a non-preferred brand (e.g., UNI) or non-preferred color (e.g., blue) is presented, Takao will touch the picture card depicting the preferred color or preferred brand, depending on the attribution that the listener misunderstood in the second breakdown, within 5 s with 80% accuracy for two consecutive blocks.

*Color-Size.* In this phase, the attributions misunderstood by the listener were color and size. Four plates of pens were placed on the table behind the teacher. The four plates contained two black pens, two red pens, two blue pens, and two green pens, respectively. The two pens on each plate were of a preferred size (i.e., thin) and a non-preferred size (thick). All pens on the four plates were a preferred brand (i.e., MITSUBISHI). Two picture cards, each symbolizing thin or thick, and four picture cards, each colored red, black, blue, or green, were placed within easy reach. The instructional objective in the Color-Size phase was defined as follows:

When the communication initiation is misinterpreted and a pen of a preferred brand (e.g., MITSUBISHI), non-preferred color (e.g., blue), and non-preferred size (e.g., thick) is presented, Takao will touch a picture card depicting the preferred color (i.e., black or red) or preferred size (i.e., thin) within 5 s. In addition, when the first communication repair is misinterpreted and a pen of a non-preferred color (e.g., green) or non-preferred size (e.g., thick) is presented, Takao will touch a picture card depicting the preferred color or preferred size, depending on the attribution that the communication partner misunderstood in the second breakdown, within 5 s with 80% accuracy for two consecutive blocks.

*Size-Brand.* In this phase, the attributions misunderstood by the listener were brand and size. Four plates of pens were placed on the table behind the teacher. Each plate included four pens of two preferred colors (i.e., red and black) and two non-preferred colors (i.e., blue and green). Two of the four plates consisted of pens of a preferred brand (i.e., MITSUBISHI). Of these two plates, one consisted of four thick pens and the other of four thin

pens. The remaining two plates consisted of pens with a non-preferred brand (i.e., UNI or ZEBRA). Of the latter two plates, one consisted of four thick pens and the other of four thin pens. Two picture cards, each symbolizing thin or thick, and three picture cards, each symbolizing MITSUBISHI, ZEBRA, or UNI, were placed within easy reach. The instructional objective in the Size-Brand phase was defined as follows:

When the communication initiation is misinterpreted and a plate of pens of a non-preferred brand (e.g., UNI) and non-preferred size (e.g., thick) is presented, Takao will touch a picture card depicting the preferred brand (i.e., MITSUBISHI) or preferred size (i.e., thin) within 5 s. In addition, when the first communication repair is misinterpreted and a plate of pens of a non-preferred brand (e.g., UNI) or non-preferred size (e.g., thick) is presented, Takao will touch a picture card depicting preferred brand or preferred size, depending on the attribution that the listener misunderstood in the second breakdown, within 5 s with 80% accuracy for two consecutive blocks.

Following the first repair responses made by Takao, the teacher provided the second type of misunderstanding in which a pen with one non-preferred attribution and two preferred attributions was presented (e.g., a pen of a non-preferred size, a preferred brand, and a preferred color). Which non-preferred attribution was presented depended on Takao's first repair response. For example, if he touched a picture card depicting black (preferred color) within 5 s after a green (non-preferred color), thick (non-preferred size), and MITSUBISHI pen (preferred brand) was presented in the first breakdown, the teacher presented a MITSUBISHI (preferred size), black (preferred color), and thick (non-preferred size) pen in the second breakdown. If Takao touched a picture card depicting black (preferred color) and then a picture depicting thin (preferred size) within 5 s after a MITSUBISHI (preferred brand), thick (non-preferred size), and green (non-preferred color) pen was presented, the teacher honored the one he touched longer (e.g., thin)

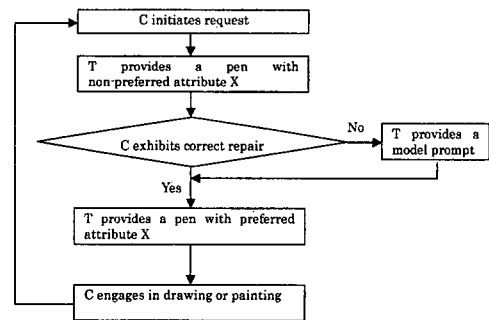
and provided Takao a pen with thin (the honored attribution), MITSUBISHI (preferred brand), and green (non-preferred color). Reducing the number of wrong attributions one by one as Takao exhibited a repair attempt in Two Attribute Repair was viewed as analogous to a gradual understanding by the listener on the basis of a piece of information provided by Takao, which typically occur in their daily interactions.

