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Promoting adaptive behavior in persons with acquired brain injury, extensive motor and communication disabilities, and consciousness disorders

Giulio E. Lancioni [a,*], Nirbhay N. Singh [b], Mark F. O'Reilly [c], Jeff Sigafoos [d], Marta Olivetti Belardinelli [e], Francesca Buonocunto [f], Valentina Sacco [f], Jorge Navarro [f], Crocifissa Lanzilotti [f], Marina De Tommaso [a], Marisa Megna [a], Francesco Badagliacca [g]

[a] University of Bari, Italy
[b] American Health and Wellness Institute, Raleigh, NC, USA
[c] Meadows Center for Preventing Educational Risk, University of Texas at Austin, TX, USA
[d] Victoria University of Wellington, New Zealand
[e] "Sapienza" University of Rome, Italy
[f] S. Raffaele Rehabilitation Center, Ceglie Messapica, Italy
[g] ISPE Residential Care Center, Mola di Bari, Italy

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ABSTRACT

These two studies extended the evidence on the use of technology-based intervention packages to promote adaptive behavior in persons with acquired brain injury and multiple disabilities. Study I involved five participants in a minimally conscious state who were provided with intervention packages based on specific arrangements of optic, tilt, or pressure microswitches (linked to preferred environmental stimuli) and eyelid, toe and finger responses. Study II involved three participants who were emerging from a minimally conscious state and were provided with intervention packages based on computer presentations of stimulus options (i.e., preferred stimuli, functional caregiver's procedures, and non-preferred stimuli) and pressure microswitches to choose among them. Intervention data of Study I showed that the participants acquired relatively high levels of microswitch responding (thus engaging widely with preferred environmental stimuli) and kept that responding consistent except for one case. Intervention data of Study II showed that the participants were active in choosing among preferred stimuli and positive caregivers' procedures, but generally abstained from non-preferred stimuli. The results were discussed in terms of the successful use of fairly new/infrequent microswitch-response arrangements (Study I) and the profitable inclusion of functional caregiver's procedures among the options available to choice (Study II).

1. Introduction

Persons with acquired brain injury, extensive motor and multiple disabilities, and minimally conscious state may be quite passive and isolated, even if potentially capable of some adaptive behavior (e.g., engagement with environmental

* Corresponding author at: Department of Neuroscience and Sense Organs, University of Bari, Via Quintino Sella 268, 70100 Bari, Italy.
E-mail address: g.lancioni@psico.uniba.it (G.E. Lancioni).

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events or basic communication) (Canedo, Grix, & Nicoletti, 2002; Coleman & Pickard, 2011; Giacino & Kalmar, 2005; Giacino & Trott, 2004; Lancioni, Bosco, et al., 2010; Lancioni, O'Reilly, et al., 2009; Laureys & Boly, 2007; Spivey, 2007). A similar type of frustrating and under achieving experience may also be endured by persons with comparably extensive brain injury and motor and communication disabilities, who are emerging from a situation of minimal consciousness and becoming gradually more aware of their surroundings (Lancioni, Singh, O'Reilly, Sigafoos, et al., 2012; Nakase-Richardson, Yablon, Sherer, Nick, & Evans, 2009; Rispoli, Machalicek, & Lang, 2010; Taylor, Aird, Tate, & Lammi, 2007). Indeed, a limited motor repertoire and absence of verbal or other functional communication output can make these persons inadequate in dealing with environmental events and interactions in spite of their higher levels of awareness (Cavinato et al., 2009; Katz, Polyak, Coughlan, Nichols, & Roche, 2009; Lancioni, O'Reilly, et al., 2011; Leisman & Kock, 2009; Noé et al., 2012).

Intervention strategies such as transcranial magnetic stimulation and general sensory (e.g., musical) stimulation may produce some positive alertness effects for both groups of persons in that they increase the amount of input the persons receive and help them avoid risks of stimulus deprivation and general impoverishment (Dimyan & Cohen, 2010; Formisano et al., 2001; Lancioni, Bosco, et al., 2010; Lapitskaya, Coleman, Nielsen, Gosseries, & Noordhout, 2009; Magee, 2005, 2007; Pape et al., 2009). In spite of their potential usefulness, the aforementioned strategies may not have a direct and immediate bearing on the development and consolidation of adaptive behavior, that is, on the persons' engagement with and control of environmental events or communication and choice efforts (Lancioni, Bosco, et al., 2010).

