Journal of
Applied Behavior Analysis

JOURNAL OF APPLIED BEHAVIOR ANALYSIS 2019, **52,** 974–993 NUMBER 4 (FALL)

Treatment of resistance to change in children with autism

Wayne W. Fisher, Jennifer M. Felber and Lauren A. Phillips
UNIVERSITY OF NEBRASKA MEDICAL CENTER'S MUNROE-MEYER INSTITUTE

Andrew R. Craig
SUNY UPSTATE MEDICAL UNIVERSITY

Amber R. Paden and Jessica J. Niemeier
UNIVERSITY OF NEBRASKA MEDICAL CENTER'S MUNROE-MEYER INSTITUTE

"Resistance to change" represents a core symptom of autism that we conceptualized and assessed as resulting in part due to factors known to govern free operant choice. During a free choice baseline, participants chose between problematic, resistive responses and an appropriate alternative response. During the asymmetrical choice condition, we delivered their most highly preferred item if the participant chose the alternative response (i.e., differential reinforcement of alternative behavior [DRA]). During the guided (Experiment 1) and singular (Experiment 2) choice conditions, we prompted participants to choose the alternative response and then delivered their most highly preferred item (i.e., DRA with escape extinction). All participants learned to tolerate (Experiment 1) or choose (Experiment 2) the alternative response when we combined DRA with escape extinction. After exposure to escape extinction, two participants showed strong maintenance effects with DRA alone. We discuss these finding relative to the effects of DRA and escape extinction on resistance to change.

Key words: autism spectrum disorder, automatic negative reinforcement, choice, resistance to change, restricted and repetitive behavior

Autism spectrum disorders (ASDs) affect approximately 1 in 68 children and involve impairments in social relatedness and language, and inflexible or repetitive behaviors (Christensen et al., 2016). The repetitive and restricted response patterns displayed by children with ASD occur frequently, across multiple contexts, and persist over time (Joseph, Thurm, Farmer, & Shumway, 2013). Results of factor-analytic studies suggest that lower-order repetitive motor behaviors (e.g., motor stereotypies, lining up toys) are somewhat separate and distinct from higher-order response patterns alternatively called "insistence on sameness" or "resistance to change" (e.g., emotional outbursts in response to minor changes in routines; eating the same few foods at every meal; Bishop et al., 2013; Carcani-Rathwell, Rabe-Hasketh, & Santosh, 2006; Cuccaro et al., 2003; Richler, Bishop, Kleinke, & Lord, 2007; Shuster, Perry, Bebko, & Toplak, 2014; Turner, 1999). Researchers are beginning to study the underlying brain processes that may contribute to the symptoms of resistance to change (Bonnet-Brilhault et al., 2018; Gomot et al., 2006; Gomot & Wicker, 2012), and these studies suggest that children with ASD detect and process changes in environmental stimuli in an atypical manner.

The research literature is replete with studies showing the beneficial effects of behavioral interventions for reducing lower-order restricted and repetitive behaviors in children with ASD (e.g., Boyd, Woodard, & Bodfish, 2013; Cunningham & Schreibman, 2008; Hagopian, Rooker, Zarcone, Bonner, & Arevalo, 2017;

Address correspondence to: Wayne W. Fisher, Center for Autism Spectrum Disorders, 985450 Nebraska Medical Center, Omaha, Nebraska 68198 (email: WFisher@UNMC.Edu)
doi: 10.1002/jaba.588

Hausman, Kahng, Farrell, & Mongeon, 2009; Kuhn, Hardesty, & Sweeney, 2009; Lam & Aman, 2007; Leon, Lazarchick, Rooker, & DeLeon, 2013; Saini et al., 2016). However, only a small number of studies have evaluated behavioral interventions for higher-order restricted and repetitive behaviors in ASD (e.g., Fisher, Rodriguez, & Owen, 2013; Rispoli, Camargo, Machalicek, Lang, & Sigafoos, 2014), and many of those have focused on food selectivity (e.g., Peterson, Piazza, & Volkert, 2016; Roth, Williams, & Paul, 2010; Wood, Wolery, & Kaiser, 2009). The existing literature demonstrates that response blocking (i.e., extinction; Wolff, Hupp, & Symons, 2013), differential reinforcement of alternative behaviors (DRA) with extinction (Fisher et al., 2013), and functional communication training with extinction (Rispoli et al., 2014) are all effective ways of treating higher-order restricted and repetitive behaviors. Given the well-supported distinction between lower- and higher-order restricted and repetitive behaviors, it is important to more fully evaluate the effects of behavioral interventions with and without extinction on individuals' resistance to change (Whitehouse, Curry-Pochy, Shafer, Rudy, & Lewis, 2017).

Behavior referred to as *resistant to change* often persists despite programmed reinforcement for engaging in alternative behavior and negative collateral effects of engaging in the resistive behavior (Cuccaro et al., 2003), similar to self-injurious behavior categorized as Type II by Hagopian and colleagues (Hagopian, Rooker, & Zarcone, 2015; Hagopian et al., 2017). For example, one of our participants insisted on wearing the same pair of shorts every day, even when the weather turned cold. He reluctantly wore a similar pair of shorts when his parents laundered his favorite pair, but he consistently refused to wear pants. Resistive behavior reportedly continued even though his parents offered access to preferred edibles and toys contingent on wearing pants, even when the weather turned bitterly cold and he showed visible signs of being cold (e.g., teeth chattering, shivering, saying "It's cold").

When maladaptive responses persist in the absence of social contingencies, the responses themselves produce the maintaining consequences (i.e., automatic reinforcement; Hagopian et al., 2015; Querim et al., 2013; Rapp & Vollmer, 2005). In addition, resistance to change represents a component of the syndrome of ASD and its provenance may be influenced by the same genetic, epigenetic, and environmental factors that confer vulnerability to the development of ASD (for a discussion, see Persico & Bourgeron, 2006). Said another way, children with ASD may be more likely to display resistive behavior maintained by automatic-negative reinforcement (i.e., they engage in resistive behavior because the resistive response allows them to avoid changes in the environment) because they are predisposed to do so by genetic and other biological variables, though this supposition remains untested.

The present study demonstrates such an approach to assessing and treating resistance to change in children with ASD that is conceptually based on the principles of choice behavior. When presented with multiple alternatives, children and other organisms allocate relatively more behavior to alternatives associated with relatively more (i.e., a higher rate or larger magnitude of) reinforcement than to alternatives associated with relatively less reinforcement (e.g., Baum, 1974, 1979; Caron, Forget, & Rivard, 2017; Elliffe, Davison, & Landon, 2008; Neuringer, 1967; Rivard, Forget, Kerr, & Bégin, 2014; for review, see Fisher & Mazur, 1997). The systematic relation between relative reinforcer amounts and relative behavioral allocation is perhaps one of the most general findings in behavior analysis across a range of species and different behaviors (for review, see Mazur & Fantino, 2014; McDowell, 1988, 1989) including individuals with ASD (e.g., Banda, McAfee, Lee, & Kubina, 2007;

Borrero et al., 2010; Borrero & Vollmer, 2002; Caron et al., 2017; Reed, Hawthorn, Bolger, Meredith, & Bishop, 2012; Rivard et al., 2014).

Based on these insights from the choice literature, at least two environmental factors could contribute to participants' consistent selection of resistive behaviors over appropriate alternatives. First, as reviewed above, resistive responses might produce automatically reinforcing consequences that are not produced by the alternative behavior. Second, exclusive engagement in the resistive response produces an extensive reinforcement history for the resistive behavior and prevents establishment of a reinforcement history for alternative behaviors. Either of these circumstances would result in high levels of engagement in the resistive response compared to the alternative response.

In this investigation, we conducted a free-choice baseline and gave participants a choice between continuing a parent-identified problematic response (i.e., *resistive response*; e.g., wearing shorts during the winter) and engaging in an appropriate alternative response (e.g., wearing pants). If the resistive response persisted in the absence of social contingencies, the consequences automatically produced by the response (e.g., avoidance of novel stimuli and contexts) may have functioned as reinforcement for the response. This is analogous to identifying automatic reinforcement as a maintaining variable based on response persistence in an alone or ignore condition of a functional analysis (e.g., Querim et al., 2013; Rapp & Vollmer, 2005). Next, we examined the extent to which an asymmetrical-choice arrangement involving DRA altered response allocation in a beneficial way (i.e., promoted engagement with the alternative response without contrary behavior [Experiment 1] or increased choices for the alternative response relative to the resistive response [Experiment 2]). If the participant's choices did not shift toward the alternative response, we added prompting (i.e., guided selection) or presented only the alternative response with escape extinction with DRA. Prompting ensured that the participants developed a history of reinforcement for engaging in the alternative response. Finally, we periodically conducted reversals to the free-choice and asymmetrical-choice conditions to examine the relative persistence of the resistive and alternative responses when we removed escape extinction. Thus, the purpose of these studies was to evaluate the impact of DRA and prompting on response allocation of resistive and alternative responses.

