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FURTHER EVALUATION OF THE HIGH-PROBABILITY INSTRUCTIONAL SEQUENCE WITH AND WITHOUT PROGRAMMED REINFORCEMENT

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In 2 experiments, we examined the effects of programmed reinforcement for compliance with high-probability (high-*p*) instructions on compliance with low-probability (low-*p*) instructions. In Experiment 1, we compared the high-*p* sequence with and without programmed reinforcement (i.e., edible items) for compliance with high-*p* instructions. Results showed that the high-*p* sequence increased compliance with low-*p* instructions only when compliance with high-*p* instructions was followed by reinforcement. In Experiment 2, we examined the role of reinforcer quality by delivering a lower quality reinforcer (praise) for compliance with high-*p* instructions. Results of Experiment 2 showed that the high-*p* sequence with lower quality reinforcement did not improve compliance with low-*p* instructions; the addition of a higher quality reinforcer (i.e., edible items) contingent on compliance with high-*p* instructions did increase compliance with low-*p* instructions.

Key words: compliance, high-probability instructional sequence, motivating operations, noncompliance

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The high-probability (high-*p*) instructional sequence includes the presentation of a series of instructions with which an individual is likely to comply immediately before presentation of an instruction with which an individual is otherwise unlikely to comply (the low-probability or low-*p* instruction; Mace et al., 1988). The high-*p* sequence has increased compliance with low-*p* instructions in a number of populations, including individuals with intellectual disabilities (Ducharme & Worling, 1994; Mace & Belfiore, 1990; Mace et al., 1988) and typically developing children (Ardoin, Martens, & Wolfe, 1999; Davis & Reichle, 1996; Wehby & Hollahan, 2000).

Despite evidence that supports the use of the high-*p* sequence as an intervention for noncompliance, several studies have also noted cases in which the high-*p* sequence alone failed to improve compliance with low-*p* instructions (e.g., Rortvedt & Miltenberger, 1994; Wilder, Zonneveld, Harris, Marcus, & Reagan, 2007; Zarcone, Iwata, Mazaleski, & Smith, 1994). One component of the high-*p* sequence that may play a role in its effectiveness is the delivery of reinforcement contingent on compliance with the high-*p* instructions. Zuluaga and Normand (2008) examined the effect of the high-*p* sequence with and without programmed reinforcement (edible items) to increase compliance among two young children with intellectual disabilities. They found that the high-*p* sequence increased compliance with low-*p* instructions only when reinforcement was provided for compliance with high-*p* instructions, suggesting that reinforcement delivery may be important for the effectiveness of the sequence. It is also notable that these authors programmed a 10-s delay between each high-*p* instruction. In practice, the interinstruction interval may be considerably smaller (as brief as 1 to 2 s).

Pitts and Dymond (2012) conducted a similar analysis of the effects of reinforcement for high-*p* instructions within the high-*p* sequence but also

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included a comparison of 5-s and 10-s interinstruction intervals with three children with autism. Compliance with the low-*p* instruction was highest when reinforcement was delivered for compliance with high-*p* instructions and when instructions were delivered every 5 s. These results suggest that briefer interinstruction intervals may improve the efficacy of the high-*p* sequence.

Despite these findings, more research on the high-*p* instructional sequence is needed. For example, although Pitts and Dymond (2012) found that the high-*p* sequence was more effective with delivery of reinforcement for compliance with high-*p* instructions and a 5-s interinstruction interval, the 5-s interval may still be longer than what is used in practice. Compliance may be particularly likely when the rate of high-*p* instruction delivery is even denser. Although no data on common interinstruction intervals used during the high-*p* sequence exist, anecdotal observations suggest that this interval is often very brief. The use of very brief intervals is logical, in that one of the hypothesized mechanisms responsible for high-*p* effects is that the procedure produces an increase in the rate of reinforcement received immediately before the delivery of a low-*p* instruction (i.e., the momentum of compliance). Therefore, the purpose of Experiment 1 was to replicate Zuluaga and Normand (2008) and Pitts and Dymond (2012) by examining the effectiveness of the high-*p* sequence with and without programmed reinforcement. However, we used a very short interinstruction interval (i.e., 1 to 2 s), which may be more similar to what is used in practice.

In addition, both Zuluaga and Normand (2008) and Pitts and Dymond (2012) delivered only one type of reinforcement, edible items, to reinforce compliance with high-*p* instructions. Other reinforcers such as praise, which may be of lower quality for at least some individuals, were not examined but may be more commonly delivered in practice. Although one study (Mace, Mauro, Boyajian, & Eckert, 1997) examined reinforcer quality in the context of the high-*p* instructional sequence, determination of quality in that study was informal. Thus, in Experiment 2, we examined the delivery of a lower quality reinforcer (praise; formally identified via a stimulus preference assessment) contingent on compliance with high-*p* instructions.

EXPERIMENT 1

Method

Participants and setting. Two boys, referred by their preschool teachers for noncompliance in the classroom, participated. Carl was 4 years old, and Gary was 3 years old. Both participants were typically developing and had age-appropriate language skills. We conducted six to 12 sessions per day in a private room at the preschool, 2 to 3 days per week. A graduate student in behavior analysis served as the experimenter.

