JOURNAL OF APPLIED BEHAVIOR ANALYSIS 2008, **41,** 393–404 NUMBER 3 (FALL 2008)

THE ROLE OF OVERT AND COVERT SELF-RULES IN ESTABLISHING A DAILY LIVING SKILL IN ADULTS WITH MILD DEVELOPMENTAL DISABILITIES

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The purpose of the current study was to explore the use of overt and covert self-rules in the acquisition, maintenance, and generalization of a chained task by adults with mild developmental disabilities. This research differed from previous research in that the experimenter did not deliver reinforcement for correct responses during training, and we examined the correspondence between each self-rule statement and each subsequent response on each trial. Results showed that the self-rules participated in control over participants' responding, in that the skill was acquired and shown to generalize in the absence of experimenter-delivered reinforcement. Moreover, performance was shown to deteriorate when the emission of overt, but not covert, self-rules was blocked.

DESCRIPTORS: daily living skills, rule following, self-rules, verbal behavior

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The study of rule following has been important conceptually for the field of behavior analysis because the functional control over behavior exerted by verbal rules or instructions was initially difficult to explain. In addition, the finding that the behavior of verbally competent participants often comes under control of rules when the rules are directly in conflict with reinforcement contingencies has engendered many questions about the relations among rules, behavior, and behavioral consequences (e.g., Hayes, Brownstein, Zettle, Rosenfarb, & Korn, 1986). Findings from a number of laboratory studies have given rise to the conceptualization of rules as verbal antecedent stimuli, which may at times be effective because reinforcement is made contingent on the emission of the behavior specified in the rule (Catania, Shimoff, & Matthews, 1989). The practical advantages of arranging for behavior to come under the control of rules are apparent. Catania et al. maintain that responding may be more likely to come under the control of rules when contingencies are too weak, remote, or complex; as stated by Skinner (1974, p. 129), "rules can usually be learned more quickly than the behavior shaped by the contingencies they describe."

A variety of studies have shown that verbally competent participants often generate and follow their own self-rules (Lowe, Beasty, & Bentall, 1983; Rosenfarb, Newland, Brannon, & Howey, 1992; Zlomke & Dixon, 2006). When the emission of self-rules occurs at the covert level, an individual is said to be functioning as a speaker and listener within the same skin (Poppen, 1989). This may occur when an individual repeats a rule covertly after following the same rule provided by others, but self-rules may also be derived from one's own observations of and interactions with the prevailing reinforcement contingencies (Poppen).

Learning to generate and follow self-rules seems to be a potentially useful self-management strategy for individuals who would otherwise be dependent on external instructions or prompting systems. For example, verbal

This project constituted the master's thesis in the Behavior Analysis and Therapy program at Southern Illinois University of the first author under the supervision of the second author. We thank Michael Lane and Erica Pozzie for their assistance with interobserver agreement data. We also gratefully acknowledge the Evaluation and Developmental Center in Carbondale, Illinois.

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doi: 10.1901/jaba.2008.41-393

prompts often are used when initially teaching chained tasks to individuals with developmental disabilities (Cooper, Heron, & Heward, 2007). The correct implementation and ultimate elimination of such a prompting system may require considerable time and resources. Moreover, once an individual is performing a skill independently, the prompts may no longer be accessible should a situation come about in which they are again necessary.

Teaching individuals with developmental disabilities to state and follow self-rules may be effective in facilitating the acquisition and generalization of a variety of chained tasks. For example, an individual employed in a cafeteria might be taught the chained task of assembling deli sandwiches by stating a self-rule prior to each step in the chained task. Such an instructional strategy may be advantageous in that the rules can be easily accessible as the task is performed in a variety of settings, and no preparation or upkeep of an external prompting system is required. Furthermore, the statement of rules at the covert level may be particularly acceptable in settings where a number of others are present. Thus, an instructional protocol in which individuals are taught to state and follow their own self-rules seems to be worthy of investigation.