GENERAL METHOD

Participants and Setting

Two individuals, Eli and Santo, participated in Experiment 1 and another two, Kurt and Glenn, participated in Experiment 2. All participants attended an early intervention program to reduce problem behavior (e.g., aggression, disruption) and to promote verbal, social, play, and other adaptive skills. We recruited participants for this study based on caregiver report that the participants reliably engaged in problem behavior when asked to change specific aspects of their routine (e.g., new pants, new feeding tray, wearing a hat). Eli, a 5-year-old boy diagnosed with ASD, engaged in problem behaviors (i.e., disruptions, disrobing) when asked by his parents to wear a hat during the winter. Santo, a 5-year-old boy diagnosed with ASD, engaged in problem behaviors (i.e., aggression, disruptions, vocal refusals) when his parents asked him to use a feeding tray other than his usual tray or to wear a bib other than his usual bib. Kurt, a 7-year-old boy diagnosed with ASD, displayed problem behaviors (i.e., aggression, disruptions, flopping, screaming) when asked by his parents to wear pants rather than his usual shorts during the winter. Glenn, a 4-year-old boy diagnosed with ASD engaged in problem behavior (i.e., aggression, disruptions, disrobing, flopping, screaming, vocal refusals) when prompted by his parents to put on a hat or gloves during the winter, and immediately removed the clothing items.

Sessions occurred in a clinic room equipped with a table, chairs, and session materials (i.e., the items needed for the resistive and alternative responses, reinforcers). Each session lasted approximately 5 min, and occurred 2 to 5 days per week.

Response Measurement

Trained observers collected trial-by-trial data on the participants' (a) choice of the resistive versus the alternative response (e.g., wearing shorts vs. pants), (b) level of prompting required before the participant emitted the resistive or alternative response (e.g., verbal instruction, modeled prompt, or physical guidance), (c) occurrences of problem behavior, and (d) topography of problem behavior. Observers also recorded whether the therapist correctly delivered the programmed reinforcement. Observers scored the participant's choice when the participant independently pointed to or touched the resistive or alternative response option (e.g., picture cards). We defined aggression as hitting, punching, kicking, pushing, pulling, grabbing, throwing objects at, pinching, or scratching the therapist (Kurt, Santo, and Glenn). We defined disruption as throwing, kicking, or hitting objects, turning over furniture, and swiping objects from the table (Eli, Kurt, Santo, and Glenn). We defined disrobing as moving a currently worn clothing item at least 2.54 cm away from the body (Eli and Glenn). We defined contrary behavior as moving away from or attempting to remove the alternative item (e.g., a novel bib; Santo), or physically blocking the therapist from placing the alternative item on the participant's body (e.g., clothing items; Eli, Kurt, Glenn) or close to the participant's body (e.g., placing a tray in front of the participant; Santo). We defined flopping as the client's bottom leaving the seat of the chair and any body part making contact with the floor (Kurt and Glenn).

Interobserver Agreement and Procedural Integrity

Two trained observers independently collected data during 63% of sessions for Eli, 42% of sessions for Santo, 60% of sessions for Kurt, and 63.8% of sessions for Glenn. We calculated exact agreement for participant's choice, prompt level, and topography of problem behavior. We calculated occurrence and nonoccurrence agreement for percentage of intervals of problem behavior and reinforcement delivery. Interobserver agreement was 100% for all target responses for Eli and Santo, except reinforcement delivery for Santo, which averaged 98.6% (range, 75% to 100%). For Kurt, agreement coefficients were 100% for participant's choice and topography of problem behavior, and averaged 98.6% for prompting level (range, 87.5% to 100%) and 99.3% for occurrence and nonoccurrence of problem behavior (range, 87.5% to 100%). For Glenn, agreement coefficients were 100% for participant's choice and prompting level, and averaged 99.5% for occurrence of problem behavior (range, 90% to 100%), and 99.5% for topography of problem behavior (range, 90% to 100%).

Two independent observers collected occurrence and nonoccurrence data on procedural integrity for correct reinforcement delivery for 100% of sessions for Santo and Glenn and 83% of sessions for Kurt. Procedural integrity averaged 96.6% for these three participants (range, 86.5% to 99.6%). We did not collect procedural integrity data for Eli.

Experimental Design and General Procedure

To evaluate the effects of the free-choice, asymmetrical-choice, and guided-choice conditions on the resistive and alternative responses in Experiment 1, we used a nonconcurrent multiple-baseline design with an embedded reversal design for Eli (ABCBCBAB), Santo (bib; ABCBCBCBA), and Santo (tray; ABCBCBCBAB). To evaluate the effects of the free-choice, asymmetrical-choice, and singular-choice conditions on the participants' choices and tolerance of the resistive and alternative responses in Experiment 2, we used a multiple-baseline design with an embedded reversal design for Kurt (ABCBAB), Glenn (hat; ABABCBC), and Glenn (gloves; ABCBCBCBC).

Presession Identification of Preferred Stimuli

We used the results of a brief preference assessment (DeLeon et al., 2001) to select the most highly preferred reinforcer delivered during the free-choice condition (Experiments 1 and 2), the asymmetrical-choice condition (Experiments 1 and 2), the guided-choice condition (Experiment 1), and the singular-choice condition (Experiment 2). We repeated the preference assessment prior to each session and used the results to select the most highly and the moderately preferred stimuli for that session. We used the first item selected as the highly preferred item for the asymmetrical-, guided-, and singular-choice sessions and the second or third item selected during the free-choice sessions as the moderately preferred item.

Contingency Exposure (Guided Choice) Trials

Prior to each free-, asymmetrical-, and guided-choice session, the participant experienced the consequences associated with each choice during two guided-choice trials. In each trial, the therapist randomly rotated the position of the items on the table (i.e., left or right side) and presented a rule (see session types below for a description of the rule statements). Then, in quasirandom order, the therapist physically guided the participant to (a) select one response option (e.g., the resistive response) and contact the contingency associated with that option, and then to (b) select the other response option (e.g., the alternative response) and contact the contingency associated with that response option. For the singular-choice condition, we conducted just one exposure trial during which the therapist physically guided the participant to select the alternative response and contact the contingency associated with that response option. For all contingency-exposure trials, if the participant removed or attempted to remove the clothing item during the reinforcement interval, the therapist removed the relevant preferred item and required him to remain in the chair for the remainder of the trial. Following the contingency-exposure trial(s), we conducted eight additional trials per session according to the procedures described below for each condition.

Choice Picture Cards

We correlated the free-, asymmetrical-, guided-, and singular-choice conditions with specific pictures to bring responding under discriminative control for Eli, Santo, and Glenn, but not Kurt. Specifically, during the free-choice baseline, we presented (a) a picture of the participant emitting the resistive response (e.g., wearing shorts) while he interacted with the moderately preferred item and (b) a picture of the participant emitting the alternative response (e.g., wearing pants) while he interacted with the same moderately preferred item. During the asymmetrical- and guided-choice conditions, we presented (a) a picture of the participant emitting the resistive response (e.g., wearing shorts) without interacting with a preferred item and (b) a picture of the participant emitting the alternative response (e.g., wearing pants) while interacting with the most highly preferred item. During the singular-choice condition, we presented a picture of the participant emitting the alternative response (e.g., wearing pants) while interacting with the most highly preferred item. The participant emitted a choice response by touching or pointing at one of these picture cards. The picture cards always depicted the most highly or moderately preferred item that corresponded with the items selected in the presession brief preference assessment. For Kurt, we implemented similar procedures but required that he point to an actual pair of shorts for his resistive response and point to an actual pair of pants for his alternative response.

Treatment Evaluation

Free-choice condition (baseline). The therapist placed one moderately preferred item behind the item associated with the participant's resistive response (e.g., interlocking blocks placed behind a pair of shorts) and an identical, moderately preferred item behind the item associated with the participant's alternative response (e.g., interlocking blocks placed behind a pair of pants). In addition, for Eli, Santo, and Glenn, the therapist positioned the associated picture cards described above and in front of the resistive and alternative items. Each session began with the two exposure trials described above. For the remaining eight trials in a session, the therapist delivered the following instruction at the start of each trial: "If you choose (the resistive response; e.g., to wear shorts), you get to play with (moderately preferred item; e.g., interlocking blocks). If you choose (alternative response; e.g., to wear pants), you get to play with (moderately preferred item; e.g., interlocking blocks). Pick one."

For Eli and Kurt, once the participant chose one of the response options (e.g., chose the picture card showing him without a hat on [Eli] or wearing shorts [Kurt]), the therapist used three-step prompting (i.e., sequential verbal, model, and physical prompts) as needed to help the participant put on the chosen clothing item, if applicable, and then delivered the moderately preferred item for 20 s. The participant maintained access to the moderately preferred item contingent on continuing to wear the clothing item for the duration of the 20-s interval. If the participant complied with the verbal or model prompts while putting on the clothing item, the therapist provided praise. If the participant engaged in problem behavior while putting on the chosen clothing item, the therapist physically guided him to put on that piece of clothing and then required him to sit in the chair for 20 s without reinforcement. If the participant removed or attempted to remove the clothing item during the reinforcement interval, the therapist removed the moderately preferred item and required him to remain in the chair for the remainder of the trial.