### Procedure

**Baseline.** During baseline, Standard Opportunities and Repair Probes were presented with a 1-to-1 ratio. On Standard Opportunities, when a communication initiation occurred, the teacher immediately exhibited acknowledgment (e.g., nodding or saying OK), moved to the table to pick up a pen or a plate of pens, and provided a pen or a plate of pens that Takao requested. On Repair Probes, when a communication initiation occurred, the teacher immediately nodded or said “OK” to show her acknowledgment, moved to the table to pick up a pen or a plate of pens, and provided a pen or a plate of pens with one non-preferred attribution (One Attribute Repair), or two non-preferred attributions (Two Attribute Repair). When Takao exhibited a correct response within 5 s after the first breakdown, the teacher immediately provided the requested pen (One Attribute Repair) or a pen with one non-preferred attribution (Two Attribute Repair). When the target behavior did not occur within 5 s, the teacher provided the pen requested by Takao (One Attribute Repair) or a pen with one non-preferred attribution (Two Attribute Repair).

With regard to Two Attribute Repair, when the student exhibited a correct response within 5 s after the second breakdown occurred, the teacher immediately nodded or said “OK” to show her acknowledgment, moved to the table to pick up a pen, and provided the requested pen. When the target behavior did not occur within 5 s, the teacher provided the pen requested by Takao. The order of picture cards was changed every session.

**Interventions.** During intervention, Standard Opportunities and Repair Probes were presented with a 1-to-3 or 1-to-4 ratio. The



**Figure 1.** One Attribute Repair intervention flow-chart. C = Takao, T = Special education teacher.

procedures for Standard Opportunities were the same as those in the baseline sessions. On Repair Probes, a constant time-delay procedure was employed to enable Takao to use a picture card that corresponded to the misunderstood attribution any time a misunderstanding occurred. Specifically, when he did not touch a card that corresponded to the misunderstood attribution within 5 s after a communication breakdown occurred, the teacher provided a model prompt as a controlling prompt across all phases. Takao failed to exhibit the target behavior after the controlling prompt was provided once across all phases. To deal with the unexpected response, a physical prompt was provided. As in baseline, the order of picture cards was changed every session.

The intervention procedures in One Attribute Repair and Two Attribute Repair were presented in Figure 1 and 2, respectively.

### Research Design

One Attribute Repair required Takao to repair a misunderstanding with a wrong attribution. Two Attribute Repair required him to repair two misunderstandings with two wrong attributions. Therefore, a changing-criteria design across two conditions was used to demonstrate two occurrences of behavior change immediately after the constant time-delay procedure was introduced. In addition, baseline and intervention were inserted in each of the phases.