Surprisingly, a technology based on rule governance is only in its infancy. Very few studies have examined the facilitative effects of self-rules on task performance, but results from those have been promising. For example, Wacker et al. (1988) examined whether teaching young adults with moderate to severe mental retardation to label the correct characters in a typing task prior to the typing of each character would result in skill mastery. Reinforcement was made contingent on both accurate labeling and typing. Not only did participants rapidly acquire the skills, but the typing skills generalized to novel settings and stimuli (Wacker et al.). Likewise, Vintere, Hemmes, Brown, and Poulson (2004) examined the role of self-instructions in the acquisition of ballet dance routines in preschool-aged children. A treatment package that consisted of self-instructions, modeling, and verbal praise was compared to a package that consisted of modeling and praise alone. The dance routines were acquired easily in both conditions, but acquisition was more rapid in the self-instruction condition. Some of the participants decreased their emission of self-rules once the routines were mastered, leading the authors to conclude that self-instructions may serve a discriminative function during skill acquisition, but this function may change once a skill is mastered. Finally, Grote (2003) showed that self-instructions were necessary for the correct completion of a sorting task by individuals with developmental disabilities, with task accuracy decreasing when the statement of self-rules also decreased.

Together, these results suggest that the statement of self-rules may enhance skill acquisition in persons with developmental disabilities. In all of the aforementioned studies, however, reinforcement was delivered for correct responses, making it difficult to attribute changes in behavior to rule versus reinforcement control. In many instances of rule following, socially mediated reinforcement is not delivered, as in the case of tracking, or rule-governed behavior under the control of the correspondence between the rule and the way the world is arranged (Hayes, Zettle, & Rosenfarb, 1989). For example, the behavior of turning on a television by pressing a button on the remote control device may come under the control of the statement "to turn on the TV, press the big red button," because of apparent correspondence between the rule and the way to actually turn on the television (Hayes et al.). In this example, behavior may eventually come under contingency control because rule following is followed by the activation of the television; however, socially mediated reinforcement is not necessary for the acquisition or maintenance of the behavior. In addition, in the aforementioned studies the possibility of arranging the statement of covert self-rules was not examined.

A pioneering study by Taylor and O'Reilly (1997) investigated the role of overt and covert self-instructions in facilitating the acquisition and generalization of a chained task in individuals with mild intellectual disabilities. Participants were first taught to overtly self-instruct the steps involved in a grocery shopping task. Specifically, four self-instruction statements that corresponded to each step in the task were established: (a) statement of the problem (e.g., "I need to look at my shopping list"), (b) statement of the correct response (e.g.,"look at shopping list"), (c) report on the response (e.g., "I am looking at the shopping list"), and (d) self-acknowledgment (self-reinforcement; e.g., "good job"). Rule statements and steps in the task analysis were modeled by the experimenter, and verbal praise was provided contingent on accuracy for each. Once the task was mastered, the statement of self-rules was blocked by requiring participants to repeat random numbers aloud, during which time task accuracy decreased. The same procedure was then used to establish control by covert rules, after which the statement of rules was again blocked, and task accuracy was again shown to decrease. These results suggest a powerful role for overt and covert self-rules in skill maintenance, in that results from the blocking sessions particularly allude to functional control over behavior exerted by the rules. However, contingency control could not be ruled out because the experimenter delivered reinforcement for correct steps in the task analysis. In addition, the authors call for an analysis of the degree to which each individual step in the task is controlled by each prior self-rule statement (Taylor & O'Reilly): If the behavior specified in each rule and the behavior itself do not correspond, rule control cannot be inferred (Matthews, Shimoff, & Catania, 1987).

The purpose of the present study was to use a procedure similar to that of Taylor and O'Reilly (1997) to examine the relation between overt and covert self-rules and performance on a chained task. Unlike Taylor and O'Reilly, we omitted the delivery of socially mediated reinforcement for correct steps in the chained task during training and also examined the correspondence between each overt self-rule statement and each subsequent response.

METHOD

Participants

Three young adults with mild developmental disabilities and reasonably well-developed receptive and expressive language skills participated in the study and were selected because of their need for instruction on daily living skills. Earl was a 22-year-old man with a learning disorder, not otherwise specified, who scored a 91 on the Full-Scale Intelligence Quotient (FS-IQ) portion of the WAIS III (Wechsler, 1997) with a Verbal Scale (VS) score of 81. Piper was a 19-year-old woman with a learning disability and generalized anxiety disorder who scored a 78 on the FS-IQ portion of the WAIS III with a VS score of 77. Max was a 19-year-old man with mental retardation, a speech impairment, and attention deficit hyperactivity disorder, who scored a 59 on the FS-IQ portion of the WAIS III with a VS score of 58. The Woodcock Johnson III (WJ-III) Cognitive Abilities assessment is used by the facility to summarize an individual's strengths and weaknesses, determine the nature of impairment, and aid in the classification and diagnosis (Mather & Woodcock, 2001). Max scored a 58 on the verbal ability section, which places him in the low range of the scale. Earl and Piper were administered the WJ-III Achievement Test, which provides grade equivalents on academic skills. Earl scored a grade equivalent of 6 on the oral language portion of the examination, and Piper scored a 4.5 grade equivalent on the oral language portion of the examination.