Response definitions and measurement. The target (low-*p*) instructions were identified based on teacher report of instructions to which participants did not comply. For Carl and Gary, the low-*p* instruction was "Give me the toy." The same toy was used throughout sessions; for both participants, the toy was a cellular phone on which a video game was played. We also evaluated a second low-*p* instruction for Carl, which was "Put your socks on." To identify high-*p* instructions, we asked teachers and parents to nominate six instructions with which each participant was likely to comply. We then presented each of these instructions 10 times to each participant and measured compliance. Instructions with which the participant complied on 100% of presentations were designated as high-*p* instructions. For Carl, the high-*p* instructions were "Touch your nose," "Give me five," and "What's your teacher's name?" For Gary, the high-*p* instructions were "Give me five," Touch your head," and "What color is this?"

For the low-*p* instructions, we defined *compliance* as initiating (for "Put your socks on") or completing (for "Give me the toy") the task the therapist specified in the instruction within 10 s. We focused on initiation, rather than completion, for the "Put your socks on" instruction because the task took the participant some time to complete. For the high-*p* instructions, we defined compliance as completing the task within 2 s, because only 1 to 2 s separated the delivery of high-*p* instructions. *Noncompliance* was scored if participants did not meet the definition of compliance with either a low-*p* or high-*p* instruction. Each trial consisted of one low-*p* instruction (baseline) or three high-*p* instructions and one low-*p* instruction (high-*p* with and without programmed reinforcement). We calculated the percentage compliance for each session by dividing the number of trials with compliance to the low-*p* instruction by the total number of trials per session (three) and converting this quotient to a percentage.

To assess interobserver agreement, a second independent observer collected data during 93% of sessions for Carl's "Give me the toy" instruction, 48% of sessions for Carl's "Put your socks on" instruction, and 100% of Gary's sessions. We compared observer records on a trial-by-trial basis and defined an agreement as both observers recording compliance or noncompliance on a given trial. We calculated overall agreement by dividing the number of sessions with agreement by the total number of sessions. We then converted this ratio to a percentage. Overall agreement was 100% for Carl and Gary. An independent observer also collected treatment integrity data on the delivery of the high-*p* instructions and edible items for compliance with high-*p* instructions during the two conditions in which the high-*p* instructions were scheduled to be delivered. Treatment integrity values for all instructions across both participants were 100%.

Stimulus preference and reinforcer assessment. We first conducted a paired-choice stimulus preference assessment (Fisher et al., 1992) with eight items to identify preferred edible items to be delivered contingent on compliance for each participant. In addition, a reinforcer assessment was conducted for each participant to verify that the selected edible items functioned as reinforcers. The preference assessment identified candy corn and a mini M&M as the first and second ranked items, respectively, for both Carl and Gary.

During 3-min reinforcer assessment sessions, a card (10 cm by 15 cm) was taped to a wall. In baseline, participants were told that they could touch the card as much or as little as they wanted. No programmed consequences were provided contingent on card touching. In the reinforcement phase, participants were told that each time they touched the card, they would receive a small piece of candy corn or an M&M. Contingent on card touching, one small piece of the item was delivered. Sessions in which candy corn was available were alternated with sessions in which M&Ms were available in a multielement design. After the first reinforcement phase, a second baseline phase was conducted followed by a second reinforcement phase.

Procedure. We used an ABACABAC reversal design to evaluate the impact of the high-*p* sequence with and without reinforcement delivered for compliance with high-*p* instructions on the levels of compliance to low-*p* instructions. During all sessions, the experimenter stood within 1.5 m of the participant. During baseline (A), the experimenter simply presented the low-*p* instruction (e.g., "Give me the toy" or "Put on your socks") once every 3 min. Compliance resulted in delivery of a small piece of candy corn. The experimenter then held the toy for 1 min and returned the toy for 2 min before initiating the next trial. Carl typically removed his socks independently within 1 min of compliance. Noncompliance resulted in no programmed consequence. During the high-*p* with edible reinforcement phase (B), the experimenter presented the three high-*p* instructions described above immediately before presenting each low-*p* instruction. Contingent on compliance with each high-*p* instruction, the experimenter immediately delivered a mini M&M (second most preferred item identified in the preference assessment). The time between delivery of the next high-*p* instruction or the low-*p* instruction was no more than 2 s; a stopwatch was used to prompt delivery. As in baseline, compliance with the low-*p* instruction resulted in delivery of a small piece of candy corn. The high-*p* without edible reinforcement phase (C) was identical to the high-*p* with edible reinforcement phase except that no edible item was delivered for compliance with the high-*p* instructions; candy corn was delivered for compliance with the low-*p* instruction. Praise was not delivered contingent on compliance with any instructions throughout Experiment 1. If a participant did not comply with a high-*p* request after 2 s (this never occurred with Carl and occurred once with Gary), the experimenter stopped presentation of the sequence, waited 3 min, and re-presented the high-*p* sequence.

Results and Discussion

The results of the reinforcer assessment demonstrated increased responding for both candy corn ($M = 20$ and 18 responses per minute for Carl and Gary, respectively) and M&M ($M = 22.3$ and 20.5 responses per minute for Carl and Gary, respectively) relative to baseline ($M = 1.2$ and 0.2 per minute, for Carl and Gary, respectively), which indicated that both edible items functioned as reinforcers.

