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Assistive technology for promoting choice behaviors in three children with cerebral palsy and severe communication impairments

Fabrizio Stasolla [a,*], Alessandro O. Caffò [b], Luciana Picucci [b], Andrea Bosco [b]

[a] Lega del Filo d'Oro Research Center, Molfetta, Italy
[b] Department of Educational Sciences, Psychology, Communication, University of Studies of Bari, Italy

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ABSTRACT

A technology-based program to promote independent choice behaviors by three children with cerebral palsy and multiple disabilities was assessed. The program was based on learning principles and assistive technology (i.e., customized input devices/sensors, personal computers, screening of preferred stimuli according to a binomial criterion). The first purpose of the present study was to provide the participants with a new set-up of assistive technology and to allow them to choose among three categories (i.e., food, beverage and leisure), and to request a specific item out of four in each category, adopting a procedure that minimized (according to a conditional probability criterion) unintentional choices. The second aim of the study was to carry out the effects of the program on detectable mood signs (i.e., happiness index). The study was conducted according to an ABAB sequence with a subsequent post intervention check for each participant. The results showed an increase of engagement and of the happiness index during intervention phases. Psychological as well as educational implications were discussed.

1. Introduction

Children with cerebral palsy and profound multiple disabilities are often isolated and passive due to an extensive inability to control their environment (Borg, Larson, & Ostegren, 2011; Kagohara et al., 2011; Lancioni, O'Reilly, Singh, Sigafoos, Buonocunto, et al., 2011, Lancioni, Singh, et al., 2012). They have difficulties to reach and manipulate objects surrounding them and consequently remain almost totally dependent on caregivers (Lancioni, Singh, et al., 2012). This situation adversely affects occupation, leisure and social interaction (Lancioni, Sigafoos, O'Reilly, & Singh, 2012). Moreover, they present a lack of communication skills, albeit they are potentially capable of adaptive behavior (Lontis & Struijk, 2010; Mechling, 2006; Reichle, 2011). A severe communication impairment (Sigafoos et al., 2000) complicates the relationship with the caregiver and make even more difficult for children to achieve their goals. Rehabilitative/clinical and psychological implications of such kind of limitation on the ontogenetic development are straightforward.

Basic forms of assistive technology such as microswitch-based programs are considered crucial in enabling people to activate stimulus sources by producing minimal responses (Gutowski, 1996; Holburn, Nguyen, & Vietze, 2004; Lancioni, O'Reilly, Singh, Sigafoos, Oliva, et al., 2011). For example, participants of such programs can receive brief periods of auditory stimulation by tapping his or her hand on a pressure microswitch fixed on a table in front of him/her (Lancioni et al., 2007,

* Corresponding author. Tel.: +39 3496635397.
E-mail address: f.stasolla@psico.uniba.it (F. Stasolla).

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2010, Lancioni, Sigafoos, et al., 2012). A second approach adopts a vocal output communication aid (VOCA) for asking a social contact with one or more caregivers (Sigafoos, O'Reilly, Ganz, Lancioni, & Schlosser, 2005), or microswitch and VOCA to choose between self-determination of preferred stimuli and social contact (Lancioni et al., 2008b). A third more elaborate and complex form of assistive technology involves computer-aided system combined with microswitch devices enabling children with multiple disabilities asking for personal needs (Lancioni, Singh, O'Reilly, Sigafoos, Green, et al., 2011). The literature on the use of microswitches is vast (Lancioni, Sigafoos, et al., 2012; Lancioni, Singh, et al., 2009; Lancioni, Singh, O'Reilly, & Oliva, 2005), as well as extensive is the literature on VOCA (Lancioni et al., 2008a, Lancioni, Singh, et al., 2009, Lancioni, O'Reilly, et al., 2009, Lancioni, Sigafoos, et al., 2012, Lancioni, Singh, et al., 2012; Sigafoos et al., 2005; Schlosser & Sigafoos, 2006). However, studies on computer-aided set ups allowing the person to select independently and receive preferred stimuli are limited (Lancioni, Singh, O'Reilly, Sigafoos, Alberti, et al., 2011; Lancioni, Sigafoos, et al., 2012, Lancioni, Singh, et al., 2012).