Table 1
Task Analysis for Ironing Pants

Step	Description
1	Set up board
2	Check water level
3	Fill up water
4	Plug in iron
5	Check setting
6	Holding by cuff, line up front and back
7	Place back side up, completely on the board
8	Iron back of leg, no wrinkles
9	Flip over, front side up, completely on board
10	Iron front of leg, no wrinkles
11	Holding by cuff, line up front and back
12	Place back side up, completely on the board
13	Iron back of leg, no wrinkles
14	Flip over, front side up, completely on board
15	Iron front of leg, no wrinkles
16	Hang up pants on hanger
17	Unplug iron
18	Fold up board

Setting

Self-instruction training sessions were conducted at a human service agency for young adults with mild disabilities. The facility provides vocational, independent living, residential, and adult educational services. Training sessions were conducted in an unused classroom equipped with tables and chairs. Generalization probes were conducted in the laundry room of the residential center equipped with a washer, dryer, storage cabinets, and drying racks. Task materials included an iron, a folding ironing board with a pad, a bottle of distilled water, a hanger, and a pair of polyester dress pants. A different iron and different pair of pants (cotton khaki dress pants) were used in the generalization setting.

Task, Response Measurement, and Interobserver Agreement

The experimental task was ironing a pair of pants based on an 18-step task analysis (see Table 1). We based the steps in the task analysis on a proficient model's performance. The independent living skills instructor at the facility socially validated the task. We chose this task because it is an adult daily living skill that is age appropriate and useful for individuals seeking independent living and employment. Mastery of the task would permit the participants to look professional when applying and interviewing for employment positions.

The primary dependent measure was the percentage of correct steps completed based on the task analysis in the training and generalization settings. The secondary dependent measure was the number of correspondences between each participant's overt self-instruction statement prior to each step in the task analysis and his or her completion of each respective step (during overt training). The independent variables were the overt self-instruction statements (the statements of the correct response and the self-acknowledgment statements) emitted in the training and generalization settings during overt training and generalization testing.

During all phases, a task analysis response was scored as correct if the participant independently completed the response. Any step the experimenter had to complete for the participant to advance through the task analysis was scored as incorrect. Statements of the correct response and self-acknowledgment statements were scored separately and as correct if the participant gave a correct unprompted response to the experimenter's query (i.e., "What do you do first [next]" for the statement of the correct response and "How did you do?" for the self-acknowledgment statement). If a self-instruction statement was verbalized out of sequence in the task analysis, it was scored as incorrect. Correspondence was scored as occurring if the participant's self-instruction statement was followed by the accurate completion of the step specified in the self-instruction statement. In other words, the participant correctly performed the nonverbal task that was verbally instructed (e.g., the participant stated "set up ironing board" and then set up the ironing board). Correspondence was scored as not occurring if the participant's self-instruction statement was not followed by the accurate completion of the step specified in the self-instruction statement or if the self-instruction statement was prompted or did not occur (e.g., the participant stated "iron the back of pants, no wrinkles" and did not iron the wrinkles).

Interobserver agreement on the four dependent measures was measured for each participant across all phases. The point-by-point agreement method was used to assess the percentage of agreement during 37% of all sessions. Agreement was calculated by dividing the number of agreements for each correct and incorrect step on the task analysis, overt self-instruction statements, self-acknowledgment statements, and correspondence between the participant's overt self-instruction and his or her completion of each respective step by the total number of agreements plus disagreements and converting this ratio to a percentage. The mean agreement for all measures during all phases ranged from 93% to 100%.