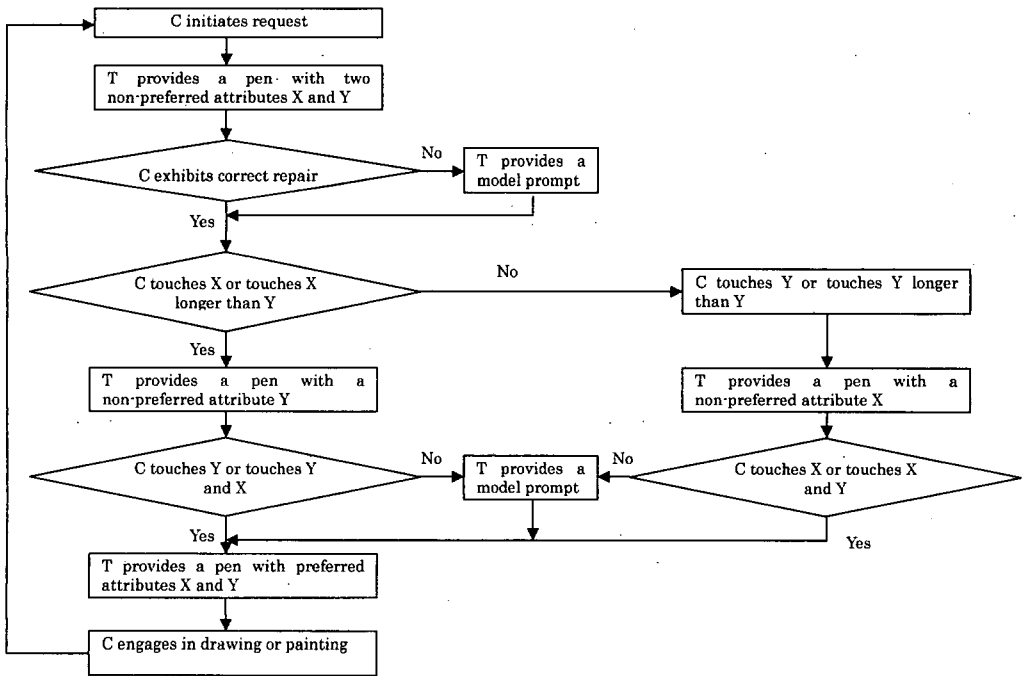


Figure 2. Two Attribute Repair intervention flowchart. C = Takao, T = Special education teacher.

*Inter-Observer Agreement and Treatment Fidelity*

The first author recorded topography of behavior and correct repair. A trained graduate student independently recorded an average of 35.9% of all trials across all conditions. If the two raters recorded the same category, an agreement was scored. If not, a disagreement was scored. Mean point-by-point agreement for topography of behavior (Behavior Indication, Picture Use, Combined Use) and target behaviors (correct or incorrect repair) was 93.8% and 95.7%, respectively.

The first author scored treatment fidelity by checking if the special education teacher correctly implemented the procedures in the Standard Opportunities and Repair Probes. If all procedures were implemented correctly, the trial was scored as a correct treatment procedure. The first author recorded approximately 50% of all of the trials across sub-phases. The percentage of correct procedures was 92.7%.

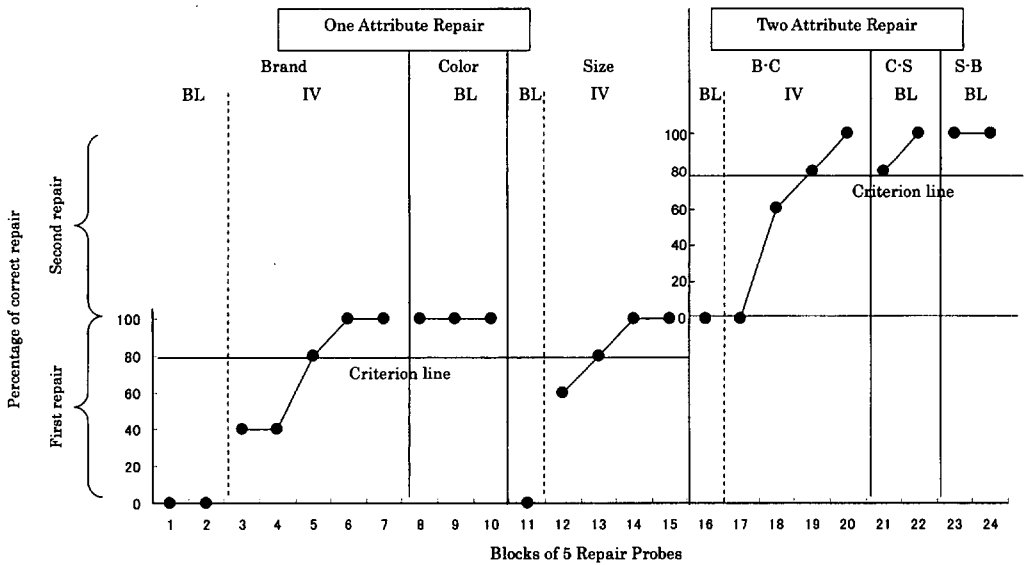
**Results**

Figure 3 shows the percentage of correct re-

pairs across all phases. Data are plotted in blocks. One block consists of 5 Repair Probes.