With respect to a standard microswitch program, computer-aided set ups ensure the participant to navigate along a series of subsequent steps hierarchically structured and aim to obtain a specific item. This approach can make the communication with the caregiver more functional to the child's needs (Van der Meer, Sigafoos, O'Reilly, & Lancioni, 2011), improving the sense of self efficacy in both (Sigafoos, 2010; Sigafoos, Ganz, O'Reilly, Lancioni, & Schlosser, 2007) as well as contributing to decrease the burden of caregiving (Machalicek et al., 2010). Finally, the participant can receive the item he/she was looking for, with the aid of a caregiver (Lancioni, Sigafoos, et al., 2012, Lancioni, Singh, et al., 2012). The latter form of technology may represent a solution of constructive engagement and offers request and choice opportunities for persons with multiple disabilities (Saunders, Baros-Bailey, Chapman, & Nunez, 2009). Furthermore, it is conceived to enhance leisure capacities and communication abilities (Gruis, Wren, & Huggins, 2011). In recent years, considerable attention has been given to the development and assessment of technological resources for helping persons with severe and profound mental retardation and multiple disabilities in order to reduce isolation and passivity, to reach higher levels of constructive performance, and to improve their overall appearance and status (Weightman et al., 2010) and consequently their quality of life (Brown, Schalock, & Brown, 2009; Dillon & Carr, 2007). The most distinct aspect of quality of life is happiness. This latter construct involves different components such as personal well-being, pleasure and contentment (Felce & Perry, 1995; Ivancic & Bayley, 1996). These components are difficult to detect and quantify among individuals with non verbal behavior and low levels of functioning. To overcome this methodological problem, researchers have selected behavioral expressions already connected to possible conditions of pleasure and well-being, labeling them as indices of happiness (Lancioni, Singh, O'Reilly, Oliva, & Basili, 2005).

The present study is aimed at extending the available evidence on the use of aforementioned computer-aided technology with three children having a diagnosis of cerebral palsy and severe communication impairments. The study describes a model of intervention for promoting opportunity of engagement, request and choice (i.e., communication skills) of personal needs. Moreover, evaluation of mood (i.e., happiness index) and of the ongoing involvement with the technologies (i.e., through a post intervention check carried out 15 days after the end of the intervention) are also provided (Lancioni et al., 2007).

2. Method

2.1. Participants and setting

The participants (Fred, Lionel and Mark) were 6, 9 and 7 years old, respectively. They were diagnosed with cerebral palsy by a team of neurologists; consequently, they had motor impairments, dystonic movements, lack of speech, communication and developmental disabilities; nonetheless they were able to use head movements to answer yes or no about their preferences, activities, knowledge and understanding. Although no formal intellectual quotient score was available and no regular test was feasible, due to their general conditions, they were estimated to be in the moderate range of intellectual disabilities. They had some awareness of sphincter needs; however they were unable of independent ambulation responses and had no opportunities to reach and interact positively with any object immediately surrounding them and used a wheelchair. They could attract people's attention in their immediate proximity with small head and hand movements. They were provided with physiotherapy, psychomotor and speech therapy sessions twice a week, and attended regular classes with a special educational trainer and program. They were recruited by reporting from their general practitioner to the research team and included since they were unable to make request that caregivers could understand and to achieve their needs independently. Moreover, they showed to be able to match correctly an object with its picture (i.e., a spoon with a picture of the spoon itself) and an object within its semantically appropriate category (i.e., a spoon within the action of eating).

The study was carried out by two research assistants, in a quiet room at the participants' homes, where they lived with their parents. The rehabilitation program was considered highly desirable from the participants' parents, who signed a formal consent for children's involvement in the study (video-recording and data collection).

2.2. Selection of stimuli

Parents' interviews and a screening preference check (Crawford & Schuster, 1993) served to select preferred stimuli used in this study. Screening involved four to six sessions for each participant with a 10-s presentation of an item suggested by