Experimental Design

A multiple baseline design across participants with multielement phases embedded (i.e., blocking and nonblocking) was used to determine the effects of the overt and covert self-instruction training on skill acquisition and maintenance. Test probes were conducted prior to overt self-instruction training and again following completion of that phase. Alternating blocking and nonblocking sessions were then implemented to determine whether there was a functional relation between the overt self-instructions and performance on the task. Following this alternation, covert self-instruction training was introduced, which was followed by test probes. Alternating blocking and nonblocking sessions were implemented again to determine whether there was a functional relation between the covert self-instructions and performance on the task. Sessions were conducted 3 to 5 days per week and lasted 30 to 40 min.

Baseline

Baseline sessions were conducted in the training setting with an additional probe in the generalization setting to determine each participant's current skill level on the task and his or her initial level of self-rule and self-acknowledgment statements prior to any instruction. No instructional feedback was provided by the experimenter during this phase. During each session, the participant was provided with all of the supplies necessary for the task and was given the general instruction to iron the pants. Prior to performing each step on the task analysis, the experimenter asked the participant, "What do you do first [next]?" which provided the opportunity for the participant to state the correct response. If the participant performed the step correctly, the experimenter said "How did you do?" which provided the opportunity for the participant to state a self-acknowledgment. The experimenter did not respond to the participant's statements of the correct response, self-acknowledgment statements, or statements that were unrelated to the task. If the participant performed the step incorrectly or did not perform the step at all, the experimenter arranged for the next step to be completed using the multiple opportunity method (Cooper et al., 2007). If the participant's error prevented his or her completion of the next step in the chain, the experimenter completed the step for the participant in order for the participant to proceed in the chained task. The baseline phase ended for a participant when the percentage of steps correct was judged to be stable via visual inspection.

Overt Self-Instruction Training

Each session began with the experimenter first explaining to the participant that he or she was going to watch the experimenter iron the pants and listen to what the experimenter said before and after each step in the task. The experimenter then modeled the steps of the task analysis from beginning to end and stated each step's self-instruction statements prior to each step. For example, the statement of the correct response for setting up the board was "set up board." The experimenter then verbalized the self-acknowledgment statement ("good job") after completing each step. Next, the experimenter told the participant to iron the pants while listening to what the experimenter said before and after each step in the task. During this portion of training, the experimenter stated the correct response (e.g., "set up board"), the participant performed the step, and the experimenter verbalized the self-acknowledgment statement (e.g., "good job") once the participant correctly completed the response. Finally, the experimenter told the participant to iron the pants while emitting the statement of the correct response prior to performing the step and the self-acknowledgment statement following the correct completion of the step.

Incorrect responses on the task analysis were prompted with a manual or gestural prompt after the step was undone, if necessary. Incorrect statements were prompted using a from least-to-most prompting hierarchy. First, the experimenter said, "What do you say next?" or "How did you do?" followed by the instruction to try again. If the first prompt was insufficient to produce the correct statement, then the experimenter gave a direct prompt (e.g., "say, [statement]" or "say, [acknowledgment]"), again followed by the instruction to try again. If the direct prompt was still unsuccessful, the experimenter recited the statement and instructed the participant to try again. No experimenter feedback in the form of verbal or nonverbal praise was provided during this phase.

Overt self-instruction training ended once a participant performed all of the steps on the task analysis with 100% accuracy for three consecutive sessions and emitted the correct response and self-acknowledgment statements without prompts for three consecutive sessions.

Test Probes

Test probes were conducted in both the training and generalization settings. The procedures were identical to those used during baseline, with the exception that a novel iron and pair of pants were used in the generalization setting.

Blocking and Nonblocking of Overt Self-Instruction

Blocking and nonblocking sessions were conducted in both the training and generalization settings. Each pair of blocking sessions was followed by a pair of nonblocking sessions. Prior to the start of each blocking session, the participant was told to repeat the numbers that the experimenter stated aloud while the participant was ironing the pants. The experimenter presented the numbers approximately every second. It was assumed that repeating numbers aloud would block the emission of overt self-instruction statements (Ericsson & Simon, 1984; Hayes, 1986; Taylor & O'Reilly, 1997). If the step was performed incorrectly, the experimenter arranged for the next step to be completed using the multiple opportunity method. If the participant's error prevented him or her from completing the next step in the chain, the experimenter completed the step in order for the participant to continue.

During the nonblocking sessions, the experimenter told the participant that he or she did not have to repeat any numbers aloud. The experimenter used a manual or gestural prompt after the step was undone following a participant's incorrect response on the task. The experimenter used least-to-most prompting following incorrect statements.