For Santo and Glenn, once the participant chose one of the response options (e.g., chose the picture card showing him wearing his usual bib [Santo], or no hat [Glenn]), the therapist implemented that option. For example, if Santo chose his usual bib, the therapist placed the bib on him; if Santo choose the tray, the therapist placed it in front of him on the table; or if Glenn selected no hat or no gloves, the therapist did not place the item on him. If the therapist placed an item on or in front of the participant and the participant attempted to remove the chosen item during the reinforcement interval, the therapist blocked that attempt, removed the moderately preferred item, and required the participant to remain in the chair for the remainder of the trial. Thus, Santo and Glenn's sessions differed in that the therapist either placed the item on or in front of them, or did not require them to wear the item, and did not use sequential prompting to guide the participant to consume his chosen item.

Asymmetrical choice. The therapist placed the clothing or feeding items on the table with the most highly preferred item behind the item associated with the alternative response (e.g., tablet behind the pants) and nothing behind the item associated with the resistive response (e.g., nothing behind the shorts). Each session began with the two exposure trials described above. For the remaining eight trials in a session, the therapist delivered the following instruction at the start of each trial: "If you choose (the alternative response; e.g., to wear pants), you get to play with (most highly preferred item; e.g., the tablet). If you choose (the resistive response; e.g., to wear shorts), you get nothing. Pick one." If the participant chose the alternative response and did not engage in problem behavior, the therapist used three-step prompting (Eli and Kurt) or placed the item on or in front of the participant (Santo and Glenn) and provided the participant with 20 s of access to the most highly preferred item (e.g., the tablet). If the participant attempted to remove the alternative item (e.g., take off the pants), the therapist blocked those attempts, removed the most highly preferred item, and required him to remain in the chair for the remainder of the trial. If the participant chose the resistive response, the therapist required the child to complete the resistive response while remaining seated without access to his most highly preferred item during this trial.

EXPERIMENT 1

As described above, each session during the guided-choice condition in Experiment 1 began with the two exposure trials that involved presenting participants with the resistive and alternative options and immediately guiding participants to select the resistive (and subsequently the alternative option, in quasirandom order). The therapist placed the clothing or feeding items on the table with the most highly preferred item behind the item associated with the alternative response (e.g., tablet behind the pants) and nothing behind the item associated with the resistive response (e.g., nothing behind the shorts). For the remaining eight trials in a session, the therapist delivered the following instruction at the start of each trial, "If you choose (the alternative response; e.g., to wear pants), you get to play with (most highly preferred item; e.g., the tablet). If you choose (the resistive response; e.g., to wear shorts), you get nothing. Pick one." The therapist then immediately guided the child to choose the alternative response (e.g., guided Santo to point to the picture of him wearing the alternative bib while playing with the most highly preferred item). Following the prompted response, the therapist guided the child to engage in the alternative response and then presented the most highly preferred item (e.g., guided Santo to wear the alternative bib and gave him access to toys). If the participant attempted to remove the alternative item (e.g., remove the alternative bib), the therapist removed the item and required the child to remain seated for the remainder of the trial.

Results and Discussion

Figure 1 depicts the percentage of trials in which Eli (top panel) and Santo (middle and bottom panels) tolerated change (defined as emitting the alternative response [e.g., wearing the hat] without any contrary or problem behavior). For example, if Eli selected the hat he would have received the tablet as long as he continued to wear the hat. However, if Eli removed the hat after 11 s, the therapist would have removed the tablet and scored the trial as not engaging in the alternative response. Likewise, if Eli engaged in problem behavior during the reinforcement interval, the therapist would have removed the tablet and scored the trial as not engaging in the alternative response.

During the initial free-choice condition, Eli (top panel) tolerated change during a mean of 2.1% of trials per session (range, 0% to 12.5%). In the initial asymmetrical-choice condition, Eli never displayed tolerance of change in any session. During the first phase of the

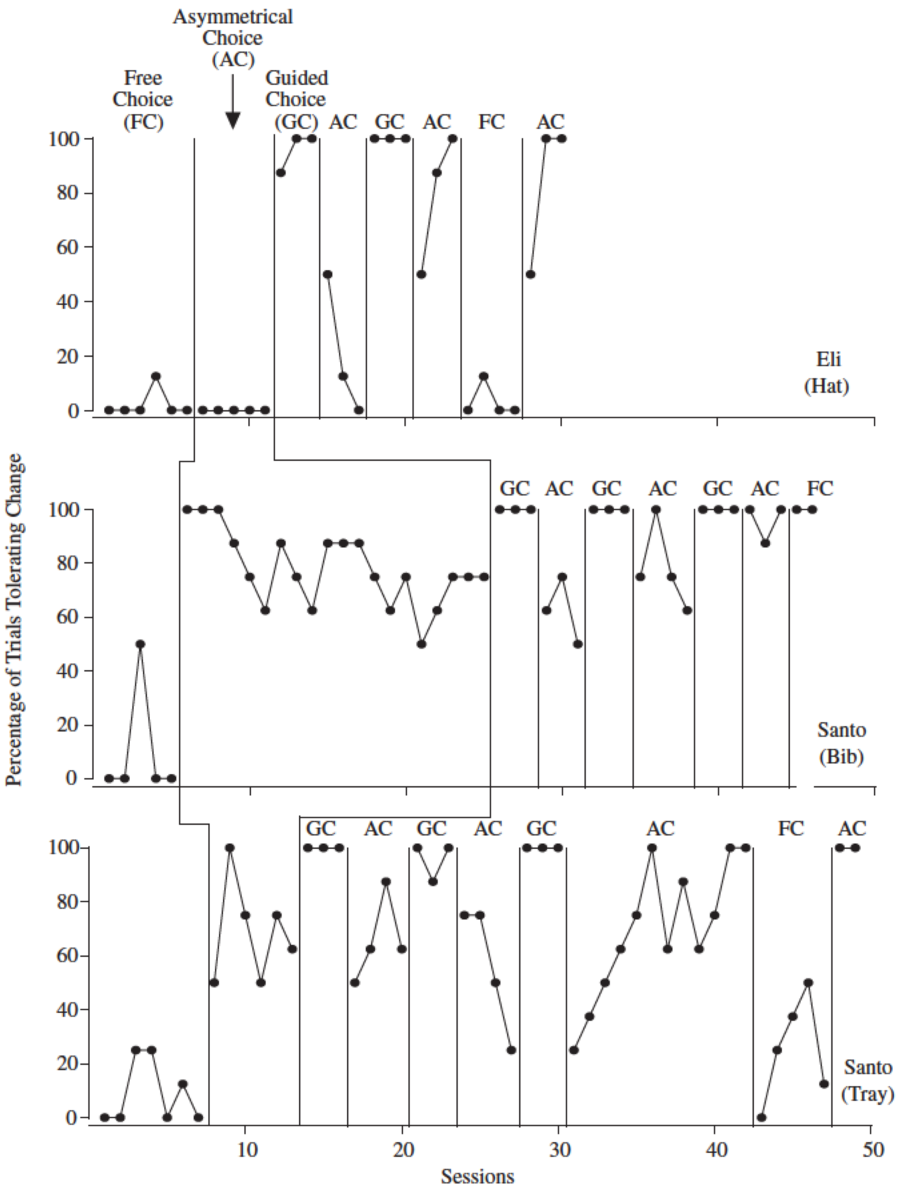

Figure 1. Percentage of trials tolerating change (i.e., wearing or using the item for the entire 20 s trial without problem behavior) across the free choice, asymmetrical choice, and guided choice conditions for Eli wearing a hat (top panel), Santo wearing a new bib (middle panel), and Santo using a new tray (bottom panel).

guided-choice condition, Eli tolerated change during a mean of 95.8% of trials (range 87.5% to 100%). Eli tolerated change during every trial, in every session, for the second phase of the guided-choice condition. That is, after the therapist guided him to select the picture of him wearing the hat and guided him to put the hat on, he kept the hat on without contrary or problem behavior for the remainder of the trial. Moreover, after the first exposure to the guided-choice condition, Eli showed (a) a small and temporary increase in tolerance of change during the second phase of the asymmetrical-choice condition (*M* = 20.8%, range, 0% to 50%), and (b) a large and sustained increase in tolerance of change during the third (*M* = 83.3%; range, 50% to 100%) and fourth (M = 83.3%; range, 50% to 100%) phases of the asymmetrical-choice condition (i.e., during the sixth and eighth phases of the analysis). During the reversal to the free-choice condition in the seventh phase of the analysis, Eli showed low levels of tolerance of change (*M* = 3.1%; range, 0% to 12.5%), similar to the first phase.