Figure 1 depicts the percentage of trials with compliance to low-*p* instructions. Carl complied with "Give me the toy" during 2% of trials in the baseline phases (Figure 1, top) but complied during 87% of trials during the high-*p* with programmed reinforcement phases. He did not comply with the instruction during the high-*p* without programmed reinforcement phases. He did not comply with the instruction to "Put your socks on" during baseline (Figure 1, middle). He complied during 94% of trials in the high-*p* with programmed reinforcement phases relative to

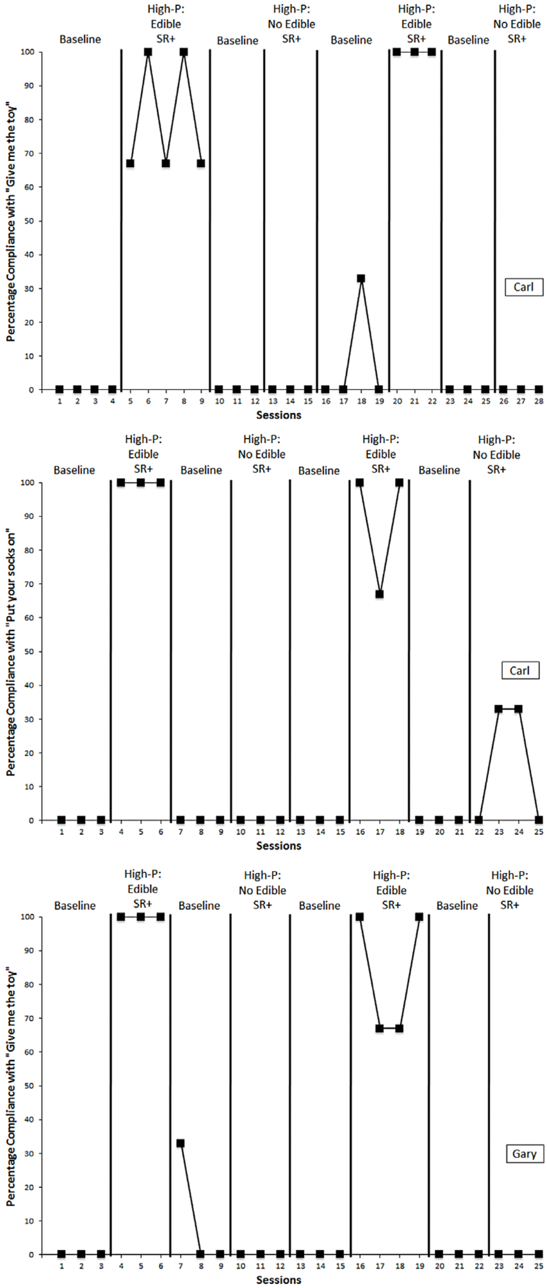

Figure 1. Percentage of compliance during baseline, high *p* with programmed reinforcement (High-*p*: Edible SR+), and high *p* without programmed reinforcement (High-*p*: No Edible SR+) across target instructions for Carl and Gary.

9% of trials during the high-*p* without programmed reinforcement phases. Gary complied with 3% of instructions during baseline (Figure 1, bottom). He complied with 90% of instructions across the high-*p* with programmed reinforcement phases. Gary did not comply with instructions during the high-*p* without programmed reinforcement phases.

The results of Experiment 1 suggest that the high-*p* instructional sequence is most effective when reinforcement is delivered contingent on compliance with high-*p* instructions. Despite the short interinstruction interval used in the current study, compliance did not increase without programmed reinforcement. These results add to the findings of Zuluaga and Normand (2008) and Pitts and Dymond (2012) in that they suggest that the rate of high-*p* instruction delivery may be less important than the delivery of reinforcement for compliance with high-*p* instructions to increase compliance with low-*p* instructions. It is also worth noting that the delivery of reinforcement for compliance with high-*p* instructions was effective without direct manipulation of contingencies for compliance.

Although reinforcement for compliance with high-*p* instructions increased compliance to low-*p* instructions, the high-*p* sequence without reinforcement for compliance did not affect compliance with low-*p* instructions, despite the fact that compliance with low-*p* instructions resulted in access to high-quality reinforcement throughout the study. This is in contrast to the many studies that have shown the high-*p* sequence to be effective in the absence of high-quality reinforcement (e.g., edible items) for compliance with high-*p* instructions. Of course, in the current study it is possible that the prior history of reinforcement for compliance with high-*p* instructions influenced performance; both participants had been exposed to reinforcement for compliance with high-*p* instructions before they were exposed to the absence of reinforcement for compliance with high-*p* instructions (i.e., a sequence effect may have occurred). Another difference between the current study and previous research is that participants were required to complete a nonpreferred task and surrender a preferred item. These tasks may have been more demanding than the tasks used in previous studies.

Although the results of Experiment 1 suggest the delivery of reinforcement for compliance with high-*p* instructions is effective to increase compliance with low-*p* instructions, this may be difficult to do in application, particularly if the reinforcement delivered consists of edible items. Edible items may (a) have a low satiation point, (b) produce weight gain, and (c) compete with the consumption of more nutritious foods. It is not clear if other, perhaps lower quality, reinforcers can produce increases in compliance to low-*p* instructions when delivered contingent on compliance with high-*p* instructions.

