Effect of a Motor-Based Role-Play Intervention on the Social Behaviors of Adolescents With High-Functioning Autism: Multiple-Baseline Single-Subject Design

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KEY WORDS
- adolescent
- autistic disorder
- motor activity
- role playing
- social behavior

OBJECTIVE. We examined the effect of a motor-based role-play intervention on the social skills of adolescents with high-functioning autism.

METHOD. An ABA multiple-baseline design with three 3-mo phases occurring over 12 mo was used with 7 participants. Frequency of targeted verbal and nonverbal behaviors was tallied in each phase. Frequency data were analyzed using repeated-measures analyses of variance with post hoc comparisons to examine differences in targeted behaviors over the three phases.

RESULTS. Three participants completed all three study phases, 2 completed Phase 2, and 2 completed Phase 1. All participants (N = 7) demonstrated improved social skill use in Phase 1. Participants completing Phase 2 (n = 5) further improved social skill use. Additional improvements were observed among participants (n = 3) who completed Phase 3.

CONCLUSION. The intervention helped participants improve targeted social skill use. Further testing with larger samples and intervention modifications is warranted.


High-functioning autism (HFA), an autism spectrum disorder (ASD) affecting approximately 1 in 130 children (Kogan et al., 2009; Newschaffer et al., 2007), is characterized by normal or above-average intelligence and impaired ability to interpret and use social interaction skills (American Psychiatric Association, 2000). Children and adolescents with HFA have difficulty detecting and interpreting facial expressions, body language, and vocal inflection. Eye contact tends to be restricted; body movements commonly appear awkward or clumsy; and speech can be characterized by unusual inflection, volume, pitch, and rhythm. Although children and adolescents with HFA often have typical intelligence and can display unique cognitive gifts (e.g., memorizing hundreds of historical events and dates), the deciphering of emotions and social behaviors presents great challenges that affect social participation and inclusion throughout life (Tantam & Girgis, 2009).

The etiology of HFA is not well understood; however, most researchers believe that ASD has a genetic and neurological basis (Rutter, 2005). A growing body of research has suggested that people with ASD have deficits in the mirror neuron system, although the precise mechanism of impairment is not understood (Rizzolatti, Fabbri-Destro, & Cattaneo, 2009). Mirror neurons are part of neural networks in the inferior frontal, premotor, supplementary motor, primary somatosensory, and inferior parietal cortices that are activated when a person performs an action or observes others’ actions (Iacoboni & Dapretto, 2006). Rizzolatti and Craighero (2004) have theorized that a primary role of
the mirror neuron system is to integrate motor actions with their cognitive and emotional content. For example, when a person observes another person eating and deriving satisfaction, the association of the motor action with the cognitive intent of satiation and emotional experience of pleasure is learned (Rizzolatti, 2010).

Some researchers have suggested that impairment in the mirror neuron system results in a disrupted chain linking motor behavior with sensory awareness, cognitive understanding, and emotional interpretation (Iacoboni & Mazziotta, 2007; Rizzolatti et al., 2009). Children and adolescents with HFA have difficulty observing motor actions and connecting them to the performer’s cognitive and emotional intentions. A smiling face and an extended hand are not innately understood as signs of welcome. Motor behaviors underlying facial expressions and gestures cannot be used to decipher the performer’s thoughts and emotions. Such children and adolescents frequently display a lack of fluidity in their movements and show difficulty anticipating the next movement in a sequence of patterned behaviors (Rizzolatti, 2010).

On the basis of mirror neuron models, ASD researchers (Iacoboni & Mazziotta, 2007; Rizzolatti, 2010) have suggested that effective social skill interventions should teach children and adolescents to link observed motor behaviors with the cognitive intent and emotions of the performer. Rizzolatti et al. (2009) further asserted that cognitive interventions alone will not be optimally effective because impairment involves not intellectual ability or analytical skill but rather the ability to associate motor behaviors with cognitive intention and emotion. Much of the literature regarding the effectiveness of social skill intervention with children and adolescents with ASD supports this contention. The evidence supporting the use of cognitive therapies (e.g., cognitive–behavioral therapy, psychoeducation, and paper-and-pencil–based activities) to help youths with ASD interpret and use social skills is limited (Bauminger, 2002; Lopata, Thomeer, Volker, & Nida, 2006; White et al., 2010). Interventions providing the opportunity for active role-playing, however, have shown greater effectiveness, although the number of studies addressing the effect of social skill interventions with children and adolescents with HFA is small; studies specific to adolescents with HFA are sparse. Yet, problems of social exclusion become pronounced in adolescence when developing and maintaining peer relationships becomes a primary developmental objective.

