Children with multiple disabilities miss opportunities to participate in the "primary activity of the young child"—play (Mack, Lindquist, & Parham, 1982, p. 366).

These children are not free to immerse themselves in the simple joy of playing with toys, a process that helps them discover themselves, probe their surroundings, and relate to playmates (Copeland & Golden, 1979). This lack of active exploration may further complicate their physical development, as well as delay mental, emotional, and social maturation (Bobath, 1984; Lindquist, Mack, & Parham, 1982).

Toys are powerful tools for the development of sensory, motor, and perceptual skills. They also can be used to motivate children to practice their newly discovered abilities (Darbyshire, 1980; Lederman, 1986). Battery-operated toys are now being adapted by occupational therapists to make purposeful, stimulating activity accessible to disabled children (Burkhart, 1985a, 1985b). On/off controls such as large surface/low-pressure touch, sip and puff, mercury tilt, and grip switches, along with proportional joystick devices, offer a child an opportunity to interact with a toy that may be equipped with seemingly unmanageable controls.

Skills developed from play with adapted toys may serve the future functional, academic, and vocational needs of children with multiple disabilities. This play activity may be used as preliminary training for interaction with augmentative communication devices, the navigation of electric wheelchairs, the operation of environmental control devices, and access to computers in the home, classroom, business office, and community.

The following presents the use of a radio-controlled toy truck adapted to encourage the development of head and neck control, purposeful movement of the upper extremities, and performance of reaction time tasks by a 6-year-old boy with cerebral palsy. Competence in achieving the sensory, motor, and decision-making skills to operate this adapted toy will facilitate his interaction with more sophisticated devices, such as communication aids, environmental control systems, and computer-based equipment. Details on the modification of the toy are presented to encourage similar work and stimulate ideas for adapting toys in ways other than providing simple on/off controls.

Background

J. J. was a 6-year-old boy with a diagnosis of cerebral palsy with athetosis. He lacked proximal stability of the trunk and shoulder girdle and was therefore unable to free his arms for use. Even when supported, he...
was unable to use his upper extremities for purposeful activities. He was dependent on his family for all activities of daily living. His speech was labored. He was often unable to vocalize because of a high, fluctuating oral tone and an inability to coordinate speech with respiration. Despite these limitations, J. J. exhibited cognitive and receptive language skills at or above age level. And he demonstrated an enthusiasm for learning.

An occupational therapy treatment plan was designed to address the following goals:

1. Improvement of midline orientation of the head
2. Improvement of shoulder girdle stability through upper extremity weight bearing
3. Encouragement of purposeful and accurate hand placement
4. Provision of opportunities for active sensory motor experiences and decision-making tasks
5. Development of the skills necessary for access to a variety of augmentative devices, including computers
6. Inclusion of the family in the occupational therapy program through home participation

Toy Adaptation

J. J. selected a battery-powered, radio-controlled truck as the toy to be adapted for use in the treatment plan. Previously, he had been able to interact only passively with this toy; that is, he had only been able to watch his father maneuver the truck with its small push-button control switch. Under normal operation of the toy, the truck moved forward in a straight line as soon as the power switch was turned on. Steering was managed by pressing the hand-held control switch to simultaneously halt the truck’s forward motion, reverse its direction, and turn the front wheels to the left.

Figure 1. Operation of dual switch. The dual switch feature allowed J. J. to steer his adapted radio-controlled truck as the occupational therapist was prepared to keep it in range.
Release of the switch allowed forward travel in a new direction.

The occupational therapist considered the truck to be an excellent skill-training tool because many of the active sensory-motor tasks described above as therapy goals were inherent in its operation. The constant movement of the truck required adequate head control to visually track its path. J. J. had to make timely decisions about when to use the controller. Purposeful hand placement, some degree of upper extremity weight bearing, and the controlled release of upper extremity pressure were necessary to operate an adapted control switch, which was selected by the occupational therapist.