EXPERIMENT 2

Mace et al. (1997) suggested that the quality of reinforcement delivered for compliance with high-*p* instructions may affect compliance with low-*p* instructions. Specifically, Mace et al. found that delivery of presumably more preferred stimuli for compliance with high-*p* instructions increased compliance with low-*p* instructions more than delivery of less preferred stimuli for compliance with high-*p* instructions. However, Mace et al. identified reinforcer quality via informal observation and parent report. They did not conduct a formal preference assessment to determine item preference and did not conduct a reinforcer assessment to compare the reinforcing efficacy of items delivered for compliance with high-*p* instructions. In other words, reinforcer quality was not empirically determined or verified. Although Mace et al.'s results are suggestive of a reinforcer-quality effect, more data on the relation between compliance and reinforcer quality are needed. Thus, the purpose of Experiment 2 was to evaluate the effects of the high-*p* instructional sequence on compliance with low-*p* instructions when lower quality reinforcement (praise) is provided for compliance with high-*p* instructions.

Method

Participants and setting. Carl and Gary participated in Experiment 2. Sessions were conducted in the same setting as Experiment 1. Six to 12 sessions were conducted per day, 2 to 3 days per week. A graduate student served as the experimenter.

Response definitions and measurement. Compliance was scored as described in Experiment 1. A second independent observer collected data during 32% of sessions for Carl and 27% of sessions for Gary. Overall agreement was 100% for Carl and Gary. An independent observer also collected treatment integrity data on the delivery of the high-*p* instructions, praise, and edible items for compliance with high-*p* instructions during the three conditions in which the high-*p* instructions were scheduled to be delivered. Treatment integrity values for both participants were 100%.

Stimulus preference and reinforcer assessments. We first conducted a paired-choice preference assessment (Fisher et al., 1992) with five social praise statements ("I like your work," "way to go," "nice effort," "super," and an enthusiastic "great job") to identify preferred phrases to be delivered contingent on compliance with high-*p* instructions for each participant. During the assessment, each praise statement was written on an index card, and cards were presented to the participant in pairs on each trial. When the participant touched a card, the experimenter read the statement on each card aloud. We conducted a reinforcer assessment with each participant to verify that the praise identified as most preferred in the preference assessment functioned as a reinforcer. Both Carl and Gary selected "great job" as their most preferred form of praise during the preference assessment.

The reinforcer assessment was similar to that described in Experiment 1, except that in lieu of an edible item, each card touch during a reinforcement phase resulted in the enthusiastic delivery of the targeted praise statement. Also, because only one statement was evaluated for each participant, there was no multielement comparison of reinforcers.

We conducted a second preference assessment (multiple stimulus without replacement; DeLeon & Iwata, 1996) in which edible items (candy corn and M&M) and praise ("great job") were compared to assess participants' relative preferences for these stimuli. In addition, we conducted a progressive-ratio (PR) reinforcer assessment (Roane, Lerman, & Vorndran, 2001) designed to identify the relative reinforcing value of these three stimuli.

The assessment began with a baseline phase in which card touching produced no programmed consequence during 3-min sessions. During a reinforcement phase (also 3 min in duration), the available reinforcer was delivered for card touching, but the number of responses required for reinforcement increased each trial by a multiplier of two. That is, the participant were required to touch the card 2 times, then 4 times, then 8 times, then 16 times, and so on, to produce reinforcement. Each reinforcer was assessed in a separate session followed by a second baseline phase.

Procedure. We used an ABACABACADAD reversal design to evaluate the effects of the high-*p* sequence with high- and low-quality reinforcement for high-*p* instruction compliance on low-*p* instruction compliance. During all sessions, the experimenter stood within 1.5 m of the participant and delivered the low-*p* instruction every 3 min. During baseline (A), the experimenter simply presented the low-*p* instruction; compliance resulted in delivery of a small piece of candy corn, and noncompliance resulted in no programmed consequences. During the high-*p* with praise phase (B), the experimenter presented the three high-*p* instructions described above immediately before presenting the low-*p* instruction and enthusiastically said "great job" after each instance of compliance with a high-*p* instruction. The time between delivery of the next high-*p* instruction or the low-*p* instruction was no more than 2 s. Compliance with the low-*p* instruction resulted in delivery of a small piece of candy corn. The high-*p* without praise phase (C) was identical to the high-*p* with praise phase except that no praise was delivered for compliance with the high-*p* instructions. As with all other phases, compliance with the low-*p* instruction resulted in delivery of a small piece of candy corn. Finally, the high-*p* with social and edible reinforcement phase (D) was identical to the high-*p* with praise phase except that the second most preferred edible item (M&M; identified in Experiment 1) was also delivered contingent on compliance with each of the three high-*p* instructions. If a participant did not comply with a high-*p* request (this occurred once with Carl and twice with Gary), the experimenter stopped the sequence, waited 3 min, and re-presented the high-*p* sequence.