Role-playing can provide an opportunity to synthesize motor, cognitive, and emotional information through repeated practice and feedback. Many studies incorporating role play, however, have shown modest gains that have not been evaluated by means of follow-up designs or generalized to real-life situations beyond the treatment setting (Barnhill, Cook, Tebbenkamp, & Myles, 2002; Herbrecht et al., 2009; Laugeson, Frankel, Mogil, & Dillon, 2009; Solomon, Goodlin-Jones, & Anders, 2004; Tse, Strulovitch, Tagalakis, Meng, & Fombonne, 2007; Webb, Miller, Pierce, Strawser, & Jones, 2004).

Our purpose in this study was to assess the effect of a motor-based role-play intervention designed to increase social skill use in adolescents with HFA. Role plays were based on real-life scenarios that participants reported commonly encountering and occurring in the high school setting and local community. Intervention helped participants to both interpret the motor behaviors underlying others’ cognitive intentions and emotions and use motor behaviors to communicate their own ideas and feelings. The research question was, “Can a motor-based, social skill intervention, provided in three 3-mo phases over 12 mo, increase targeted verbal and nonverbal skill use in 7 adolescents with HFA?”

Method

Research Design

We used a multiple-baseline single-subject ABA design in which A represented baseline, B represented intervention, and A represented follow-up probe. In multiple-baseline designs, participant start dates are staggered so that participants can serve as their own controls (Bloom, Fischer, & Orme, 2009). Intervention was provided in three 3-mo phases over 12 mo. Each phase consisted of a 2-wk baseline period, 7-wk intervention, and 1-mo follow-up probe. Phases were separated by a 2-mo no-intervention period. Intervention start dates were staggered at 1-wk intervals. The study received Columbia University institutional review board approval; all participants’ guardians provided consent, and participants provided assent.

Instrument

Frequency of targeted verbal and nonverbal behaviors was tallied at baseline, intervention, and probe periods using a recording sheet developed by the first two authors (Gutman and Raphael-Greenfield; Figure 1). Recording sheet construction was completed after a literature review identifying the core foundational verbal and nonverbal skills constituting typical social skill interaction (Leutenberg & Liptak, 2008; Liptak, 2004; Myles, Trautman, & Schelvan, 2004; Williamson & Dorman, 2002). After initial construction, the recording sheet was...
assessed for face validity by a panel of seven doctoral-level occupational therapists with expertise in social skill development or autism. On the basis of panel feedback, the 10-item recording sheet was expanded to 12 items, and specific skills were more precisely defined and operationalized.

Participants

The study took place at a specialized high school for adolescents with HFA and pervasive developmental delay located in a large metropolitan area in the northeastern United States. Inclusion criteria were (1) a diagnosis of HFA listed in the student’s Individualized Education Program, (2) age 15–21, and (3) an intelligence level of “normal” or above as determined by high school aptitude tests. Exclusion criteria were the presence of a behavioral disorder, anger management problem, or history of violence. The school administrator alerted all high school parents to possible participation in the study through a mailed invitation letter. Interested parents were asked to contact the school administrator, who then selected 7 students whom teachers perceived as having greater difficulty with social interaction.

Procedures

During intervention, the 7 participants were paired with a peer of similar age and social skill level as determined by the school administrator and initial baseline observation periods. Specific participant pairs were not maintained over the three phases because of participant withdrawal and changes in social skill functional level.