The occupational therapist addressed two concerns in adapting the toy. First, J. J. needed a more manageable control switch that involved the upper extremity, and second, the speed of the truck had to be reduced because it was simply too fast (on some surfaces) for J. J. to control. The biomedical engineer performed the necessary hardware modification.

To satisfy the first need, a low-pressure 3 in. X 5 in. plate switch (available for $16 from Steve Kanor, Ph.D., Inc., 8 Main Street, Hastings-on-Hudson, New York 10706, 914-478-0960) was connected (in parallel) to the original push-button switch inside the hand-held controller. A small hole was drilled in the plastic controller case for standard speaker wire. A commonly available ¼ in. phone jack was attached to the speaker wire to connect to the plate switch equipped with a ¼ in. phone plug. Both switches could then be used to steer the truck, thereby allowing someone to play along and keep the toy within J. J.'s range. Figure 1 shows J. J. putting the truck through its paces as the occupational therapist plays along. Here, J. J. was pressing his plate switch, which was attached with suction cups to his tray. The occupational therapist held the original controller in her right hand. The plate switch cable is shown joining with the radio control switch cable just to the left of the therapist's right knee. The radio antennas attached to the top of the hand-held controller and the side of the truck were provided with the toy.

The second requirement, speed reduction, was accomplished by modifying the truck's battery compartment. Figure 2 illustrates how four AA batteries were used to provide the truck with power and direction control, as designed by the manufacturer. Point C, a connecting pad between batteries 2(−) and 3(+), was permanently connected to one side of the motor. Under forward travel conditions, internal switch K1 was normally closed and K2 was normally open. With K1 closed, a +3V supply was connected to the motor (batteries 1 and 2 in series, points C-B-A). Whenever the internal radio-controlled switch was activated by the hand-held controller, K1 was disconnected and K2 connected a −3V supply to the motor (batteries 3 and 4 in series, points C-D-E). This polarity change (plus to minus) in battery voltage caused the truck to reverse its direction of travel.

Two-speed selection was provided as illustrated in Figure 3. It was necessary to cut the metal pads at points B and D, thereby isolating all four batteries. Point C remained permanently connected to one side of the motor. Battery polarity was used to control direction of travel. With the addition of an inexpensive dual-acting switch (DPDT, double pole-double throw), two levels of battery power could be selected. Note that only the forward travel switch configuration is shown in Figure 3. (For clarity, an independent configuration for batteries 3 and 4—reverse travel—is omitted. Pad D2 was connected similarly to B1, and pad D1 similarly to B2.) In the slow switch position, points B2(+) and A(+) were connected, as were points C(−) and B1(−), which resulted in a parallel battery configuration. This configuration provided a 1.5V supply to the motor, which produced nominally one half the speed of the fast mode. The fast switch position disconnected B2(+) from A(+) and connected B1(−) to B2(+), which restored the original +3V battery supply to the motor for maximum drive.

On some surfaces, such as rugs, the truck could be operated only in the fast mode. On other surfaces, such as a tile floor, the selectable speed feature allowed us to challenge J. J. with different reaction time control tasks.
Progress

J. J. was pleased with his new ability to operate a toy he enjoys, and the toy has been a key in motivating him to work toward accomplishing therapeutic goals. As of this writing, he has been using it at home for 10 months. His mother has been using it as a motivator and reward for compliance with assigned homework and therapy activities. The feature of two available control switches encourages family members to play along with him, thereby accomplishing the goal of family involvement.

The decision tasks and switch operation helped J. J. develop the preliminary skills necessary to interact with augmentative communication devices, operate an electric wheelchair, coordinate environmental control systems, or perhaps access a computer. Knowing how to operate these devices will be essential for J. J.'s future long-term independence. Our impression is that this positive experience gave J. J. the confidence to achieve competence in controlling his environment.

References


Editor's Note. To continue the Case Report department, we need and welcome reports that document the practice of occupational therapy for specific clinical situations. Guidelines for writing case reports are available from the Editor.