Covert Self-Instruction Training

Sessions were identical to the overt self-instruction training with the addition of covert training following overt training. After the participant performed the ironing task with the overt training procedures, the experimenter told the participant to iron the pants while saying the instructions and self-acknowledgment statements silently to him- or herself. If the participant emitted any statement aloud, he or she was reminded to state the self-instructions to him- or herself. No feedback (verbal or nonverbal praise) was provided during this phase. Covert self-instruction training ended once a participant performed all of the steps on the task analysis with 100% accuracy for three consecutive sessions.

Blocking and Nonblocking of Covert Self-Instruction

Blocking and nonblocking sessions were conducted in both the training and generalization settings. Each pair of blocking sessions was followed by a pair of nonblocking sessions. The same blocking procedure that was used during the overt blocking sessions was used to block covert self-instruction statements. The same procedure used for incorrect responses in the blocking of overt self-instructions was used for any incorrect response during these blocking sessions.

During the nonblocking sessions, the experimenter told the participant that he or she would not have to repeat any numbers. The nonblocking sessions were identical to those implemented during the covert self-instruction sessions.

RESULTS

Figure 1 shows the percentage of correct steps in the task analysis for baseline, overt self-instruction training sessions, blocking and nonblocking of overt self-instructions, covert self-instructions, blocking and nonblocking of covert self-instruction training sessions, and test probes for each participant. Piper completed a mean of 23% and 33% of the steps correctly during baseline in the training and generalization settings, respectively. She performed with 100% accuracy during overt self-instruction training and attained mastery criterion in 12 sessions. She completed 100% and 94% of the steps correctly in the training and generalization settings, respectively, during test probes following overt self-instruction training. Her performance decreased during the blocking sessions in the training (M = 91%) and generalization (M = 75%) settings. She performed with high accuracy in all of the alternating nonblocking sessions. She performed with 100% accuracy immediately after the introduction of covert self-instruction training, attaining mastery criterion in three sessions. She completed 100% and 94% of the steps in the task correctly in the training and generalization settings, respectively, during the test probes following covert self-instruction training. She completed a mean of 96% and 83% of the steps correctly during the covert blocking sessions and 98% and 95% in the nonblocking sessions in the training and generalization settings, respectively.

During baseline (data not shown), Piper made (a) the correct response on a mean of 22% and 33% of the steps, (b) 44% and 50% correct self-acknowledgment statements, and (c) a mean of two and four verbal responses that corresponded with her nonverbal behavior in the training and generalization settings, respectively. When overt self-instruction training began, her statements of the correct response, self-acknowledgment statements, and the correspondence between her verbal and nonverbal behavior increased steadily. She stated (a) the correct response on a mean of 100% of steps, (b) correct self-acknowledgment statements on a mean of 100% of steps, and (c) 18 and 17 verbal responses that corresponded with her nonverbal behavior in the training and generalization settings, respectively during test probes following overt self-instruction training. She emitted no statements of the correct response or self-acknowledgment statements during overt blocking sessions. She stated (a) the correct response prior to 100% of the steps, (b) correct self-acknowledgment statements on 100% of the steps, and (c) a mean of 18 verbal responses that corresponded to her nonverbal behavior during nonblocking sessions in the training and generalization settings, respectively. She emitted no statements of the correct response or self-acknowledgment statements, and the correspondence between her verbal and nonverbal behavior was zero during covert self-instruction training and blocking and nonblocking of covert self-instruction.