Results and Discussion

During the first reinforcer assessment of Experiment 2, Carl's and Gary's responding increased when it was followed by the phrase "great job" ($M = 41$ and 14.1 responses per minute, respectively, for Carl and Gary) relative to the initial baseline ($M = 0.3$ and 0 per minute for Carl and Gary, respectively); these data indicate this form of social praise functioned as a reinforcer. During the PR reinforcer assessment, Carl and Gary did not respond during baseline phases. During the alternating arrangement, responding for all three stimuli (i.e., candy corn, M&M, and praise) increased over baseline levels. For Carl, the mean rates of card touching for candy corn, M&M, and praise were 20.5, 23, and 7.1, respectively. For Gary, the mean rates of card touching for candy corn, M&M, and praise were 41.6, 38, and 13, respectively. For both participants, responding was greatest for the candy corn and M&M; praise produced less responding and was therefore designated as a lower quality reinforcer.

Figure 2 depicts the percentage of trials with compliance to low-*p* instructions. Carl did not comply with the instruction to "Give me the toy" during baseline phases (Figure 2, top). He also did not comply during the high-*p* with programmed social reinforcement phases, and Carl complied during only 5% of trials during the high-*p* without programmed social reinforcement phases. Because the preceding phases did not increase compliance, we added a high-*p* with programmed social and edible reinforcement phase; Carl complied on 83% of trials during this phase.

Gary did not comply with the instruction to "Give me the toy" during baseline phases (Figure 2, bottom), the high-*p* with programmed social reinforcement phases, and the high-*p* without programmed social reinforcement phases. However, compliance to low-*p* instructions increased to 62% of trials when that instruction was preceded by high-*p* instructions with high-quality reinforcement for compliance.

The results of Experiment 2 show that despite functioning as a reinforcer during the reinforcer assessment, praise delivered contingent on compliance with preceding high-*p* instructions did not result in an increase in compliance with low-*p* instructions. Together with those of Experiment 1, these data suggest that the delivery of some reinforcers contingent on compliance with high-*p* instructions may produce increases in compliance with low-*p* instructions. However, not all reinforcers will produce these increases; reinforcer quality seems to mediate the effects of the high-*p* sequence.

These results are consistent with Mace et al. (1997) who found that the quality of reinforcement delivered for compliance with high-*p* instructions affected compliance with low-*p* instructions. However, unlike Mace et al., compliance with low-*p* instructions in the current study was nonexistent when lower quality

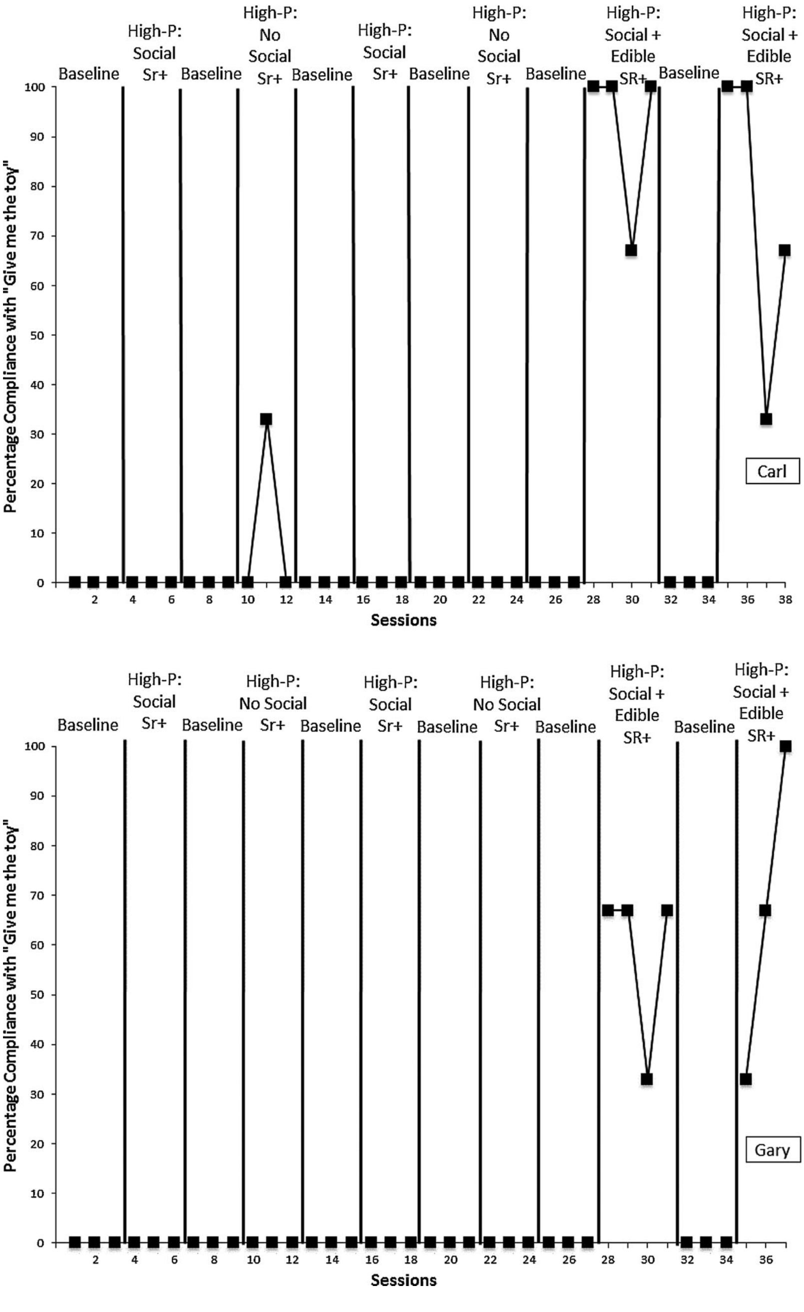

Figure 2. Percentage of compliance during baseline, high *p* with programmed reinforcement (High-*p*: Social Sr+), high *p* without programmed reinforcement (High-*p*: No Social Sr+), and high *p* with programmed reinforcement (High-*p*: Social + Edible SR+) for Carl and Gary.