*One Attribute Repair*

As illustrated, during baseline in the Brand phase, Takao never exhibited correct repairs. Instead, he exclusively relied on reaching for or pointing to the preferred brand of pens. However, once the intervention was introduced, the percentage of correct repairs increased and stabilized at 80 to 100%. In the Color phase, Takao exhibited 100% accuracy of repair responses for three consecutive blocks. During baseline in the Size phase, Takao never used the picture card in repair turns to request the pen of a preferred size. Instead, as seen in the Brand phase, he exclusively relied on reaching for or pointing to the preferred size of pens. Immediately after introducing the intervention, however, the percentage of correct repairs dramatically increased and maintained at 80% or higher for three consecutive blocks.



**Figure 3.** Percentages of correct repair in One Attribute Repair and Two Attribute Repair. One block consisted of five repair probes for baseline and intervention. B-C = Brand-Color, C-S = Color-Size, S-B = Size-Color, BL = Baseline, IV = Intervention.

*Two Attribute Repair*

During baseline in the Brand-Color phase, no correct repair occurred. Takao exclusively used the picture of his favorite color (i.e., black or red) to repair the first wrong response (i.e., wrong color and brand). In this sense, he exhibited correct responses with 100% accuracy in the first repair. Therefore, in Figure 3, the data point of the baseline is plotted on the level of 100% in One Attribute Repair. When the partner presented a pen of a preferred color and non-preferred brand in response to the first repair response, Takao did not use brand as a repair strategy. Instead, he exclusively pointed to the picture of his preferred color. Introducing interventions did not produce any correct repair in the first block. As in the baseline condition, he exclusively touched the picture of his preferred color in the first repair response. However, from the second intervention block, his performance improved dramatically and met the acquisition criteria in the fourth intervention block.

During baselines in the Color-Size and Size-Brand phases, the percentages of correct repair reached the criterion line or above from the very first sessions. That is, Takao pointed

to the picture that corresponded to a misunderstood attribute. Therefore, no interventions were needed to reach the pre-set criterion with two consecutive blocks in both phases.

**Discussion**

The purpose of this study was to extend the work of Sigafoos, Drasgow et al. (2004) by teaching a prelinguistic communicator with autism to use picture cards as a repair strategy when he encounters single and multiple incorrect responses. Takao's repair skills improved only when a constant time-delay procedure was implemented in One Attribute Repair and in Two Attribute Repair. In addition, within One Attribute Repair, two occasions (i.e., in the Brand and Size phases) were observed in which behavior change occurred immediately after a constant time-delay procedure was initiated. We acknowledge that our design was a pseudo-changing criterion design because the number of criterion changed was only one. In this regard, this study should be called a case study. However, given that behavior change occurred more than one time upon introducing repair training, it can be

stated that the training program may have contributed to enabling the student to use a picture card as a repair strategy any time a misunderstanding occurred.

The study provided a maximum of two breakdown opportunities per episode. Nevertheless, Takao never terminated his attempt to repair the communication breakdowns. One of the reasons for his perseverance may be the nature of the activity selected for teaching repair skills. Coloring the logo of a favorite TV program was one of Takao's most preferred activities. In addition, the wrong response made by the teacher consisted of a wrong brand, color, and size—attributions with which Takao was highly preoccupied. Utilizing his perseverative interests (Frost & Bondy, 2002) may have helped develop a teaching context where Takao had a high level of motivation to repair multiple misunderstanding opportunities presented by the teacher. As Halle et al. (2004) argued, the level of motivation to communicate is one of the critical factors determining whether or not the individual repairs communication breakdowns. Utilizing highly preferred activities and preoccupied attributions may influence the effectiveness of our instructions.

We did not use a multiple-probe design in which baseline data of all the six phases were taken at the beginning of the study and at the time when a target behavior receiving the treatment was improved. Therefore, caution must be used in concluding that Takao's repair skills acquired in the Brand phase generalized to the Color phase, or that his repair skills acquired in the Brand-Color phase generalized to the Color-Size and Size-Brand phases. However, it is safe to conclude that Takao's repair skills acquired in the Brand and Color phases did not generalize to the Size phase and that his repair skills acquired in One Attribute Repair did not generalize to the Brand-Color phase in Two Attribute Repair.