When tolerance of wearing an alternative bib served as the dependent measure for Santo (middle panel of Figure 1), he showed low levels of tolerance of change, with a mean of 10% of trials per session (range, 0% to 50%) during the initial free-choice condition. In the first asymmetrical-choice condition, Santo showed an immediate increase in tolerance of change to 100% of trials for the first three sessions with a gradual decrease over the course of this phase (*M* = 75% for the last three sessions of the phase). Each time we introduced the guided-choice condition (Phases 3, 5, and 7), Santo's tolerance for wearing the alternative bib increased to 100% (i.e., he wore the bib throughout each trial without displaying contrary or problem behavior). During the first two reversals to the asymmetrical-choice condition in the fourth and sixth phases, Santo displayed decreased tolerance of change relative to the guided-choice condition (*M*s = 62.5% and 78.1%, respectively; range, 50% to 100%). However, during the final reversal to the asymmetrical-choice condition in the eighth phase, Santo displayed high levels of tolerance of wearing the alternative bib (*M* = 95.8%; range, 87.5% to 100%). In addition, when we reintroduced the free-choice trial in the final phase, Santo chose to wear the alternative bib during 100% of the trials in each session.

When tolerance of the alternative tray served as the dependent measure for Santo (bottom panel of Figure 1), he tolerated change during a mean of 8.9% of trials per session (range, 0% to 25%) during the initial free-choice condition. When we introduced the asymmetrical-choice condition, Santo showed an immediate increase in tolerance of change to moderate to high levels (*M* = 68.8%; range, 50% to 100%). Each time we introduced the guided-choice condition (Phases 3, 5, and 7), Santo's tolerance for having the alternative tray on his highchair increased to high levels (*Ms* = 100%, 95.8%, and 100%, respectively; range, 87.5% to 100%). During the first two reversals to the asymmetrical-choice condition in the fourth and sixth phases, Santo displayed decreased tolerance of change relative to the guided-choice condition (*M*s = 65.6% and 56.3%, respectively; range, 25% to 87.5%). However, during the third reversal to the asymmetrical-choice condition in the eighth phase, Santo initially showed relatively low levels of tolerance of change, but his levels of tolerance of having the alternative tray on his highchair gradually increased to high levels over the course of the phase, with the percentage of tolerance of change at 100% for the final two sessions. When we conducted a reversal to the free-choice condition in the ninth phase, Santo's levels of tolerance of change decreased (*M* = 25%; range, 0% to 50%). Finally, when we reinstated the asymmetrical-choice condition in the tenth and final phase, Santo's levels of tolerance increased to 100% in each session.

Problem and contrary behavior remained low for both participants throughout the course of this evaluation. Figure 2 depicts the percentage of trials in which Eli (top panel) and Santo (middle and bottom panels) engaged in problem or contrary behavior. These behaviors occurred infrequently, but Eli did engage in problem or contrary behavior during one trial of the initial free-choice condition (Session 4), one trial of the initial guided-choice condition (Session 12), and two trials during his third exposure to the asymmetrical-choice condition (Sessions 21 and 22). Santo engaged in

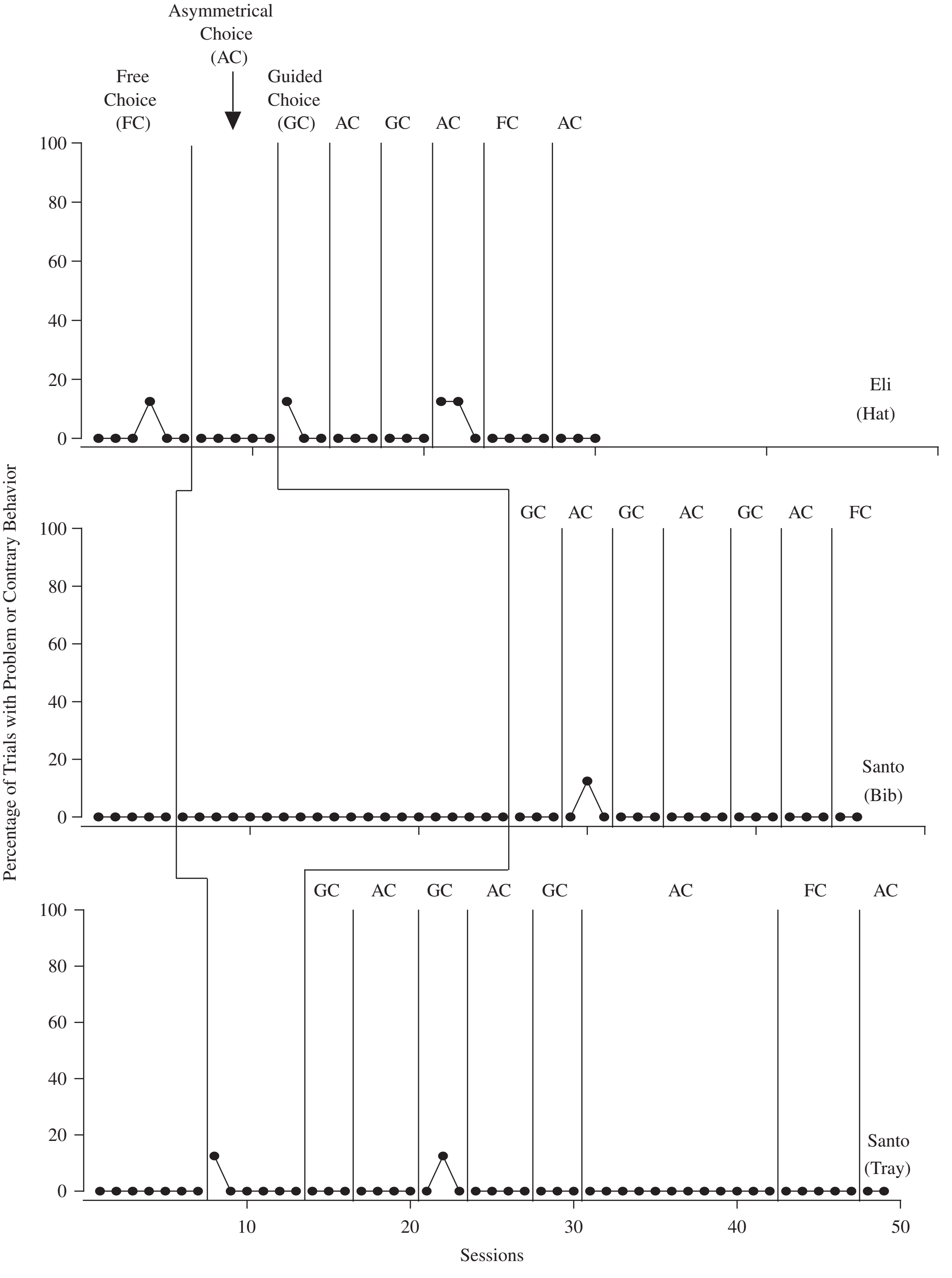

Figure 2. Percentage of trials with problem or contrary behavior across the free choice, asymmetrical choice, and guided choice conditions for Eli wearing a hat (top panel), Santo wearing a new bib (middle panel), and Santo using a new tray (bottom panel).

problem or contrary behavior during one trial in his second exposure to the asymmetrical-choice condition (alternative bib panel, Session 30) and during two trials (Sessions 8 and 22 in the alternative tray panel.

In summary, all participants showed low levels of tolerance of change during the initial free-choice conditions, indicating that this resistance to change persisted in the absence of differential social contingencies and thus may be maintained by automatic-negative reinforcement. The asymmetrical-choice conditions initially either produced no increase in tolerance for change (Eli) or increased tolerance for change somewhat, but not to clinically acceptable levels (Santo). By contrast, the guided-choice condition increased tolerance of change to high levels (M = 98.9%; range, 87.5% to 100%) in every session with every participant and target response. Moreover, after multiple exposures to the guided-choice condition, the asymmetrical-choice condition produced high and clinically acceptable levels of tolerance of change. Finally, after multiple exposures to the guided-choice condition, Santo showed large (bib) or small (tray) increases in tolerance of change in the free-choice condition. Thus, the guided-choice condition not only produced large and consistent increases in tolerance of change, but after repeated exposure to the guided-choice condition, it also appeared to increase the efficacy of the other two conditions to varying degrees.

EXPERIMENT 2

One limitation of Experiment 1 was differential opportunity to display the alternative response independently across conditions. In the free- and asymmetrical-choice conditions, participants had an opportunity to choose among the response options in front of them. In the guided-choice condition, we immediately guided the participant to emit the alternative response which meant that the participant did not have an opportunity to display the alternative response independently. Therefore, in Experiment 2, we replaced the guided-choice condition with a singular-choice condition in which the participants had an opportunity to display the alternative response independently, but did not have the option to continue to emit the resistive response. That is, the participants in Experiment 2 could either emit or not emit the alternative response in the singular-choice condition. The purpose of both the guided-choice condition in Experiment 1 and the singular-choice condition in Experiment 2 was to ensure that (a) participants emitted the alternative response and (b) the alternative response contacted reinforcement (i.e., contingent access to the most highly preferred item).

