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Persons with multiple disabilities exercise adaptive response schemes with the help of technology-based programs: Three single-case studies

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ABSTRACT

The present three single-case studies assessed the effectiveness of technology-based programs to help three persons with multiple disabilities exercise adaptive response schemes independently. The response schemes included (a) left and right head movements for a man who kept his head increasingly static on his wheelchair's headrest (Study I), (b) left- and right-arm movements for a woman who tended to hold both arms/hands tight against her body (Study II), and (c) touching object cues on a computer screen for a girl who rarely used her residual vision for orienting/guiding her hand responses. The technology involved microswitches/sensors to detect the response schemes and a computer/control system to record their occurrences and activate preferred stimuli contingent on them. Results showed large increases in the response schemes targeted for each of the three participants during the intervention phases of the studies. The importance of using technology-based programs as tools for enabling persons with profound and multiple disabilities to practice relevant responses independently was discussed.

1. Introduction

Persons with severe/profound multiple disabilities (i.e., intellectual, motor, and sensory impairments) tend to spend most of their time in a wheelchair and to experience daily programs largely characterized by general stimulation and physical therapy (Green & Reid, 1999; Heller, McCubbin, Drum, & Peterson, 2011; Lancioni et al., 2010; Shih, Shih, & Shih, 2011; Tam, Phillips, & Mudford, 2011). General stimulation may be highly useful in enriching the persons' input and improving their mood, but it can hardly serve to foster their functional and adaptive responding (Dillon & Carr, 2007; Lancioni, Singh, O'Reilly, Oliva, & Basili, 2005). In practice, they may remain quite passive with a tendency to show forms of behavioral and physical deterioration (e.g., development of stereotyped behaviors and worsening of adaptive body schemes and postures) (Jansen, Villien, Egeland, Stanghelle, & Holm, 2004; Lancioni, O'Reilly, et al., 2008).

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Physical therapy (often based on the Bobaths' conceptual model; Bobath, 1980; Bobath & Bobath, 1984) may heavily rely on specific maneuvers of the therapist aimed at promoting and supporting adaptive postures and responses and inhibiting abnormal (interfering) postural and movement components (Cherng, Liu, Lau, & Hong, 2007; Ketelaar, Vermeer, Hart, Van Petegem-van Beek, & Helders, 2001; Tsorlakis, Evaggelinou, Grouios, & Tsorbatzoudis, 2004). The possibility of this approach producing relevant effects (i.e., improving the persons' motor condition or preventing deterioration of it) may largely depend on a systematic use of exercise sessions, that is, sessions directed at helping the persons practice adaptive postures and responses or close (preliminary) forms of them (Bugg & Head, 2011; Cotman & Berchtold, 2007; Lancioni et al., 2004; Lancioni, Singh, et al., 2008).

The use of these exercise practices, which are based on the notion of experience-dependent plasticity (Begnoche & Pitetti, 2007; Damiano & DeJong, 2009; Kollen et al., 2009), would be more effective and feasible if embedded in intervention programs that ensure the persons' motivation to perform. Such motivation would enable the persons to take an active role and eventually carry out the exercise independently (Lang et al., 2010). This independence would be critical not only to improve the persons' general situation and social status but also to reduce the staff's direct time investment and, thus, to make their program supervision more plausible (Brown, Schalock, & Brown, 2009; Findorff, Wyman, Croghan, & Nyman, 2005; Nordberg et al., 2007).

The only possibility of building a program that ensures the persons' motivation and independent performance would rest on the availability of assistive technology (Chantry & Dunford, 2010; Lancioni, Singh, O'Reilly, & Sigafoos, 2011). This could involve (a) microswitches or other sensor devices to monitor the persons' responding, (b) a microprocessor-based control system that records the responding and activates brief periods of preferred stimulation contingent on it, and (c) stimulus sources linked to the control system and activated briefly in case of responding (i.e., as mentioned above) (Holburn, Nguyen, & Vietze, 2004; Mechling, 2006). This technology would be expected to be accurate in detecting responding, and rapid in providing stimulation contingent on its occurrence (i.e., thus ensuring the persons' motivation to respond independently of staff intervention) (Lancioni, O'Reilly, et al., 2008; Lancioni et al., 2011).

The present three single-case studies were aimed at assessing the effectiveness of technology-based programs, such as those mentioned above, for three persons with multiple disabilities for whom different forms of responding were targeted. In Study I, left and right head movements were targeted for a man who kept his head increasingly static on the headrest of his wheelchair and resisted external maneuvers directed at helping him move/rotate it (Lancioni et al., 2009). In Study II, left- and right-arm movements were targeted for a woman who tended to hold both arms/hands tight against her body (Lancioni et al., 2002). In Study III, touching object cues on a computer screen (i.e., a preliminary form of eye-hand coordination) was targeted for a girl who rarely used her residual vision for orienting/guiding her hand responses (Pizzamiglio et al., 2008).

2. Study I

2.1. Method

2.1.1. Participant

The participant (Peter) was 37 years old and had congenital encephalopathy with hydrocephalus and blindness. He presented with spastic tetraparesis and was confined to a wheelchair, could use single words often in an echolalic manner, but could not handle objects, did not possess self-help skills or sphincteric control, and depended on his caregiver for any interaction with his environment. His level of intellectual disability had been reported to be in the severe-to-profound area, but no formal assessments had been carried out due to his condition, which made testing impossible. He attended a center for persons with multiple disabilities in which he received personal care as well as physiotherapy and stimulation in the form of music and songs. Care and physiotherapy were made quite difficult by the severity of his general motor condition and the fact that he could show signs of displeasure in relation to specific motor maneuvers, particularly if repeated/protracted. For example, he was known to show resistance (displeasure) to protracted attempts by others to move/rotate his head, which was increasingly static on the headrest of his wheelchair. A technology-based program that could help him to exercise his head and neck on his own (i.e., independent of external intervention) was considered highly desirable by his staff and family. His family had signed an informed consent for his involvement in this study, which had been approved by a scientific and ethics committee.

2.1.2. Position, responses, technology and stimuli

Peter sat in his wheelchair throughout the sessions of the study. Two head turning responses were targeted for the intervention, that is, left head turning and right head turning. Left turning initially required the head to cover an angle of about 30°. Subsequently, the angle was increased to about 45°. Right turning required the head to cover an angle of about 30°. The technology included (a) optic sensors/microswitches (i.e., mini photocells), which were fixed to the wheelchair's headrest and served to detect the head turning responses, and (b) a computer device, which served as a control system that recorded the responses and regulated the delivery of stimuli contingent on them during the intervention phases of the study (Lancioni et al., 2011).

The stimuli selected for the study included a series of songs and a series of music and comedy pieces. These stimuli had been recommended by staff personnel and confirmed through a brief stimulus preference screening procedure. The screening procedure, which involved 5–10 nonconsecutive presentations of one or two 10-s clips of the songs and music/comedy pieces available, confirmed that Peter reacted positively (e.g., alerted/oriented and smiled) in about or more than 60% of the presentations.