reinforcement was delivered for compliance with high-*p* instructions. Levels of compliance with low-*p* instructions in Mace et al. were reduced with lower quality reinforcement, but some compliance did occur. Of course, Mace et al.'s procedures differed from the current study in that Mace et al. determined reinforcer quality informally. The PR reinforcer assessment conducted in the current study confirmed that participants worked more for M&Ms than praise, indicating that praise was a lower quality reinforcer.

Higher quality reinforcement delivered contingent on compliance with high-*p* instructions may be necessary to increase compliance with low-*p* instructions. In the current study, the higher quality reinforcement consisted of preferred edible items. As noted in Experiment 1, the delivery of edible items may be impractical or unhealthy in many settings. Practitioners may need to strike a balance between the quality of reinforcement and the practicality of delivering these items. It is possible that the delivery of lower preference edible items may be sufficient to increase compliance; future research should examine this possibility.

Although the reinforcer assessments conducted in Experiment 2 were valuable for methodological reasons, they would not be necessary in application because the preference assessments preceding them have already been empirically validated to predict reinforcer efficacy. In fact, the relatively large amount of candy delivered to participants during the reinforcer assessments may prohibit the use of this assessment with some children.

GENERAL DISCUSSION

Previous research has shown that the high-*p* instructional sequence can increase compliance to low-*p* instructions, but the effects of this intervention have been mixed both between and within studies. In the current experiments, we examined the effects of programmed reinforcement for compliance with high-*p* instructions on compliance with low-*p* instructions. Specifically, in Experiment 1, we compared the high-*p* sequence with programmed reinforcement (i.e., edible items) for compliance with high-*p* instructions to the high-*p* sequence without programmed reinforcement. The delivered edible items functioned as reinforcers based on a previous reinforcer assessment. Unlike previous research on this topic, we used a 1- to 2-s interinstruction interval. Results showed that the high-*p* sequence was effective only when compliance with high-*p* instructions was followed by reinforcement.

In Experiment 2, we replicated Experiment 1 but delivered a lower quality reinforcer, praise, contingent on compliance with high-*p* instructions. Results showed that the high-*p* sequence was ineffective, even when it included reinforcement (in the form of praise) for compliance with high-*p* instructions. When edible items were added for compliance with high-*p* instructions, compliance with low-*p* instructions increased.

These experiments replicate previous studies that have shown that delivering explicit reinforcement for compliance with high-*p* instructions may be necessary to increase compliance. In addition, Experiment 2 demonstrated that compliance improved only when high-quality reinforcement was delivered for high-*p* instructions. These results extend the literature related to the high-*p* sequence in two important ways. First, these results provide additional evidence that the effectiveness of the high-*p* instructional sequence to increase compliance with low-*p* instructions may be due to the delivery of reinforcement for compliance with high-*p* instructions. Although previous research (Pitts & Dymond, 2012) has suggested that the duration of the interinstruction interval may also play a role in the effectiveness of the high-*p* sequence, the current study demonstrates that delivering reinforcement for compliance with high-*p* instructions may be necessary even when the interinstruction interval is extremely short. The 1- to 2-s interinstruction interval used in the current study, in the absence of programmed reinforcement, had little effect on compliance with low-*p* instructions. Second, these results suggest that the quality of reinforcement delivered contingent on compliance with high-*p* instructions may be an important factor in the effectiveness of the procedure. Praise, which may be a common type of reinforcement delivered for compliance with high-*p* instructions in practice, may not always be effective. In the current study, this was the case even though the type of praise delivered contingent on compliance with high-*p* instructions was shown to function as a reinforcer (albeit for a different task) in a reinforcer assessment.

The instruction to "Give me the toy" involved both the initiation of a novel response and the termination of an ongoing, presumably preferred activity (i.e., playing with a video game on a cellular phone). Because many instructions given to children involve a requirement to stop one activity and begin a new activity, the topography of instruction that we chose to study may enhance the external validity of the findings. It also highlights the fact that the items delivered contingent on compliance had to both serve as reinforcers for compliance and outweigh continued access to the video game. The relative values of these two consequences may have contributed to the effectiveness of the higher quality reinforcer and the ineffectiveness of the lower quality reinforcer across the two experiments.