One way to help them develop and consolidate adaptive behavior consists of the use of assistive technology combined with behavioral (motivational) strategies (Bauer, Elsaesser, & Arthanat, 2011; Borg, Larson, & Östegren, 2011; Chantry & Dunford, 2010; Lancioni, O'Reilly, et al., 2010; Lancioni, O'Reilly, et al., 2011). Specifically, one might envisage the use of technology-based intervention packages to assist in (a) bridging the gap between the person's behavioral repertoire and the abilities required for the type of adaptive responding targeted and (b) motivating the person to engage in adaptive responding through positive environmental contingencies (Bauer et al., 2011; Catania, 2007; Kazdin, 2001; Lancioni, Singh, et al., 2010; Lancioni, Singh, et al., 2011; Lancioni, Singh, O'Reilly, Sigafoos, Buonocunto, et al., 2011; Reichle, 2011; Shih, 2011). Two main types of technology-based intervention packages may be mentioned here, that is, (a) packages relying on microswitches that allow the person direct access to (engagement with) specific/preferred environmental stimuli, and (b) packages relying on computer presentations of stimulus options and microswitches that allow the person to choose among those options and access (engage with) them (Lancioni, O'Reilly, et al., 2010; Lancioni, Singh, et al., 2010; Lancioni, Singh, O'Reilly, Signorino, et al., 2010).

The two studies reported here were aimed at extending the evidence available on the use of the aforementioned technology-based intervention packages with new participants with acquired brain injury and multiple disabilities. Study I involved five participants in a minimally conscious state. Three of them were provided with intervention packages based on optic microswitches placed on their cheekbone and activated via eye-blinking responses performed with the help of a mini paper sticker, which was attached to their eyelid. Only five other participants had previously used this microswitch arrangement (Lancioni, O'Reilly, et al., 2011; Lancioni, Singh, O'Reilly, Sigafoos, Ricci, et al., 2012). The fourth participant used an intervention package based on tilt microswitches fixed to his right foot's big toe and activated through a small movement of the toe. This response had been used only with three other participants previously (Lancioni, O'Reilly, et al., 2009; Lancioni, Singh, et al., 2009; Lancioni, Singh, O'Reilly, Sigafoos, et al., 2012). The fifth participant used a pressure microswitch fixed inside his hand and activated through a small finger pressure (i.e., used an adapted microswitch-response combination; see Lancioni, Bosco, et al., 2010).

Study II involved three participants who were emerging from a minimally conscious state and were provided with intervention packages based on computer presentations of stimulus options and pressure microswitches fixed inside their hands. The stimulus options also included various functional procedures performed by a caregiver (e.g., clearing the participant's tracheal cannula and washing his or her face), which had never been targeted in previous studies (Lancioni, Singh, et al., 2010; Lancioni, Singh, O'Reilly, Signorino, et al., 2010). The participants' responses were small hand-closure movements that activated the pressure microswitch devices.

2. Study I

2.1. Method

2.1.1. Participants

The five adults participating in this study (Miriam, Nigel, William, Thomas, and Claude) were in special rehabilitation or care centers and had a diagnosis of minimally conscious state following brain injury and coma. All patients showed extensive motor impairment with lack of body and head control, and absence of speech or any other form of communication. Moreover, they used a gastrostomy tube for enteral nutrition as well as a tracheostomy tube and a urinary catheter. Miriam was 37 years old and her condition was subsequent to frontal oligodendroglioma removal about 1 year prior to this study. The neurosurgery was followed by a coma lasting about 2 weeks. This developed into a vegetative state lasting about 6 months. Eventually, her condition progressed into a minimally conscious state. Her total score on the JFK Coma Recovery Scale-Revised (CRS-R) was 8 with partial scores ranging from zero (oromotor/verbal subscale) to 2 (arousal, auditory, and motor subscales) (Kalmar & Giacino, 2005; Lombardi, Gatta, Sacco, Muratori, & Carolei, 2007).