Effects of Covert Audio Coaching on Parents' Interactions with Young Children with Autism

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Published online: 20 August 2014

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Abstract Children with autism spectrum disorders (ASD) frequently present intervention challenges for parents. Covert audio coaching (CAC) has not been studied with parents, nor as an intervention to teach household routines and tasks. Further, evidence of generalization with CAC is limited. We examined the effectiveness of immediate feedback via CAC on mothers' interactions with their children with ASD. Mothers learned to deliver effective prompts and praise, and generalized these interactions to novel (untrained) routines. Children increased the accuracy of training and generalization tasks after their mothers received the coaching intervention.

Keywords Covert audio coaching · Parent child interactions · Home-based interventions · Parent coaching · Generalization outcomes

- Coaching has strong potential as an in-home intervention for families;
- Covert audio coaching (CAC) provides immediate performance feedback from a distance and shows promise in teacher preparation and supported employment studies;
- CAC's generalized outcomes are not well established, nor has CAC been applied in families' homes;
- As mothers increased the effectiveness of their interactions, they applied these interactions in novel situations, and improvements were seen in children's performance of household routines.

Effective prompts rely on a trainer's ability to deliver the right prompt, at the right time, and with high probability that the prompt will be present in naturally occurring interactions. Since young children with autism spend most of their time with parents or caregivers, an effective prompting technology is needed so parents can enhance children's learning in natural family environments (Carothers and Taylor, 2004). Further, parents typically raise their children without feedback from interventionists, so interventions that promote generalization and maintenance are needed (Strain and Hoyson, 2000).

CAC incorporates remote coaching to provide immediate performance feedback via wireless radio devices, with "coaches" positioned apart from the individuals receiving feedback. With families, a coach could be present in the home but play a covert, supporting role without physically entering into the parent-child interaction. CAC has been used in teacher training contexts. Scheeler and Lee (2002) increased preservice teachers' completion of three-term contingency trials when teachers wore an ear bud and a coach-provided feedback through the remote radio system. Goodman et al. (2008) increased novice teachers' rate and accuracy of learn units during instruction. Teachers also maintained their gains when the prompts were removed. Scheeler et al. (2010) used CAC with peer coaching to support co-teachers in inclusive classrooms. Scheeler et al. (2009) found mixed evidence of maintenance when only some student teachers' improvements maintained after CAC was removed. However, when CAC was paired with explicit generalization strategies, improvements maintained, and subsequently were observed in new teaching settings.

Bennett and his colleagues (2010; 2013a; 2013b) expanded CAC to deliver performance feedback directly to adolescents and adults with disabilities to improve employment skills. In these studies, supported employees and secondary students with autism showed rapid improvements in task accuracy and fluency. In all of the studies, employment skills maintained weeks after the coaching was removed. To date only one study explored

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CAC with families. Crimmins et al. (1984) helped a parent improve her interactions with her 4-year-old in a clinic playroom; her new skills maintained after the coaching was discontinued.

We investigated CAC for parents of children with autism to improve interactions during routine household tasks. If effective, this allows professionals to work in the home by playing a covert, supporting role. Our research questions explored whether a coach using CAC would change parents' prompts and praise to their children during household routines, whether parents' changes might affect children's task accuracy and independence, whether parent improvements might generalize to routines not the focus of the CAC, and whether any parent changes on the generalization tasks might improve children's performance on these same tasks.

Mothers and their children with autism spectrum disorders (ASD) participated based on willingness to allow researchers to assist them interact during typical household tasks and routines at home. Participants included Bob (6.8 years) and his mother (37-year-old attorney); Thomas (6.2 years) and his mother (33-year-old nutritionist); and Steve (5.7 years) and his mother (32-year-old homemaker). Two tasks that were difficult for their children to complete were selected because: (a) the child did not perform the task independently, (b) parents provided high levels of prompts, and (c) the task was part of the typical home routine. One task became a training task where a coach taught the mother to deliver effective prompts and praise. For the generalization task, no coaching was provided. Bob's tasks were making an art project (training) and completing a task using manipulatives (generalization); Thomas's tasks were taking a bath (training) and playing appropriately (generalization); Steve's tasks were getting dressed (training) and brushing teeth (generalization). The tasks were task-analyzed to measure mother and child outcomes.