A variety of behavioral mechanisms may be responsible for the effects of the high-*p* instructional sequence. First, it is possible that the momentum of compliance derived from presenting successive high-*p* instructions makes compliance with the low-*p* instruction more likely (Pitts & Dymond, 2012). However, data from the current study suggest that this mechanism was not responsible for the observed effects, given that the interinstruction interval was very brief. Second, it is possible that the delivery of and subsequent compliance with high-*p* instructions strengthen a response class of compliance. That is, compliance with both high-*p* and low-*p* instructions may be members of the same response class, and compliance with initial instructions may strengthen the occurrence of other members of the class.

A third possibility is that the high-*p* instructional sequence is effective because the reinforcement delivered for compliance with high-*p* instructions establishes compliance with a low-*p* instruction as a reinforcer. This possibility is consistent with the findings of Bullock and Normand (2006) and Normand and Beaulieu (2011) who demonstrated that the delivery of a preferred item (the high-*p* instructional sequence was not used in these studies) on a fixed-time schedule immediately before presentation of a low-*p* instruction increased compliance. The results of the current study are also consistent with this interpretation in that they suggest that when the high-*p* instructional sequence increases compliance, a critical component may be the delivery of reinforcement.

The delivery of edible items (but not praise) contingent on compliance with high-*p* instructions enabled the participants to sample a preferred edible item and therefore may have made compliance to the low-*p* instruction more likely (Bullock & Normand, 2006). Sampling could have acted as an establishing operation, increasing the value of edible items, and thereby increasing the likelihood of compliance with the low-*p* instruction, which resulted in an additional edible item. Sampling may have also interfered with the participants' activities during the session. This interference may have increased the likelihood of attending to the low-*p* instruction delivered by the experimenter, which could have also increased compliance. A related possibility is that the delivery of the edible items contingent on compliance with the high-*p* instructions acted as an abolishing operation for escape from the instruction. That is, the delivery of preferred edible items (but not praise) decreased the aversive properties associated with compliance to the low-*p* instruction. Compliance with the low-*p* instruction may be more likely when the demand context is less aversive (Ingvarsson, Kahng, & Hausman, 2008; Lalli et al., 1999; Lomas, Fisher, & Kelley, 2010; Lomas Mevers, Fisher, Kelley, & Fredrick, 2014).

A fourth possible mechanism is that the delivery of reinforcement for compliance with high-*p* instructions serves as a discriminative stimulus for compliance with a low-*p* instruction. In the current study, the edible item (M&M) delivered contingent on compliance with high-*p* instructions may have been discriminative for reinforcement contingent on compliance with the low-*p* instruction. That is, the M&M may have served as a discriminative stimulus for the receipt of additional edible items (candy corn) contingent on compliance with the low-*p* instruction. Although candy corn was available for compliance across all phases of the study, the delivery of M&Ms for compliance with high-*p* instructions may have made the availability of candy corn more salient. This may be similar to what occurs in the natural environment. For example, children receive instructions often, and compliance with many of these instructions does not result in the receipt of a highly preferred item. When the high-*p* sequence is used and high-quality reinforcement is delivered for compliance with high-*p* instructions, the reinforcement may be discriminative for additional reinforcement for compliance with the low-*p* instruction. In this way, compliance with the low-*p* instruction may become more likely.

Although participants in the current study received their most preferred edible item (candy corn) contingent on compliance with low-*p* requests across baseline and all other conditions, they did not contact this contingency until the second (Gary) or the third (Carl) baseline phase. Therefore, it is possible that the pattern of responding obtained in the first two to three baseline phases of Experiment 1 was due, at least in part, to this lack of exposure to the contingencies for compliance. However, both participants did eventually contact this contingency (candy corn for compliance in baseline), and their behavior did not change in any subsequent baseline sessions, which suggests that lack of exposure to the contingency was not the main reason for the obtained pattern of results.

Future research should examine various interreinforcement intervals in a procedure such as the one employed by Bullock and Normand (2006) and Normand and Beaulieu (2011) in which the experimenters found that noncontingent delivery of preferred items (without high-*p* instructions) increased compliance to low-*p* instructions, to determine if the effects are mediated by the amount of time between reinforcement deliveries. This procedural variation may identify the minimum density at which an interreinforcement interval is effective to increase compliance. This could have important implications for instruction delivery; parents and teachers could be advised to deliver reinforcement on specific fixed-time schedules to maximize compliance.

The practical implications of this study are straightforward: Practitioners should consider delivering a high-quality reinforcer contingent on compliance with high-*p* instructions to increase compliance with a low-*p* instruction. For many individuals, lower quality reinforcers may not be sufficient. Of course, the delivery of high-quality reinforcement, such as calorically dense edible items, on a frequent basis may not be possible or socially valid in some settings. Future research should examine the proportion of high-*p* instructions with delivery of high-quality reinforcement necessary to achieve increases in compliance to low-*p* instructions. It is possible that compliance with low-*p* instructions will increase with the delivery of reinforcement for compliance with only one or two high-*p* instructions rather than three. Future research should also examine reducing the proportion of high-*p* instructions on which a high-quality reinforcer is delivered for compliance while high levels of compliance to low-*p* instructions are maintained.