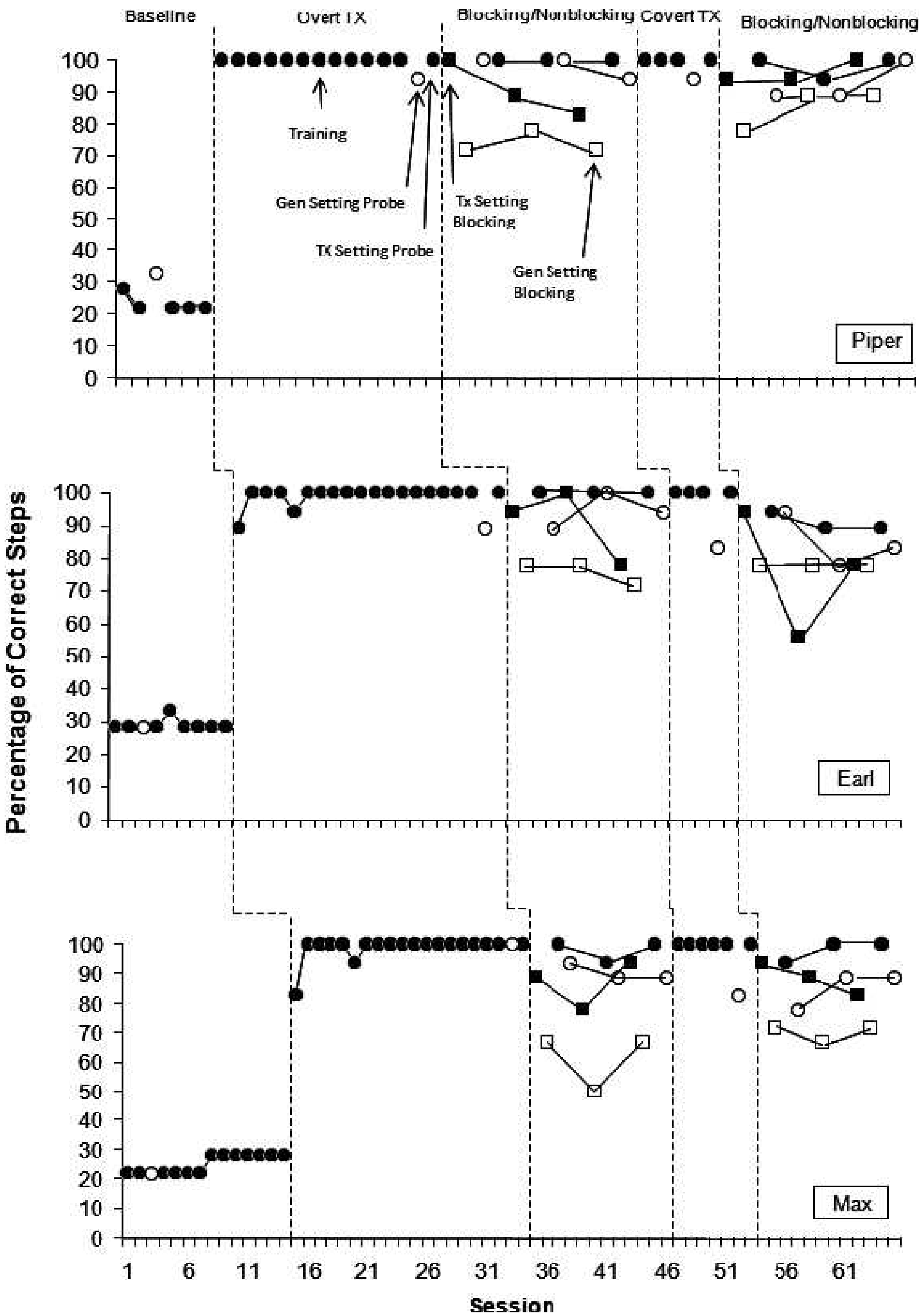

Figure 1. Percentage of correct steps in the ironing task for all participants during all experimental phases.

Earl completed a mean of 29% and 28% of the steps correctly during baseline in the training and generalization settings, respectively. He performed the steps with 100% accuracy shortly after the introduction of overt self-instruction training. He completed 100% and 89% of the steps correctly in the training and generalization settings, respectively, for the test probes following overt self-instruction training. His performance during the overt blocking sessions was more variable in the training setting (*M* = 90%) and more disrupted in the generalization setting (*M* = 75%). During the alternating nonblocking sessions, he performed with 100% and 94% accuracy in the training and generalization settings, respectively. He performed with 100% accuracy immediately after the introduction of covert self-instruction training, attaining mastery criterion in three sessions. He completed 100% and 83% of the steps in the task correctly in the training and generalization settings, respectively, during the test probes following covert self-instruction training. He completed a mean of 75% and 78% of the steps correctly during the covert blocking sessions in the training and generalization settings, respectively. He performed with a mean of 91% and 86% accuracy during the alternating nonblocking sessions in the training and generalization settings, respectively.