During baseline, the coach asked each mother to engage in the routines as they would on any typical day. The coach and mothers wore the radios, but no coaching was delivered. During the CAC intervention, a coach delivered instructions to the mothers by whispering into the microphone so they could hear what to do via the ear bud. The coach was positioned out of the mothers' line of vision, and instructed mothers to use a least-to-most prompt hierarchy, or to deliver praise for accurate child performance. To establish whether the mothers' would generalize their prompts and praise to non-training routines with the children, generalization observations were made without coaching feedback. Finally, we made follow-up observations after each mother reliably delivered prompts.

Figure 1 provides four data sets. Panel 1 shows CAC fidelity (prompts and praise delivered to mothers only during the intervention, and not during baseline or follow-up), with Bob's, Thomas', and Steve's mother presented in order. As

designed, there were no coach's instructions provided during baseline. When each mother's CAC was implemented, the coach delivered prompts and praise. As Bob's mother's prompts and praise increased (shown in panel 2), the coach's instructions decreased slightly. For Thomas' mother, the coach delivered a steady level of prompts, then decreased after nine intervention sessions; praise remained high. Steve's mother's coaching prompts were high and stable throughout the intervention; initially, few praise statements were delivered; however, the coach's praise steadily increased from session 10. With all mothers, prompts and praise by the coach remained at 0 during follow-up observations, again demonstrating CAC fidelity and that the mothers were implementing effective interactions with their children.

Next, we examined prompts and praise that mothers delivered to their children during training tasks (panel 2). Each mother provided numerous verbal prompts to their children during baseline, rarely using visual or gestural prompts. They seldom provided praise. When they received CAC, mothers showed the following pattern: an increase in visual or gestural prompts, an increase in praise for accurate child performance, and a decrease in verbal prompts. As children's skill performance improved, mothers' overall prompting levels decreased. When CAC for the mothers was removed, they continued their high levels of praise; their prompts remained balanced, but relatively low and stable.

Seeing the impact of the coaching on the mothers, we next examined whether changing interactions with children coincided with any changes in children's task completion (panel 3—training tasks). During baseline, no children performed their tasks independently. When mothers received the CAC (and subsequently changed their prompts to children), each child showed a steady increase in performance. When mothers' coaching was withdrawn, the children's performance remained accurate and stable; all displayed substantial increases on their respective training tasks following the CAC on these tasks with their mothers, and performance remained high and stable during follow-up observations.

We also explored changes in mothers' interactions with tasks that were not the target of coaching (generalization data in panel 4). During generalization observations corresponding to baseline, each mother followed a similar pattern: most prompts were verbal, and few visual or gestural prompts and praise were delivered. When mothers received CAC on the training tasks, they substantially increased their praise. They also decreased their verbal prompts on the generalization tasks and balanced the use of visual and gestural prompts. All mothers decreased their prompts as their children displayed more independent performance on generalization tasks.

The last generalization evidence we explored involved children's performance on generalization tasks. These data represent the tertiary impact of CAC: impact on mothers→impact on children's training tasks→impact on children's

Panel 1. Coach's Delivery of Prompts and Praise to Mothers. Last three data points indicate sessions were 10 days apart.

Panel 2. Mothers' Delivery of Prompts and Praise on Training Tasks. Last three data points indicate sessions were 10 days apart.

Panel 3. Child Performance on Training and Generalization Tasks. Last three data points indicate sessions were 10 days apart.

Panel 4. Mothers' Delivery of Prompts and Praise on Generalization Tasks. Last three data points indicate sessions were 10 days apart.

Fig. 1 Four data sets of the study

generalization tasks (open circles on panel 3). During generalization observations corresponding to baseline, children

showed minimal engagement in these routines. When the CAC began, each child steadily increased his task completion;

the improvements maintained when CAC was withdrawn from the training task.

In summary, covert audio coaching helped parents improve their interactions with their children with ASD during simple household routines. When coaches delivered covert feedback to the mothers, they substantially altered their interactions with children by (a) decreasing ineffective verbal requests, (b) increasing more effective visual or gestural prompts, and (c) increasing praise when their children performed the desired routines. Bob's mother increased her gestural and visual prompts and decreased verbal prompts to half of her baseline mean; her praise increased by a factor of four. Thomas' mother provided verbal prompts during nearly all initial observations, but reduced these by approximately 2/3 following the coaching and increased her gestural and visual prompts. As the mothers' adopted more effective interactions with their children, their children performed their tasks more independently and accurately.