Intervention. Intervention was provided once per week in 1-hr sessions and was held as an after-school social skills program for three 7-wk periods occurring in fall, spring, and summer semesters. Intervention was based on a manual (Gutman et al., 2010) developed by Gutman and Raphael-Greenfield and addressed intervention training, intervention administration, and intervention fidelity assessment. The manual consisted of seven modules: (1) healthy self-care habits supporting social participation; (2) social skills in the classroom, lunchroom, and gym; (3) developing and maintaining friendships; (4) social skills supporting family relationships; (5) social skills supporting sports team membership; (6) social skills in the community; and (7) exploring dating. Only the most relevant module areas were addressed with each participant on the basis of the participant’s reported interest, and modules could be presented in any order. If needed, the content of one module could be addressed over multiple sessions. Each of the three phases provided the opportunity for social skills in each module area to be revisited and refined.

Intervention sessions consisted of warm-up and role-play activities. Warm-up activities provided the opportunity for participants to practice using movement to express and interpret emotions and thoughts through games. For
example, in one warm-up activity, 1 participant stood behind the other and used his arm and hand movement to convey the other participant’s verbal statements and facial expressions. In another warm-up activity, 2 participants sat with their backs to each other and pretended to speak on the phone. Both tried to express and interpret meaning through tonal inflection and rate of speech.

Role-play activities constituted the majority of each session; they provided the opportunity for participants to practice using the motor behaviors underlying facial expressions, body language, and tonal inflection to (1) interpret others’ cognitive intentions and emotions and (2) communicate their own ideas and feelings. Intervention activities repeatedly required participants to concentrate on how they and others used body position, facial muscles, and vocal intonation to communicate meaning. Participants were also asked to practice using body position, facial muscles, and vocal intonation to communicate cognitive intent and emotions. Role plays included situations such as (1) asking a peer to study after school, (2) joining a group of acquaintances eating in the lunchroom, and (3) interacting with a group of peers on the soccer field (Figure 2).

All role-play activities initially took place in the school environment (e.g., classrooms, hallways, bathrooms, gym, lunchroom, library). As participants began to gain competence in social skills, intervention was progressively moved to the community (e.g., pizza shop, convenience store, public transportation systems, community park, playground).

**Intervention Administration and Fidelity.** The intervention was administered by pairs of graduate-level occupational therapy students who received 10 hr of training in manual use from the principal investigators (Gutman and Raphael-Greenfield). Over the 12-mo study, eight pairs of occupational therapy students participated in intervention administration. To ensure intervention fidelity, the principal investigators observed segments of intervention sessions and provided feedback to student therapists. Student therapists and the principal investigators also met in small groups after each session to discuss intervention administration, manual adherence, and future session plans.

**Data Collection**

Baseline data collection in each phase consisted of five 20-min observation sessions occurring over 2 wk and was carried out by the principal investigators, who were blinded to participant scores in each intervention phase. Baseline data collection occurred during class discussions, lunch, hallway change of classrooms, gym, and free periods because higher levels of socialization were known to occur in these school periods. Baseline data could not be videotaped because we did not have permission to record students who interacted with the participants but who were not enrolled in the study.

All intervention sessions were videotaped for later scoring, which was completed by a graduate-level occupational therapy student external to the study and blinded to study purpose, participant baseline and probe performance scores, and intervention session order. All videotaped intervention sessions were scored after completion of the 12-mo probe (Probe 3) in the final study phase. Each intervention session was divided into three 20-min periods for scoring and then averaged. The student scorer received 15 hr of training in recording sheet use and achieved interrater agreement of ≥90% with the principal investigators (as described in the next section).

Probe data in each phase were collected by the principal investigators, who were blinded to participant intervention performance scores. Similar to baseline data collection, probe data could not be videotaped because we did not have permission to record students who interacted with participants but who were not enrolled in the study. Probe data were collected during five 20-min observation periods in 1 day and occurred in the same locations as baseline data collection.

Interrater agreement between the principal investigators was established at ≥90% on three separate occasions before the study began and was calculated during the observation of YouTube videos of adolescents with HFA. YouTube videos were found using the following search terms: autism, high functioning autism, autism spectrum disorder, Asperger’s disorder, social skills. To ensure that observer drift did not occur between Gutman and Raphael-Greenfield, interrater agreement was again established at ≥90% on two separate occasions before each follow-up probe. Before intervention data were scored by the external student researcher, who was blinded to baseline and probe data, interrater agreement of ≥90% on three separate occasions was established between the student researcher and the principal investigators by observing YouTube videos of adolescents with HFA.