In baseline, Earl stated the correct response (data not shown) on a mean of 20% of the steps, emitted a mean of 33% correct self-acknowledgment statements, and emitted a mean of three verbal responses that corresponded with his nonverbal behavior. When overt self-instruction training began, his statements of the correct response, self-acknowledgment statements, and the correspondence between his verbal and nonverbal behavior increased steadily. He emitted no statements of the correct response or self-acknowledgment statements and showed no correspondence between his verbal and nonverbal behavior during the blocking of overt self-instruction sessions in the training and generalization settings. During alternating nonblocking sessions, he stated (a) the correct response prior to a mean of 98% and 90% of the steps, (b) the correct self-acknowledgment statements on a mean of 93% and 96% of the steps, and (c) 18 and 15 verbal responses that corresponded with his nonverbal behavior in the training and generalization settings, respectively. He emitted no statements of the correct response or self-acknowledgment statements, and the correspondence between his verbal and nonverbal behavior was zero during covert self-instruction training, test probes following covert training, and blocking and nonblocking of covert self-instruction sessions.

Max completed a mean of 25% and 22% of the steps correctly during baseline in the training and generalization settings, respectively. He performed with 100% accuracy shortly after the introduction of overt self-instruction training. He completed 100% of the steps correctly in the training and generalization settings during the test probes following overt self-instruction training. His performance decreased during the overt blocking sessions conducted in the training (*M* = 86%) and generalization (*M* = 59%) settings. He performed with high accuracy during the alternating nonblocking sessions that were conducted in the training and generalization settings. He performed with 100% accuracy immediately after the introduction of covert self-instruction training. He completed 100% and 83% of the steps in the task correctly in the training and generalization settings, respectively, during covert test probes following covert self-instruction training. His performance decreased during the covert blocking sessions in the training (*M* = 89%) and generalization (*M* = 70%) settings. He performed with a mean of 97% and 84% accuracy in the alternating nonblocking sessions that were conducted in the training and generalization settings, respectively.

In baseline (data not shown), Max made (a) the correct response on a mean of 10% and 6%

of the steps, (b) a mean of 25% and 18% correct self-acknowledgment statements, and (c) a mean of two and one verbal responses that corresponded with his nonverbal behavior in the training and generalization settings, respectively. When overt self-instruction training began, his statements of the correct response, self-acknowledgment statements, and the correspondence between his verbal and nonverbal behavior decreased initially, but then increased steadily. He made (a) the correct response on 100% of the steps, (b) correct self-acknowledgment statements on 100% and 89% of the steps, and (c) 18 verbal responses that corresponded with his nonverbal behavior in the training and generalization settings, respectively. He emitted no statements of the correct response or self-acknowledgment statements and showed no correspondence between his verbal and nonverbal behavior during the blocking of overt self-instruction sessions in the training and generalization settings. He made (a) the correct response on 100% and 98% of the steps, (b) correct self-acknowledgment statements following a mean of 96% of the steps, and (c) 18 and 16 verbal responses that corresponded to his nonverbal behavior during nonblocking sessions in the training and generalization settings, respectively. Statements of the correct response and correct self-acknowledgment statements decreased to zero, and the correspondence between his verbal and nonverbal behavior was zero during covert self-instruction training, covert self-instruction test probes, and blocking and nonblocking of covert self-instruction.

DISCUSSION

The purpose of the current study was to examine the effects of overt and covert self-rules on the acquisition and execution of a daily living skill in adults with developmental disabilities. As in the previous study by Taylor and O'Reilly (1997), which assessed the functional relation between self-rules and behavior, this study also arranged for the systematic blocking of the emission of self-rules. Unlike previous studies, the procedures in the present study did not include experimenter-generated reinforcement during training, thus making it easier to attribute the changes in behavior to control by the rules. In addition, the correspondence between each individual self-rule statement and subsequent nonverbal behavior was examined, an analysis that was not undertaken in previous research, such that rule control on each trial could be inferred. Overall, the results suggest that the overt and covert self-instructions played a role in the acquisition and maintenance of the task, self-instruction statements controlled responding on each trial, and the skill generalized to a novel setting and novel stimuli. These results thus converge with previous research illustrating the effects of a teaching technology based on self-rules (Taylor & O'Reilly; Vintere et al., 2004).