The exploration of generalization effects sets this study apart from previous coaching literature. Specifically, two generalized outcomes were observed: (a) improvements in mothers' prompting skills on children's routines not targeted for training and (b) improvements in children's routines that were not the focus of the CAC. As CAC helped the mothers improve their interactions on training tasks, they spontaneously improved their interactions during routines in which they never received the coaching. As mothers' interactions improved, the children also increased their accuracy and independence on generalization tasks. This is the first CAC study to show robust and controlled generalization effects. Changes in both parents' and children's behavior provide strong support for the efficacy of covert audio coaching as a future strategy for producing generalized outcomes. The implications for practice are positive. CAC could serve as an effective, family-friendly strategy for in-home interventionists. For researchers, this study extends the efficacy of CAC as a prompting strategy beyond teacher preparation and supported employment.

Method

Three mother-child dyads participated based on four criteria:

1. Child had a formal diagnosis of autism;
2. Mothers and children were willing participants;
3. Children demonstrated low accuracy on daily routines and tasks;
4. The parents allowed the research team to intervene in their homes.

Bob attended general education kindergarten and received special education daily. Bob read and understood sentences

including one-step directions. Bob's mother quit her job as an attorney when Bob was diagnosed. She lived with her husband and two sons. Thomas also attended a general kindergarten classroom. He identified 50 sight words, recognized all alphabet letters, decoded some phonemic sounds with assistance, and used visual schedules with words and picture symbols. Thomas' mother lived with her husband and Thomas' siblings who were also on the spectrum. Steve attended special and general education kindergarten classes. Steve was an avid reader who read short books and answered simple "WH" questions. Steve's mother was a homemaker who lived with her husband and Steve's sister.

The study was conducted in the families' homes. For Bob, observations of both tasks occurred in the kitchen. For Thomas, training task coaching occurred in the bathroom; generalization assessment was in a nearby playground. For Steve, training task coaching occurred in the living room, and generalization assessment was in the bathroom and kitchen.

Audio coaching equipment consisted of Motorola two-way radios, model T-6500, single ear buds for mothers, and an ear bud/microphone for the coach. Radios and ear buds cost under \$50; radios were kept by the research team, but each family kept their own ear buds (see www.factoryoutletstore.com/Motorola for radio and ear bud options). The radios were set so the coach could talk to the mothers, but mothers could not reply. Radios were clipped to the mothers' clothing for hands-free use. The coach prepared laminated visual supports using boardmaker for the families. The coach also supplied pencils, crayons, markers, construction paper, small bath tub toys, and plastic bins. A Sony hand-held recorder with prerecorded tapes signaled 10 s observe, 5 s record observation intervals.

The primary dependent variable was the percentage of intervals and the topography of mothers' prompts and praise to the children to complete their tasks. For each mother/child dyad, prompts included (a) physical, (b) gestural, (c) verbal, and (d) visual prompts, as well as praise. Prompts and praise were recorded if any of these behaviors were delivered to the child. (Definitions are available from the authors). The secondary dependent variable was the percentage of steps completed independently by the child on each task-analyzed routine. These data established whether mothers' prompts had any impact on children's task performance. A separate measure (independent variable) included the percentage of intervals with prompts to the mother to deliver instruction and praise to the children. These data established the training fidelity.

A partial interval data system was used to collect the percentage of intervals of prompts and praise delivered by the coach to the mothers, and by mothers to their children. Data were also collected on independent task completion by children. Following a direction to begin a routine, each child was observed as he completed each step. The data collector noted if the step was prompted by the mother or if it was completed independently by the child.

To select tasks, mothers nominated a pool of simple daily tasks and routines that were difficult for their children to complete. Two tasks (training and generalization) were selected for each family and task analyzed (7–9 steps apiece). Before baseline, the coach spent two sessions familiarizing mothers with the technology and equipment. During these sessions, mothers were asked to engage in a simple home routine other than the training or generalization task, and the coach delivered instructions via the radio transmitter. This allowed mothers to become familiar with the radios, listen for prompts without speaking to the coach, set appropriate volume levels, and learn the prompt vocabulary.

A multiple baseline across mother–child dyads assessed the effects of CAC; a concurrent baseline on generalization tasks established any mother or child generalization. Follow-up data were collected after removing CAC. Interobserver agreement was conducted on 96 % of the sessions. Agreement across sessions and codes for the mothers was 95 %; agreement for child task performance averaged 99 %.

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