During the singular-choice condition, the therapist presented only the alternative item with the corresponding picture and the corresponding reinforcer (e.g., a hat on the table, a picture card showing Glenn wearing the hat while playing with the tablet, and the tablet behind the hat). Each session began with the one exposure trial conducted as described above. For the remaining eight trials in a session, the therapist delivered the following instruction at the start of each trial: “If you choose (the alternative item; e.g., to wear pants), you get to play with (most highly preferred item; e.g., tablet). Pick one.” Although the participant did not have a choice between two items, the language, “Pick one” was included to remain consistent with the other conditions. The participant then earned 20-s access to his most highly preferred item for independently choosing the alternative response. If the participant did not make a choice, the therapist used the three-step prompting procedure to assist him to choose the alternative response (i.e., escape extinction). If the participant attempted to remove the alternative item (e.g., take off the hat), the therapist removed the most highly preferred item and required the child to remain seated for the remainder of the trial.

Results and Discussion

The top panel of Figure 3 depicts the percentage of trials in which Kurt independently chose (and tolerated) the alternative response (i.e., pointing to or touching the picture card or item and emitting the alternative response [e.g., wearing the hat] without any contrary or problem behavior). During the initial free-choice condition, Kurt (top panel of Figure 3) chose and tolerated the alternative response during a mean of 4.2% of trials (range, 0% to 12.5%) and chose the resistive response during a mean of 95.8% of trials (range, 87.5% to 100%). The initial introduction of the asymmetrical-choice condition did not increase Kurt's independent choices of and tolerance for the alternative response (*M* = 3.1%; range, 0% to 12.5%). Introduction of the singular-choice condition increased Kurt's independent choices for, and tolerance of, the alternative response to high levels (for the final four sessions of the phase, *M* = 93.8%; range, 87.5% to 100%). Moreover, after a single exposure to the singular-choice condition, Kurt continued to independently choose and tolerate the alternative response at high levels when we reintroduced the asymmetrical-choice condition in the fourth phase (*M* = 95%; range, 87.5% to 100%). During the reversal to the free-choice condition in the fifth phase, Kurt chose and tolerated the alternative response (*M* = 54.2%; range, 37.5% to 87.5%) slightly more than he chose the resistive response (*M* = 45.8%; range, 12.5% to 50%). Finally, during the asymmetrical-choice condition in the sixth and final phase, Kurt again displayed high levels of choosing and tolerating the alternative response (*M* = 96.4%; range, 87.5% to 100%).

The middle panel of Figure 3 shows the percentage of trials in which Glenn independently chose (and tolerated) the alternative response (i.e., wearing a hat). During the initial free-choice condition, Glenn chose and tolerated the alternative response during a mean of 5% of trials (range, 0% to 25%) and chose the resistive response (i.e., not wearing a hat) during a mean of 95% of trials (range, 75% to 100%). The initial introduction of the asymmetrical-choice condition increased Glenn's independent choices of and tolerance for the alternative response (*M* = 68.8%; range, 12.5% to 87.5%). In the reversal to the free-choice condition in the third phase, the alternative response decreased to zero for all three sessions. In the asymmetrical-choice condition in the fourth phase, Glenn chose the alternative response on 100% of the trials in the first session followed by a decrease in the alternative response to unacceptable levels in the next three sessions (*M* = 70.8%; range, 65.5% to 75%). In the singular-choice condition in the fifth phase, Glenn chose and tolerated the alternative response during 100% of trials. During the asymmetrical-choice condition in the sixth phase, Glenn chose the alternative response during 100% of trials during the first session, but levels of the alternative response decreased over the course of this phase until he chose the resistive response (i.e., not wearing the hat) during 100% of trials in the final session of this phase. In the singular-choice condition in the seventh and final phase, the alternative response again increased to high levels (*M* = 93.8%; range, 75% to 100%).

The bottom panel of Figure 3 shows the percentage of trials in which Glenn independently chose and tolerated the alternative response (i.e., wearing gloves). During the initial free-choice condition, Glenn variably chose and tolerated the alternative response during a mean of 3.1% of trials (range, 0% to 12.5%) and chose the resistive response (i.e., not wearing gloves) during a mean of 96.9% of trials (range, 87.5% to 100%). In the singular-choice condition in the third phase, Glenn chose the

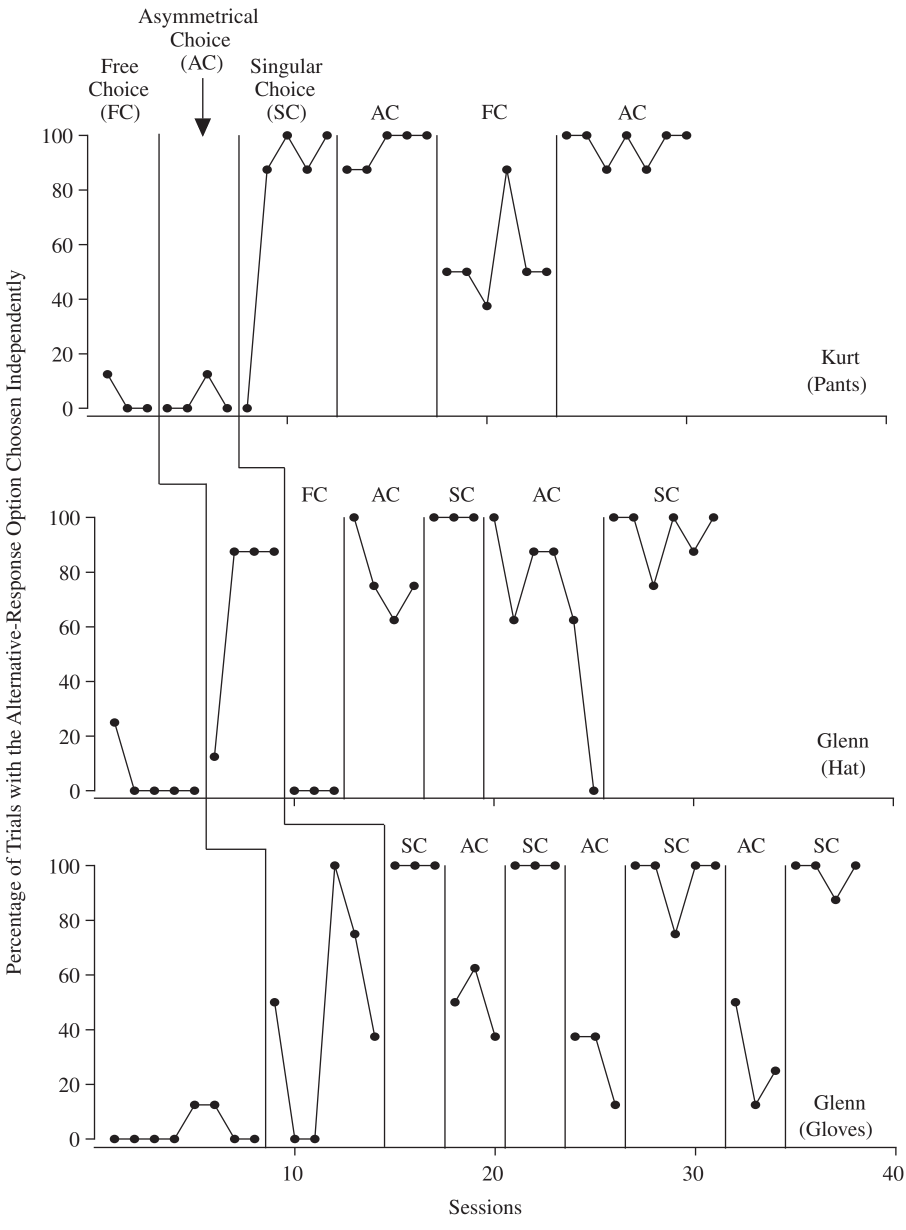

Figure 3. Percentage of trials where the alternative response option was selected independently (i.e., selected and worn for the entire 20 s trial without problem behavior) across the free choice, asymmetrical choice, and singular choice conditions for Kurt wearing pants (top panel), Glenn wearing a hat (middle panel), and Glenn wearing gloves (bottom panel).

alternative response during 100% of trials in each session. In the asymmetrical-choice condition in the fourth phase, the alternative response decreased to moderate levels (*M* = 50%; range, 37.5% to 62.5%). Additional reversals between the singular- and asymmetrical-choice conditions resulted in high levels of the alternative response in the singular-choice condition (*M* = 96.9%; range, 75% to 100%) and low to moderate levels of the alternative response in the asymmetrical-choice condition (*M* = 29.2%; range, 12.5% to 50%).