**Data Analysis**

Because 5 of the 7 participants completed Phases 1 and 2 and 3 completed Phases 1, 2, and 3 (see Results), we statistically analyzed data for the first two intervention phases and provide a descriptive analysis of the third intervention phase. We analyzed frequency of targeted
verbal and nonverbal behaviors using repeated-measures analysis of variance (ANOVA) for the first two intervention phases (Baseline 1, Intervention 1, Probe 1; Baseline 2, Intervention 2, and Probe 2). We analyzed significant main effects post hoc using Tukey’s Honestly Significant Difference procedures (Portney & Watkins, 2009). We used .05 as the level of significance (α). Statistical analysis was completed in SPSS PASW Statistics for Macintosh, Version 17.0 (SPSS Inc., Chicago).

Results

All 7 participants enrolled in the study completed Phase 1, 5 participants completed Phases 1 and 2, and 3 completed Phases 1, 2, and 3. One participant withdrew after leaving the school, 2 began participation in desired activities (i.e., taking a college class; attending an acting class in the community) that conflicted with the intervention schedule, and 1 withdrew because of illness. All withdrawals occurred during no-intervention periods. Most participants were White (n = 4), 2 were African-American, and 1 was Hispanic. All participants were male, aged 15–17, and from middle-income family households.

Means and standard deviations for the frequency of targeted behaviors for all three phases (including baseline period, intervention period, and probe) are shown in Table 1. Individual participant data (dashed lines), along with the group mean (solid line) for the first two phases, are shown in Figure 3. All participants demonstrated significant improvement in frequency of targeted behaviors during the Phase 1 intervention, and this improvement was maintained through the end of the Phase 2 probe. The overall effect of role-play intervention was confirmed by repeated-measures ANOVA, which demonstrated a main effect of training (F[5,20] = 21.79, p < .0001,
effect size = .85). Additional trend analysis revealed that the linear trend was highly significant ($F[5,20] = 30.75, p < .005$), indicating that the improvement in the frequency of targeted behaviors was sustained over time.

Post hoc analysis revealed a significant improvement in frequency of targeted behaviors during the first intervention phase (change from Phase 1 baseline to Phase 1 intervention = 23.002, $p = .005$). This improvement was maintained during the 1-mo follow-up probe in the first phase (change score from Phase 1 baseline to Phase 1 probe = 24.16, $p = .009$). No decrease occurred in the frequency of targeted behaviors between the end of the Phase 1 intervention and Phase 1 probe (change score = −1.16, $p = .399$). Similarly, despite a 2-mo period of no intervention, no decrement in performance occurred from the Phase 1 probe to the Phase 2 baseline (change score = 1.02, $p = .19$).

In the second intervention phase, targeted behaviors significantly improved (change score from Phase 2 baseline to Phase 2 intervention = 12.35, $p = .009$); however, this improvement in targeted behaviors demonstrated a decrement from Phase 2 intervention to Phase 2 probe (change score = −4.15, $p = .03$). The frequency of targeted behaviors, however, was still significantly higher when compared with that at Phase 1 baseline at the beginning of the study (change score = 30.28, $p = .004$). Our results indicate that significant improvement in targeted behaviors occurred as a result of intervention, and this improvement was maintained until the end of Phase 2.

Given that only 3 participants completed Phase 3, we describe the results of this phase qualitatively (Table 1). The frequency of targeted behaviors decreased slightly from the end of Phase 2 intervention to the beginning of Phase 3 (change score = 5). At the end of the third intervention, targeted behaviors improved (change score = 16), although the improvement was not as large as in Phase 1. After a period of no intervention, targeted behaviors decreased slightly (change score = 5), although we found no difference between frequency of targeted behaviors at the end of Phase 3 and the end of Phase 2. This result indicates that further improvement was observed during Phase 3.

**Discussion**

Our results show that adolescents with HFA improved their verbal and nonverbal behaviors as a result of a role-play intervention. The greatest amount of learning occurred during the Phase 1 intervention. Although gains in social skill use continued throughout Phases 2 and 3, increases in targeted social skills were not as great as those demonstrated in Phase 1. This type of learning curve—in which large gains in learning occur quickly and level off—is congruent with theories of social learning (Gentile, 1998; Willingham, 1998).