In the typical correct repair in Two Attribute Repair, Takao touched the card corresponding to one of the two misunderstood attributions in the first breakdown and touched the card corresponding to the misunderstood attribution in the second breakdown. The target behaviors acquired by Takao maybe called a self-determined behavior em-

ploying the framework developed by Wehmeyer and Mithaug (2003). These authors defined self-determined behavior as persistent behaviors that are directed by the individual to fill a gap between where he wants to be and where he is. Specifically, the self-determined person (a) realizes a gap between where he wants to be and where he is, (b) develops a strategy to fill the gap and implement the strategy, (c) evaluates if the gap disappeared, (d) determines what should be changed when the gap did not disappear, and (e) continues the process until the gap disappeared. In an episode in Two Attribute Repair, Takao touched a card depicting red when a piece of paper was given but his preferred pen was out of reach. It can be described that he realized a gap between where he wants (i.e., obtaining his preferred pen) and where he is (i.e., his preferred pen is not available), developed a plan to fill the gap (i.e., touching a red card), and implement the plan. Next, Takao touched a red card again when the teacher presented a pen with wrong color and brand. In this process, he realized that the gap remains large, decided a strategy to fill the gap, and implemented the strategy. Third, Takao touched a brand card when the teacher presented a pen with correct color but wrong brand. In this process he realized that the gap decreased but still existed, decided a strategy to fill the gap, and implemented the strategy. Finally, Takao showed a satisfied face and received a pen to paint when the teacher presented a pen with correct color and brand. In this process he realized that the gap disappeared and the problem was solved. This is exactly what Wehmeyer et al. described as being self-determined. In this sense, enabling prelinguistic communicators with autism to use AAC to repair multiple breakdowns may contribute to nurturing a self-determined person in a micro-unit of daily life.

He occasionally pointed to two correct cards (e.g., preferred color and brand) when a pen with two wrong attributions (e.g., non-preferred color and brand) was presented. However, this study did not honor the beyond-expected response. Instead, our procedure was to honor only the attribution that he pointed to longer by providing him another opportunity to repair. Before implementing this procedure, we discussed with Takao's

teacher whether we should fully honor “pointing to two correct cards” (i.e., provide a pen with two preferred attributions) in the first repair turn or whether we should only partly honor the same response (i.e., provide a pen with one of the two preferred attributions) in the turn and provide one more opportunity to repair. We agreed with the teacher that this study should emphasize skills of using picture cards in response to two consecutive wrong responses. Takao’s mother and teacher recognized that he frequently faced multiple misunderstandings. Enabling him to touch the card in ways that take into consideration what the listener misunderstands in more than a single opportunity was considered a priority, given his daily experiences where he frequently faced gradual understanding by the listener (e.g., “Oh, you want this. No, you want that. No, you want this . . .”).

This was the first study to teach a student with nonverbal autism to repair when the student’s request was misunderstood by the listener. In addition, this was the first study to demonstrate the possibility that we can teach students with autism to repair multiple breakdowns in ways that take into consideration which information the listener misunderstood. However, this study should be called preliminary due to the following limitations. First, this study changed the criterion one time, which is not considered rigorous in experimental control. At the beginning of the study, we planned one more criterion change in which Takao was required to repair three consecutive misunderstanding. However, we did not conduct any interventions in the condition due to the end of the school year. A multiple-baseline or probe design across different wrong responses would have been more appropriate for enhancing internal validity. However, we decided not to use a multiple-baseline or probe design because Takao would be confused if he received different baselines simultaneously. Second, the study demonstrated the effectiveness of the program with only one participant and one object (i.e., pen) with three specific attributions (i.e., color, brand, and size). As mentioned earlier, this student had been able to use prelinguistic communication forms as a repair strategy for an incorrect listener response in ways that specified what he wanted. Therefore, the

same level of effectiveness of the training cannot automatically be expected in a student with a more severe level of autism. Finally, the study failed to investigate if Takao’s repair strategy used for listener misunderstandings in daily activities changed as a result of the systematic instruction implemented.

The present study demonstrated the potential of using systematic prompting procedures in a highly motivating context (e.g., requesting preoccupied activities and attributions) to teach more conventional forms as a strategy for repairing multiple listener misunderstandings. The most intriguing finding was that the instruction enabled a student with autism to repair communication breakdowns by taking into consideration which attributions were missing. Future research needs to utilize a more rigorous design (e.g., a multiple-probe design), a variety of developmental levels of participants, and various settings outside of structured classrooms (e.g., playground, cafeteria, communities) to enhance the internal and external validity of using perseverative interests and a systematic prompt procedure to teach responses to multiple listener misunderstandings.

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