As in Experiment 1, problem and contrary behavior occurred at low levels for both participants during Experiment 2. Figure 4 depicts the percentage of trials in which Kurt (top panel) and Glenn (middle and bottom panels) engaged in these behaviors throughout the course of the evaluation. Kurt engaged in problem or contrary behavior during seven trials of the initial free-choice condition (Session 1). Subsequently, Kurt engaged in these behaviors during only two trials of his initial asymmetrical-choice condition (Session 4), one trial of his initial singular-choice condition (Session 8), two trials of his second free-choice condition (Session 20), and one trial of his final asymmetrical-choice condition (Session 26). When tolerance of the alternative hat served as the dependent measure, Glenn engaged in problem or contrary behavior during three trials of his initial free-choice condition (Session 1), five trials of his initial asymmetrical-choice condition (Session 6), and three trials of his second exposure to the asymmetrical-choice condition (Session 15). When tolerance of the alternative gloves served as the dependent measure, Glenn engaged in these behaviors during two trials of the initial free-choice condition (Sessions 5 and 6) and two trials of his second exposure to the asymmetrical-choice condition (Session 18).

GENERAL DISCUSSION

We observed low levels of tolerance of change during the initial free-choice condition across all participants in both studies and with all topographies of resistance to change. These findings indicate that resistance to change persisted in the absence of differential social contingencies and, thus, may be maintained by automatic-negative reinforcement (i.e., removal of the discriminative stimulus for environmental change; e.g., a picture of wearing pants). The addition of DRA in the first asymmetrical-choice phase resulted in no increase in the alternative response in two applications (Kurt and Eli) and moderate, but not clinically acceptable, increases in the alternative response in the remaining four applications (Santo [bib and tray], Glenn [hat and gloves]). These results indicate that DRA with the most highly preferred item initially failed to overcome the preferential choice of the resistive response. However, when we introduced escape extinction for the alternative response using either the guided-choice procedure in Experiment 1 or the singular-choice procedure in Experiment 2, all participants chose and tolerated the alternative response at high and clinically significant levels.

The results of Experiment 1 demonstrated that the guided-choice condition (i.e., a form of escape extinction) produced tolerance for change during nearly every trial with each participant and target response. That is, when the therapist physically guided the participant to choose the alternative response, the participant generally tolerated this change for the remainder of each trial without any contrary or problem behavior. Experiment 2 illustrated that when participants were presented with the alternative-response option in the singular-choice condition with three-step prompting to promote this response (i.e., another form of escape extinction), they selected the alternative response independently on the vast majority of the single-choice trials. In addition, across both studies, after exposure to escape extinction in combination with DRA in the guided- and singular-choice conditions, three of four participants showed increased levels of the alternative response in subsequent exposures to the asymmetrical-choice condition. Moreover, in four of six applications, high and clinically significant levels of the alternative response occurred in the asymmetrical-choice condition

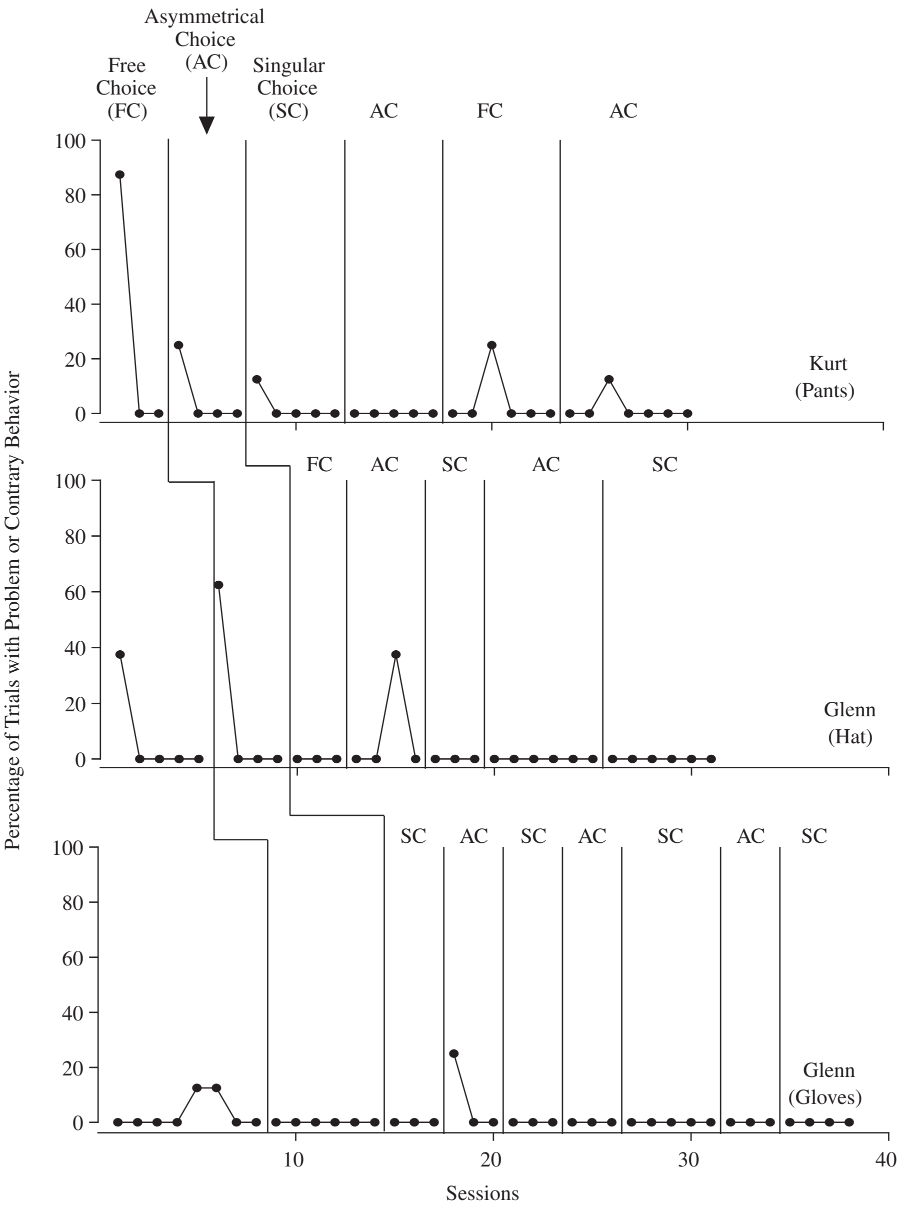

Figure 4. Percentage of trials with problem or contrary behavior across the free choice, asymmetrical choice, and singular choice conditions for Kurt wearing pants (top panel), Glenn wearing a hat (middle panel), and Glenn wearing gloves (bottom panel).

following one or more exposures to either the guided- or singular-choice condition. Finally, in two applications moderate (Kurt) or high (Santo [bib]) levels of the alternative response occurred in the free-choice condition after one or more exposures to guided- or singular-choice conditions followed by reversals to the asymmetrical-choice condition and then the free-choice condition. That is, in these two applications, the participants no longer exhibited a preference for the resistive response.

The present study applied free-, asymmetrical-, and either guided- or singular-choice procedures as a treatment to reduce resistance to change as well as associated problem behavior in four young boys with ASD. Although numerous researchers have applied DRA and extinction procedures as a treatment for food selectivity (Peterson et al., 2016; Roth et al., 2010; Wood et al., 2009), motor stereotypies (Cunningham & Schreibman, 2008), and other repetitive behaviors (Boyd et al., 2013; Fisher et al., 2013), research regarding treatment for resistance to change during daily routines has been limited. This study extends the research in this area by showing that DRA combined with escape extinction can reduce resistance to change displayed during daily routines.

The approach to treating resistance to change used in the present experiments was inspired by insights from the literature on free-operant choice (e.g., Caron et al., 2017; Fisher & Mazur, 1997). If resistance to change in individuals with ASD is governed in part by the processes that guide choice behavior, we hypothesized that engagement in resistive responses, and nonengagement in alternative responses, might result from two environmental factors. First, we hypothesize that children with ASD prefer resistive responses to new (or alternative) responses in order to avoid the unpredictable consequences associated with new responses. The fact that all of the participants required and responded well to escape extinction (i.e., guided-choice in Experiment 1 or singular-choice in Experiment 2) supports our hypothesis that automatic negative reinforcement maintained resistance to change for these participants. Second, the extensive history of reinforcement for resistive behavior, and the lack of such a history for alternative behavior, probably contributed to the near-exclusive choice of the resistive options.

