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Assistive Technology for Promoting Adaptive Behaviors of Children with Cerebral Palsy

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Cerebral palsy (CP) refers to a group of non progressive postural and/or movement disturbances dues to defects in the fetus or in the immature brain. It constitutes one of the most frequent cause of developmental disabilities. That is, some of those children are unable to walk, some of them may exhibit postural abnormalities, and some others may present different levels of intellectual disabilities [1-3]. In fact, children with CP rely constantly on parents and/or caregivers' assistance and are commonly isolated and passive towards the outside world, with negative consequences on their quality of life [4-5]. Thus, they are unable to acquire new adaptive skills by themselves [6]. To overcome this issue, one may resort on the use of assistive technology (AT) [7-8].

AT is an umbrella term including any piece, device and/or equipment aimed at promoting self-determination and independence of participants involved [9]. Therefore, based upon learning principles (i.e. causal association between a behavioral response and environmental consequences) a person with severe to profound developmental disabilities may be enabled with independent access to positive stimulation through the exhibition of small behavioral responses. This latter goal may be pursued through the use of microswitches (i.e. basic forms of AT consisting of electronic devices ensuring autonomously children with multiple disabilities with brief periods of pleasant stimuli) [10]. Although no specific rules exist, some useful guidelines may be outlined for a positive outcome concerning the use of one or more microswitches embedded in an AT-based program. Specifically, a plausible behavioral response should be identified. That is, the response should be already available within the participant's behavioral repertoire and should be performed easily without effort. Subsequently, an adapted microswitch should be selected. Thus, the electronic device (i.e. sensor) should detect the behavioral response and ensure its reliable recording, through a control system unit. Finally, a positive (i.e. high motivating) stimulation to serve as reinforcement should be retained. Therefore, the pleasant stimuli should adequately and sufficiently compensate the response cost. Once the aforementioned conditions are satisfied, the mean frequencies of behavioral responses should reasonably increase during intervention phases if compared to baselines, with beneficial effects for the participants involved [11-12].

Depending upon their levels of functioning, children with CP may be exposed to different AT-based interventions focused on various rehabilitative objectives. For instance, children disposing of a very low and limited behavioral repertoire combined with severe to profound intellectual disabilities (i.e. motor impairments combined with sensorial and communication disorders), as children with CP associated to autism spectrum disorders who exhibit multiple disabilities, may be exposed to a single microswitch-based program aimed at enhancing the participant with self-determination and independent access to a unique category of stimulation (e.g. visual stimuli) [13]. Else, a rehabilitative strategy may be planned for fostering choice behaviors with two different behavioral responses and related microswitches for autonomously receiving two categories of stimuli (e.g. visual and auditory stimulation) [14]. Moreover, a combination of microswitch and VOCA (i.e. vocal output communication aid) set-up may be considered crucial as to ensure the participants with the dual goal of independently access to positive reinforcements (i.e. through the microswitch) or asking for social contact with a caregiver (i.e. through the VOCA device) [15]. Additionally, within a dual rehabilitative intervention, a cluster-based technology may be viewed as critical for increasing an adaptive response with the simultaneous reduction of a challenge behavior (e.g. hand/objects mouthing) [16]. Furthermore, as alternative and/or integrative to traditional physiotherapy, microswitches and contingent stimulation may be designed for facilitating both ambulation responses and locomotion fluency [17-18]. For individuals with a higher level of functioning (i.e. motor disorders and mild or moderate intellectual disabilities) one may compare PECS (i.e. picture exchange communication systems) and VOCA protocols (i.e. two different alternative and augmentative strategies), otherwise provide computer-based options finalized at supplying participants with leisure and academic activities or satisfying their personal needs [19]. Finally, children with CP who have extensive motor impairments and who are estimated within the normal range of the intellectual functioning, one may resort on literacy access through the use of combined microswitches and keyboard emulators [20]. Within all the aforementioned programs, indices of happiness and/or indices of positive participations as outcome measure of the quality of life, participants preference checks, and social validation assessment involving sensitive external raters (e.g. parents, teachers, professionals, and/or caregivers) may be carried out as to corroborate the clinical validity of such interventions [21-22].

In light of the above, new research perspectives within this framework should deals with the following topics: (a) extending the suitability and the effectiveness of such AT-based strategies to new

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participants with developmental disabilities by continuously updating the technology to the participants' and environmental' s needs (i.e. by providing rigorously individualized solutions), (b) enlarging the social validation assessment to new groups of raters, (c) carrying out new maintenance/generalization and/or follow-up phases for substantiating the learning process, and (d) overall positively responding to human, economical and environmental demands.

Competing Interests

The authors declare that they have no competing interests.

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