All 3 participants mastered the task in this study, in that mastery criterion was attained soon after the onset of training despite relatively low accuracy levels during baseline. Similarly rapid acquisition was reported by Taylor and O'Reilly (1997). These results are particularly noteworthy given the absence of socially mediated reinforcement during training. It should be pointed out, however, that the instructor modeled the task at the start of each instructional session, such that the role of modeling in skill acquisition cannot be ruled out. Moreover, given the continuous presence of the experimenter throughout the study, the delivery of subtle forms of socially mediated reinforcement, albeit unlikely, remains a possibility. Finally, the availability of conditioned reinforcers after completion of each step in the chained task is an explanation that warrants consideration: The completion of each step in the chained task may have produced a stimulus change that functioned as conditioned reinforcement for each preceding step and a discriminative stimulus for the next response in the chain (Cooper et al., 2007). Because reinforcement was not available after completion of the entire task, this possibility seems doubtful as an exclusive explanation for the participants' acquisition and maintenance of the task.

A functional relation between both the overt and covert self-rules and task performance is suggested by the modest transitions in performance between the blocking and nonblocking sessions. Performance was particularly disrupted during the generalization probes that occurred during blocking sessions when participants performed the task in a novel setting and with novel stimuli. The particularly erratic patterns of responding observed during covert blocking and nonblocking sessions specifically point to the role of control by covert self-rules, because these patterns of responding are exactly what would be expected when the responding of individuals with mild cognitive deficits comes under the control of covert self-rules (e.g., Taylor & O'Reilly, 1997). Errors were not handled identically between blocking and nonblocking conditions, however, making it difficult to compare performance in the two conditions directly. Besides the recitation of random numbers, blocking sessions were identical to posttraining generalization probes, and participants' performance during blocking sessions in the generalization setting was always lower than during posttraining generalization probes. It is nonetheless possible that the participants' recitation of random numbers during blocking sessions simply interfered with their nonverbal behavior. It is also plausible that the participants did not always recite the random numbers covertly during blocking sessions. However, it was impossible to directly observe and measure covert verbal behavior, which is an obvious disadvantage of investigations of covert verbal behavior. Rather than dismissing such phenomena as being outside the realm of applied behavior analysis, we might be in a better position as practitioners to recognize that covert self-talk can, in fact, participate in control over behavior, even in individuals with cognitive deficits. The challenge, then, is to identify experimental approaches that will permit the analysis of such self-talk (see Friman, Hayes, & Wilson, 1998).

Further confirmation of rule control stems from the finding that self-rule statements were always shown to correspond to the subsequent response; thus, it can be concluded that the participants consistently followed their own self-rules. In addition, the participants' statements of the correct response and self-acknowledgment statements were remarkably consistent with each other as well as with task accuracy.

The results of this study show that individuals with mild developmental disabilities can easily be taught to emit and follow their own self-rules. Because no explicit consequences were delivered for complying with each self-rule statement, it is possible that the behavior exhibited by participants constituted tracking—rule-governed behavior under the control of the correspondence between the rule and the way the world is arranged (Hayes et al., 1989). In other words, the participants' completion of each step in the chain and the ability to go on to each subsequent step may have reinforced following the rule on each trial. It is also possible that the participants' self-acknowledgment statements reinforced compliance with the self-rule statements, in which case participants' behavior could be regarded as a ply—rule-governed behavior that is reinforced because it complies with a rule (Hayes et al., 1989). In this case, both the rules and consequences for following the rules are delivered by the speaker responding to himself or herself as listener. The latter possibility is somewhat dubious, however, because it took a number of training sessions for participants to master the self-acknowledgment statements; in fact, the task was mastered several sessions before the self-acknowledgment statements were mastered for all of the participants.

The inclusion of blocking sessions to block the emission of self-rules is one procedural approach to demonstrating a functional relation between self-rules and behavior. Future research might examine the effects on task performance when the self-rules are altered. Additional experiments might also employ a verbal protocol analysis (Ericsson & Simon, 1984; Taylor & O'Reilly, 1997), a technique that has been employed in many basic studies but few applied studies to date. Examining the correspondence between ongoing verbalizations and task performance certainly seems to be a viable approach to further analyzing the degree to which self-rule statements exert functional control over task performance. Future experimentation of this nature may contribute to the development of a technology based on rule following that may promote less reliance on staff and optimal task performance in a variety of service settings for persons with developmental disabilities.

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Received October 28, 2006
Final acceptance February 2, 2007
Action Editor, Chris Ninness