Every initial application of the free-choice condition produced results supporting this conceptualization (i.e., high levels of the resistive response and low levels of the alternative response despite equivalent programmed reinforcement for both responses). Furthermore, we developed two increasingly effective interventions in order to counteract exclusive allocation of behavior toward the resistive response and to increase the alternative response by establishing a history of relatively high-quality reinforcement for this response (i.e., pairing the alternative response with access to highly preferred tangible items). The moderately effective intervention, asymmetrical choice, consisted of providing the most highly preferred item contingent on the alternative response and no programmed consequence for the resistive response. The purpose of this intervention was to counteract any putative reinforcing consequences associated with the resistive response. This intervention inconsistently affected participants' choice of resistive responses. The highly effective interventions, guided choice and singular choice, consisted of two different forms of escape extinction combined with DRA. The purpose of these interventions was to establish a history of reinforcement for alternative behavior.

These interventions strongly and consistently counteracted the participants' choice of resistive responses. Moreover, after one or more exposures to the more effective interventions, some of the participants showed less allocation of choice toward the resistive response. For example, Kurt chose the resistive and alternative responses almost equally often during his second exposure to the free-choice condition in the fifth phase, suggesting that he no longer showed a strong preference for the resistive response. Santo actually showed a preference for the alternative response in the free-choice condition in the final phase of analysis conducted with his usual and alternative bibs. One risk that may occur when a participant shows this pattern of responding is that the individual may simply replace one resistive response with a new one (e.g., insisting on always wearing the newer bib rather than his usual one or any subsequent new ones). One potential way to address this problem, should it arise, would be to use multiple alternative responses during the free-, asymmetrical-, and guided- or singular-choice conditions; Reeve, Reeve, Townsend, & Poulson, 2007; Sprague & Horner, 1984; Stokes & Baer, 1977). Future researchers should examine whether applying the current interventions with multiple alternative responses leads to more general and enduring effects on resistance to change.

The current findings should be interpreted relative to a few limitations of the investigation. First, although the results of the free-choice condition indicated that the resistive response persisted in the absence of differential social contingencies, we did not complete a full functional analysis of the resistive behavior, and we therefore cannot rule out the possibility that social consequences also functioned as reinforcers for these responses. For example, an alternative operant interpretation of resistance to change is that it represents a response class maintained by escape from nonpreferred demands. That is, requests by caregivers to try new things (e.g., put on or tolerate a new piece of clothing) may represent examples of novel demands that caregivers historically removed contingent on resistive or other problem behavior (Mace, Browder, & Lin, 1987; Smith, Iwata, Goh, & Shore, 1995). However, this social-negative-reinforcement hypothesis is inconsistent with the fact that for Santo, the therapist placed the novel bib on him, and for Glenn, the therapist placed the novel tray in front of him. That is, the therapist did not deliver any instructional demand to Santo or Glenn. Finally, the fact that all of the participants displayed resistive behavior across a variety of new stimulus contexts seems inconsistent with a socially mediated reinforcement contingency, which, by definition, requires a history of social reinforcement.

Second, the experimental design we used in this study did not allow us to demonstrate that exposure to the two escape-extinction procedures, guided- and singular-choice, produced the subsequent increases in the alternative response and decreases in the resistive response. That is, extended exposure to the asymmetrical-choice condition alone might have eventually resulted in increases in the alternative response and decreases in the resistive response without the participants ever being exposed to the escape-extinction procedures. However, in the one extended application of the asymmetrical-choice condition prior to implementation of an escape-extinction procedure (Santo [bib]), levels of the alternative response increased to 100% initially, but subsequently decreased to unacceptable levels with repeated exposure. Nevertheless, future investigators might consider using an alternating-treatments design with some topographies of resistive behavior exposed to the asymmetrical-choice condition only, and other topographies of resistive behavior exposed to the asymmetrical-choice condition after prior exposure to either the guided- or singular-choice condition.

In summary, the current results suggest that DRA during the asymmetrical-choice condition produced zero, small, or inconsistent improvements in resistance to change in children with ASD. By contrast, adding an escape-extinction procedure (guided- or singular-choice) consistently increased the alternative response to high levels and the resistive response to low levels. In addition, exposure to these escape-extinction procedures may have increased the persistence of the alternative response and decreased the persistence of the resistive response during subsequent exposures to the asymmetrical- and free-choice conditions. These results add to the small body of research on treatment of resistance to change in children with ASD.

REFERENCES

Banda, D. R., McAfee, J. K., Lee, D. L., & Kubina, R. M., Jr. (2007). Math preference and mas tery relationship in middle school students with autism spectrum disorders. *Journal of Behavioral Edu cation*, *16*, 207 223. https://doi.org/10.1007/s10864 006 9035 5

Baum, W. M. (1974). On two types of deviation from the matching law: Bias and undermatching. *Journal of the Experimental Analysis of Behavior, 22*, 231 242. https://doi.org/10.1901/jeab.1974.22 231

Baum, W. M. (1979). Matching, undermatching, and overmatching in studies of choice. *Journal of the Experimental Analysis of Behavior, 32*, 269 281. https://doi.org/10.1901/jeab.1979.32 269

Bishop, S. L., Hus, V., Duncan, A., Huerta, M., Gotham, K., Pickles, A., … Lord, C. (2013). Subcat egories of restricted and repetitive behaviors in chil dren with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 43*, 1287 1297. https://doi.org/10.1007/s10803 012 1671 0

Bonnet Brilhault, F., Tuller, L., Prévost, P., Malvy, J., Zebib, R., Ferré, S., … Gomot, M. (2018). A strate gic plan to identify key neurophysiological mecha nisms and brain circuits in autism. *Journal of Chemical Neuroanatomy*, *89*, 69 72. https://doi.org/10.1016/j.jchemneu.2017.11.007

Borrero, C. S. W., Vollmer, T. R., Borrero, J. C., Bourret, J. C., Sloman, K. N., Samaha, A. L., & Dallery, J. (2010). Concurrent reinforcement sched ules for problem behavior and appropriate behavior: Experimental applications of the matching law. *Jour nal of the Experimental Analysis of Behavior, 93*, 455 469. https://doi.org/10.1901/jeab.2010.93 455

Borrero, J. C., & Vollmer, T. R. (2002). An application of the matching law to severe problem behavior. *Jour nal of Applied Behavior Analysis, 35*, 13 27. https://doi.org/10.1901/jaba.2002.35 13

Boyd, B. A., Woodard, C. R., & Bodfish, J. W. (2013). Feasibility of exposure response prevention to treat repetitive behaviors of children with autism and an intellectual disability: A brief report. *Autism, 17*, 196 204. https://doi.org/10.1177/1362361311414066

Carcani Rathwell, I., Rabe Hasketh, S., & Santosh, P. J. (2006). Repetitive and stereotyped behaviours in per vasive developmental disorders. *Journal of Child Psy chology and Psychiatry*, *47*, 573 581. https://doi.org/10.1111/j.1469 7610.2005.01565.x

Caron, P., Forget, J., & Rivard, M. (2017). The alloca tion of playing behavior of children in mainstream day care according to social reinforcer ratios. *European Journal of Behavior Analysis, 18*, 242 250. https://doi.org/10.1080/15021149.2017.1309956

Christensen, D. L., Bilder, D. A., Zahorodny, W., Pettygrove, S., Durkin, M. S., Fitzgerald, R. T., … Yeargin Allsopp, M. (2016). Prevalence and charac teristics of autism spectrum disorder among 4 year old children in the autism and developmental disabil ities monitoring network. *Journal of Developmental and Behavioral Pediatrics*, *37*, 1 8. https://doi.org/10.1097/DBP.0000000000000235

Cunningham, A. B., & Schreibman, L. (2008). Stereo typy in autism: The importance of function. *Research in Autism Spectrum Disorders, 2*, 469 479. https://doi.org/10.1016/j.rasd.2007.09.006

Cuccaro, M. L., Shao, Y., Grubber, J., Slifer, M., Wolpert, C. M., Donnelly, S. L., … Pericak Vance, M. A. (2003). Factor analysis of restricted and repetitive behaviors in autism using the Autism Diagnostic Interview R. *Child Psychiatry and Human Development*, *34*, 3 17. https://doi.org/10.1023/A:1025321707947

DeLeon, I. G., Fisher, W. W., Catter, V. R., Maglieri, K., Herman, K., & Marhefka, J. (2001). Examination of relative reinforcement effects of stim uli identified through pretreatment and daily brief preference assessments. *Journal of Applied Behavior Analysis, 34*, 463 473. https://doi.org/10.1901/jaba.2001.34 463

Elliffe, D., Davison, M., & Landon, J. (2008). Relative reinforcer rates and magnitudes do not control con current choice independently. *Journal of the Experi mental Analysis of Behavior, 90*, 169 185. https://doi.org/10.1901/jeab.2008.90 169

Fisher, W. W., & Mazur, J. E. (1997). Basic and applied research on choice responding. *Journal of Applied Behavior Analysis, 30*, 387 410. https://doi.org/10.1901/jaba.1997.30 387

Fisher, W. W., Rodriguez, N. M., & Owen, T. M. (2013). Functional assessment and treatment of per severative speech about restricted topics in an adoles cent with Asperger syndrome. *Journal of Applied Behavior Analysis, 46*, 307 311. https://doi.org/10.1002/jaba.19