Because the largest gains occurred early in learning, increasing intervention dose and duration in Phase 1 might enhance increases in targeted social skill use, as has recently been suggested in a systematic review of

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**Table 1. Mean Frequency of Behaviors for Each Phase**

![Figure 3](image-url)
behavioral interventions for children with ASD (Warren et al., 2011). Increasing intervention from seven 1-hr sessions over 7 wk to twenty 1-hr sessions over 10 wk may enhance the gains observed in Phase 1. The participants in our study were able to maintain increased levels of social skill use over the no-intervention period between Phase 1 and Phase 2. Testing whether an increase in dose and duration of intervention in Phase 1 would lead to greater learning and retention beyond levels observed in our study would be important. If so, subsequent intervention phases might be reduced to shorter booster sessions to enhance time and cost efficiency.

Throughout each intervention phase, participants were paired with a peer of equal social skill level on the basis of the belief that an equally performing peer would provide a challenge that was neither too great nor too simple (McCullagh, Weiss, & Ross, 1989). In Phase 3, the intervention was tailored for 1 participant who was paired with a college student when he experienced conflict with his class peers. After maintaining intervention means of 41.14 (Phase 1 intervention) and 46.85 (Phase 2 intervention), his targeted social skill use increased to 60.14 in Phase 3 intervention—a level he maintained at Phase 3 probe (the 12-mo probe). This participant’s performance suggested that once a participant reaches a plateau in performance, he or she might benefit from pairing with a partner performing at a higher level to provide an increased challenge that could enhance social skill learning (Wulf, Shea, & Lewthwaite, 2010). This intervention modification should be tested in future studies.

Although we did not test the intervention to determine whether participants’ gains in targeted social skill use generalized to real-life situations, we were informed by teachers, administrators, and parents of real-life situations in which participants demonstrated improved social performance. For example, one participant, who had been experiencing social conflict with school peers and was socially withdrawn, joined a school international affairs club after completing all three intervention phases. Teachers reported that in contrast to previously observed behaviors, the participant was able to collaborate with peers as a team member and could engage in partnered activities. The club entered and won second place in a city international affairs competition against several highly regarded schools. Another participant and his parents felt that after completing Phase 2, he was ready to begin taking a college course for credit. The participant successfully completed the college course and enrolled in a second class. A third participant and his parents felt that after completion of Phase 1, he had gained sufficient social skills to join a local community acting class for adolescents. Although acting was the student’s passion, he and his parents never felt confident that he could successfully participate in an acting class with typically developing adolescents. Although we cannot determine that the intervention influenced these events, we can note that all events required a repertoire of social skills that were practiced during the three intervention phases.

Implications for Occupational Therapy Practice

The results of this study have the following implications for occupational therapy practice:

- A motor-based role-playing program that helps clients sequence motoric skills with social behaviors may uniquely enhance social skill use in adolescents with HFA.
- Pairing of participants should be based on similar functional social skills at baseline.
- Because a higher amount of learning appears to occur in the first phase, future programs should be designed to provide a greater number of intervention sessions in the first 3 mo. Later intervention phases could be delivered as shorter booster sessions to enhance cost and time efficiency.

Limitations and Future Research

Because this study had a multiple-baseline single-subject design with 7 participants, results are not generalizable to the larger population of adolescents with HFA. Although the recording sheet used in the study was assessed for face validity, it had no other established psychometric properties, and no additional instruments were used to measure outcomes. Additionally, although social skills were practiced in role-play scenarios mirroring real-life situations, we did not measure how increased targeted social skill use generalized to successful social performance in real-life situations. A strength of this study, however, is that the three intervention and probe phases spanned 1 yr, allowing us to understand whether the participants were able to maintain gains over a 1-yr period.

In future studies, we will modify the intervention dosage to determine whether the provision of an extended Phase 1 intervention and shorter second and third booster phases will increase initial learning and allow gains to be maintained for a longer period. We will also modify the intervention to determine whether pairing a participant with a higher-level partner once the participant’s performance has plateaued will facilitate larger gains in social skill use than observed in this study. The intervention
should also be assessed through a more rigorous design using randomization, control, a larger sample size, and standardized assessments.

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References