REFERENCES

Ardoin, S. P., Martens, B. K., & Wolfe, L. A. (1999). Using high-probability instruction sequences with fading to increase student compliance during transitions. *Journal of Applied Behavior Analysis*, *32*, 339–351. doi: 10.1901/jaba.1999.32-339

Bullock, C., & Normand, M. P. (2006). The effects of a high-probability instruction sequence and response-independent reinforcer delivery on child compliance. *Journal of Applied Behavior Analysis*, *39*, 495–499. doi: 10.1901/jaba.2006.115-05

Davis, C. A., & Reichle, J. (1996). Variant and invariant high-probability requests: Increasing appropriate behaviors in children with emotional-behavioral disorders. *Journal of Applied Behavior Analysis*, *29*, 471–482. doi: 10.1901/jaba.1996.29-471

DeLeon, I. G., & Iwata, B. A. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. *Journal of Applied Behavior Analysis*, *29*, 519–533. doi: 10.1901/jaba.1996.29-519

Ducharme, J. M., & Worling, D. E. (1994). Behavioral momentum and stimulus fading in the acquisition and maintenance of child compliance in the home. *Journal of Applied Behavior Analysis*, *27*, 639–647. doi: 10.1901/jaba.1994.27-639

Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis*, *25*, 491–498. doi: 10.1901/jaba.1992.25-491

Ingvarsson, E. T., Kahng, S., & Hausman, N. L. (2008). Some effects of noncontingent positive reinforcement on multiply controlled problem behavior and compliance in a demand context. *Journal of Applied Behavior Analysis*, *41*, 435–440. doi: 10.1901/jaba.2008.41-435

Lalli, J. S., Vollmer, T. R., Progar, P. R., Wright, C., Borrero, J., Daniel, D., … May, W. (1999). Competition between positive and negative reinforcement in the treatment of escape behavior. *Journal of Applied Behavior Analysis*, *32*, 285–296. doi: 10.1901/jaba.1999.32-285

Lomas, J. E., Fisher, W. W., & Kelley, M. E. (2010). The effects of variable-time delivery of food items and praise on problem behavior reinforced by escape. *Journal of Applied Behavior Analysis*, *43*, 425–435. doi: 10.1901/jaba.2010.43-425

Lomas Mevers, J. E., Fisher, W. W., Kelley, M. E., & Fredrick, L. D. (2014). The effects of variable-time versus contingent reinforcement delivery on problem behavior maintained by escape. *Journal of Applied Behavior Analysis*, *47*, 277–292. doi: 10.1002/jaba.110

Mace, F. C., & Belfiore, P. (1990). Behavioral momentum in the treatment of escape-motivated stereotypy. *Journal of Applied Behavior Analysis*, *23*, 507–514. doi: 10.1901/jaba.1990.23-507

Mace, F. C., Hock, M. L., Lalli, J. S., West, B. J., Belfiore, P., Pinter, E., & Brown, D. K. (1988). Behavioral momentum in the treatment of noncompliance. *Journal of Applied Behavior Analysis*, *21*, 123–141. doi: 10.1901/jaba.1988.21-123

Mace, F. C., Mauro, B. C., Boyajian, A. E., & Eckert, T. L. (1997). Effects of reinforcer quality on behavioral momentum: Coordinated applied and basic research. *Journal of Applied Behavior Analysis*, *30*, 1–20. doi: 10.1901/jaba.1997.30-1

Normand, M. P., & Beaulieu, L. (2011). Further evaluation of response-independent delivery of preferred stimuli and child compliance. *Journal of Applied Behavior Analysis*, *44*, 665–669. doi: 10.1901/jaba.2011.44-665

Pitts, L., & Dymond, S. (2012). Increasing compliance of children with autism: Effects of programmed reinforcement for high-probability requests and varied inter-instruction intervals. *Research in Autism Spectrum Disorders*, *6*, 135–143. doi: 10.1016/j.rasd.2011.03.013

Roane, H. S., Lerman, D. C., & Vorndran, C. M. (2001). Assessing reinforcers under progressive schedule requirements. *Journal of Applied Behavior Analysis*, *34*, 145–167. doi: 10.1901/jaba.2001.34-145

Rortvedt, A. K., & Miltenberger, R. G. (1994). Analysis of a high-probability instructional sequence and time-out in the treatment of child noncompliance. *Journal of Applied Behavior Analysis*, *27*, 327–330. doi: 10.1901/jaba.1994.27-327

Wehby, J. H., & Hollahan, M. S. (2000). Effects of high-probability requests on the latency to initiate academic tasks. *Journal of Applied Behavior Analysis*, *33*, 259–262. doi: 10.1901/jaba.2000.33-259

Wilder, D. A., Zonneveld, K., Harris, C., Marcus, A., & Reagan, R. (2007). Further analysis of antecedent interventions on preschoolers' compliance. *Journal of Applied Behavior Analysis*, *40*, 535–539. doi: 10.1901/jaba.2007.40-535

Zarcone, J. R., Iwata, B. A., Mazaleski, J. L., & Smith, R. G. (1994). Momentum and extinction effects on self-injurious escape behavior and noncompliance. *Journal of Applied Behavior Analysis*, *27*, 649–658. doi: 10.1901/jaba.1994.27-649

Zuluaga, C. A., & Normand, M. P. (2008). An evaluation of the high-probability instruction sequence with and without programmed reinforcement for compliance with high-probability instructions. *Journal of Applied Behavior Analysis*, *41*, 453–457. doi: 10.1901/jaba.2008.41-453

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