Gomot, M., Bernard, F. A., Davis, M. H., Belmonte, M. K., Ashwin, C., Bullmore, E. T., & Baron Cohen, S. (2006). Change detection in chil dren with autism: An auditory event related fMRI study. *Neuroimage, 29*, 475 484. https://doi.org/10.1016/j.neuroimage.2005.07.027

Gomot, M., & Wicker, B. (2012). A challenging, unpredictable world for people with autism spectrum disorder. *International Journal of Psychophysiology, 83*, 240 247. https://doi.org/10.1016/j.ijpsycho.2011.09.017

Hagopian, L. P., Rooker, G. W., & Zarcone, J. R. (2015). Delineating subtypes of self injurious behav ior maintained by automatic reinforcement. *Journal of Applied Behavior Analysis*, *48*, 523 543. https://doi.org/10.1002/jaba.236

Hagopian, L. P., Rooker, G. W., Zarcone, J. R., Bonner, A. C., & Arevalo, A. R. (2017). Further analysis of subtypes of automatically reinforced SIB: A replication and quantitative analysis of published datasets. *Journal of Applied Behavior Analysis, 50*, 48 66. https://doi.org/10.1002/jaba.368

Hausman, N., Kahng, S., Farrell, E., & Mongeon, C. (2009). Idiosyncratic functions: Severe problem behavior maintained by access to ritualistic behaviors. *Education & Treatment of Children, 32*, 77 87. https://doi.org/10.1353/etc.0.0051

Joseph, L., Thurm, A., Farmer, C., & Shumway, S. (2013). Repetitive behavior and restricted interests in young children with autism: Comparisons with con trols and stability over 2 years. *Autism Research, 6*, 584 595. https://doi.org/10.1002/aur.1316

Kuhn, D. E., Hardesty, S. L., & Sweeney, N. M. (2009). Assessment and treatment of excessive straightening and destructive behavior in an adolescent diagnosed with autism. *Journal of Applied Behavior Analysis*, *42*, 355 360. https://doi.org/10.1901/jaba.2009.42 355

Lam, K. L., & Aman, M. G. (2007). The Repetitive Behavior Scale Revised: Independent validation in individuals with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 37*, 855 866. https://doi.org/10.1007/s10803 006 0213 z

Leon, Y., Lazarchick, W. N., Rooker, G. W., & DeLeon, I. G. (2013). Assessment of problem behav ior evoked by disruption of ritualistic toy arrange ments in a child with autism. *Journal of Applied Behavior Analysis*, *46*, 507 511. https://doi.org/10.1002/jaba.41

Mace, F. C., Browder, D. M., & Lin, Y. (1987). Analysis of demand conditions associated with stereotypy. *Journal of Behavior Therapy and Experimental Psychiatry, 18*, 25 31. https://doi.org/10.1016/0005 7916(87)90068 1

Mazur, J. E., & Fantino, E. (2014). Choice. In F. K. McSweeney & E. S. Murphey (Eds.), *The Wiley Blackwell handbook of operant and classical con ditioning* (pp. 195 220). Oxford, UK: Wiley Black well. https://doi.org/10.1002/9781118468135

McDowell, J. J (1988). Matching theory in natural human environments. *The Behavior Analyst, 11*, 95 109. https://doi.org/10.1007/BF03392462

McDowell, J. J (1989). Two modern developments in matching theory. *The Behavior Analyst, 12*, 153 166. https://doi.org/10.1007/BF03392492

Neuringer, A. J. (1967). Effects of reinforcement magni tude on choice and rate of responding. *Journal of the Experimental Analysis of Behavior, 10*, 417 424. https://doi.org/10.1901/jeab.1967.10 417

Persico, A. M., & Bourgeron, T. (2006). Searching for ways out of the autism maze: Genetic, epigenetic and environmental clues. *Trends in Neurosciences, 29*, 349 358. https://doi.org/10.1016/j.tins.2006.05.010

Peterson, K. M., Piazza, C. C., & Volkert, V. M. (2016). A comparison of a modified sequential oral sensory approach to an applied behavior analytic approach in the treatment of food selectivity in children with autism spectrum disorder. *Journal of Applied Behavior Analysis, 49*, 485 511. https://doi.org/10.1002/jaba.332

Querim, A. C., Iwata, B. A., Roscoe, E. M., Schlichenmeyer, K. J., Ortega, J. V., & Hurl, K. E. (2013). Functional analysis screening for problem behavior maintained by automatic reinforcement. *Journal of Applied Behavior Analysis, 46*, 47 60. https://doi.org/10.1002/jaba.26

Rapp, J. T., & Vollmer, T. R. (2005). Stereotypy I: A review of behavioral assessment and treatment. *Research in Developmental Disabilities, 26*, 527 547. https://doi.org/10.1016/j.ridd.2004.11.005

Reed, P., Hawthorn, R., Bolger, S., Meredith, K., & Bishop, R. (2012). Disrupted stimulus control but not reward sensitivity in individuals with autism spec trum disorders: A matching law analysis. *Journal of Autism and Developmental Disorders, 42*, 2393 2403. https://doi.org/10.1007/s10803 012 1494 z

Reeve, S. A., Reeve, K. F., Townsend, D. B., & Poulson, C. L. (2007). Establishing a generalized rep ertoire of helping behavior in children with autism. *Journal of Applied Behavior Analysis, 40*, 123 136. https://doi.org/10.1901/jaba.2007.11 05

Richler, J., Bishop, S. L., Kleinke, J. R., & Lord, C. (2007). Restricted and repetitive behaviors in young children with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *37*, 73 85. https://doi.org/10.1007/s10803 006 0332 6

Rispoli, M., Camargo, S., Machalicek, W., Lang, R., & Sigafoos, J. (2014). Functional communication train ing in the treatment of problem behavior maintained by access to rituals. *Journal of Applied Behavior Analysis, 47*, 580 593. https://doi.org/10.1002/jaba.130

Rivard, M., Forget, J., Kerr, K., & Bégin, J. (2014). Matching law and sensitivity to therapist's attention in children with autism spectrum disorders. *Psycholog ical Record, 64*, 79 88. https://doi.org/10.1007/s40732 014 0015 1

Roth, M. P., Williams, K. E., & Paul, C. M. (2010). Treating food and liquid refusal in an adolescent with Asperger's disorder. *Clinical Case Studies, 9*, 260 272. https://doi.org/10.1177/1534650110373500

Saini, V., Greer, B. D., Fisher, W. W., Lichtblau, K. R., DeSouza, A. A., & Mitteer, D. R. (2016). Individual and combined effects of noncontingent reinforcement and response blocking on automatically reinforced problem behavior. *Journal of Applied Behavior Analy sis. 49*, 693 698. https://doi.org/10.1002/jaba.306

Shuster, J., Perry, A., Bebko, J., & Toplak, M. E. (2014). Review of factor analytic studies examining symptoms of Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders, 44*, 90 110. https://doi.org/10.1007/s10803 013 1854 3

Smith, R. G., Iwata, B. A., Goh, H. L., & Shore, B. A. (1995). Analysis of establishing operations for self injury maintained by escape. *Journal of Applied*

Behavior Analysis, 28, 515 535. https://doi.org/10.1901/jaba.1995.28 515
Sprague, J. R., & Horner, R. H. (1984). The effects of single instance, multiple instance, and general case training on generalized vending machine use by mod erately and severely handicapped students. *Journal of Applied Behavior Analysis, 17*, 273 278. https://doi.org/10.1901/jaba.1984.17 273
Stokes, T. F., & Baer, D. M. (1977). An implicit technol ogy of generalization. *Journal of Applied Behavior Analysis, 10*, 349 367. https://doi.org/10.1901/jaba.1977.10 349
Turner, M. (1999). Repetitive behaviour in autism: A review of psychological research. *Journal of Child Psy chology and Psychiatry*, *40*, 839 849. https://doi.org/10.1111/1469 7610.00502
Whitehouse, C. M., Curry Pochy, L. S., Shafer, R., Rudy, J., & Lewis, M. H. (2017). Reversal learning in C58 mice: Modeling higher order repetitive behav ior. *Behavioural Brain Research, 332*, 372 378. https://doi.org/10.1016/j.bbr.2017.06.014
Wolff, J. J., Hupp, S. C., & Symons, F. J. (2013). Brief report: Avoidance extinction as treatment for compul sive and ritual behavior in autism. *Journal of Autism and Developmental Disorders*, *43*, 1741 1746. https://doi.org/10.1007/s10803 012 1721 7
Wood, B. K., Wolery, M., & Kaiser, A. P. (2009). Treat ment of food selectivity in a young child with autism. *Focus on Autism and Other Developmental Disabilities, 24*, 169 177. https://doi.org/10.1177/1088357609338381

Received June 22, 2017
Final acceptance April 3, 2019
Action Editor, Timothy Vollmer