Research in Developmental Disabilities 31 (2010) 397–402

Contents lists available at ScienceDirect

Research in Developmental Disabilities

Two persons with multiple disabilities use orientation technology with auditory cues to manage simple indoor traveling

Giulio E. Lancioni [a,*], Nirbhay N. Singh [b], Mark F. O'Reilly [c], Jeff Sigafoos [d], Francesca Campodonico [e], Doretta Oliva [e]

[a] Department of Psychology, University of Bari, Via Quintino Sella 268, 70100 Bari, Italy
[b] ONE Research Institute, Midlothian, VA, USA
[c] Meadows Center for Preventing Educational Risk, University of Texas at Austin, TX, USA
[d] Victoria University of Wellington, Wellington, New Zealand
[e] Lega F. D'Oro Research Center, Osimo (AN), Italy

ARTICLE INFO

Article history:
Received 4 October 2009
Accepted 6 October 2009

Keywords:
Orientation technology
Auditory cues
Indoor traveling
Travel speed
Multiple disabilities

ABSTRACT

This study was an effort to extend the evaluation of orientation technology for promoting independent indoor traveling in persons with multiple disabilities. Two participants (adults) were included, who were to travel to activity destinations within occupational settings. The orientation system involved (a) cueing sources only at the destinations (i.e., a single sound source per destination), (b) a newly developed electronic control device that allowed the participants to easily manage the activation of the sources at the destinations, and (c) the provision of approval or encouragement messages. Both participants were successful in using the system and performed their travels to the destinations fairly correctly and in relatively short amounts of time within (a) the occupational setting used for the intervention and (b) a similar occupational setting used for checking generalization effects. The findings are discussed in relation to the importance of independent indoor traveling and the impact of the new technology.

1. Introduction

Persons with blindness and other disabilities, such as neuromotor and intellectual impairments, may encounter serious orientation and mobility problems even within their homes and occupational/vocational places (Joffee & Rikhye, 1991; Lancioni, Mantini, O'Reilly, & Oliva, 1999; Lancioni, Oliva, & Bracalente, 1995a; Lancioni, Oliva, & Bracalente, 1995b; Uslan, Malone, & De l'Aune, 1983; Uslan, Russell, & Weiner, 1988). These problems can have serious negative implications in terms of activity engagement, personal independence, self-assurance, and, ultimately, quality of life (Algozzine, Browder, Karvonen, Test, & Wood, 2001; Draheim, Williams, & McCubbin, 2002; Gee, Harrell, & Rosenberg, 1987; Lachapelle et al., 2005; Lancioni, Gigante, O'Reilly, Oliva, & Montironi, 2000; Petry, Maes, & Vlaskamp, 2005).

Teaching these persons to develop maps of their daily indoor areas using miniature replicas of those areas or some landmarks as orientation cues may occasionally lead to successful outcomes (Lancioni, O'Reilly, Oliva, & Bracalente, 1998; Lancioni et al., 2007). In general, however, (a) the information provided by miniature replicas of the real environments is difficult to generalize effectively and (b) the discrimination of the landmarks and their association with different activities and travel directions may be very demanding (Bentzen, 1977; Blasch, Welsh, & Davidson, 1973; Dodds,

* Corresponding author.
E-mail address: g.lancioni@psico.uniba.it (G.E. Lancioni).

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doi:10.1016/j.ridd.2009.10.002

Howarth, & Carter, 1982; Joffee, 1995; Joffee & Rikhye, 1991; Lancioni & Oliva, 1999; Martinsen, Tellevik, Elmerskog, & Storlilokken, 2007).

A potentially effective alternative to the aforementioned maps could be the use of orientation technology and, more specifically, orientation systems relying on auditory direction cues (Lancioni et al., 1995a, 2007; Uslan et al., 1988). These systems are intended to guide (direct) the persons to the destinations without requiring them to possess special spatial/traveling abilities other than orienting/walking to the sound sources that provide direction cues (Lancioni et al., 2007, 2008).

While these systems can be quite useful, efforts are definitely needed to enhance their flexibility and simplicity so that they can more easily suit different environmental and personal situations (Scherer, Sax, Vanbiervliet, Cushman, & Scherer, 2005). Recently, a system was set up which involved (a) cueing sources only at the destinations (i.e., a single sound source per destination), thus it was simplified compared to previous systems, and (b) a portable, electronic control device with keys that the participants used to activate those sources/destinations. Both participants (adults with multiple disabilities) were successful in using the system and improved their traveling (Lancioni et al., 2008).

The present study assessed an adapted version of such a system with two new participants (women) with total blindness and moderate or moderate-to-severe intellectual disability, who were to use the system to travel to activity destinations within familiar occupational settings. Contrary to the participants of the aforementioned study (Lancioni et al., 2008), the two women could not discriminate and use the keys of the control device in the available form. To deal with this problem, a larger control device with wider/different key areas was developed. These key areas, which served for activating the destinations, consisted of embedded optic sensors covered with small (discriminated) objects representing the activities available at the destinations. By removing/detaching an object for an activity (i.e., uncovering the underlying optic sensor), the participant triggered the sound source at the corresponding activity destination. A second technical change (novelty) consisted of equipping the system with the function of providing approval or encouragement messages to the participants during the sessions. This function was deemed important to automatically ensure conditions similar to those to which the participants were used.

2. Method

2.1. Participants

The participants (Nelly and Lucille) were 24 and 21 years old, respectively, and presented with total blindness and intellectual disabilities due to congenital abnormalities or perinatal hypoxia with subsequent encephalopathy. Psychological reports placed them in the moderate intellectual disability area (Nelly) or moderate-to-severe intellectual disability range (Lucille). Moreover, they showed substantial delays in terms of daily living abilities as well as communication and social interaction. The Vineland Adaptive Behavior Scales—Interview Edition (Sparrow, Balla, & Cicchetti, 1984) showed age equivalents of about 3 years on Daily Living Skills and Socialization and near 4 years on Communication for Nelly. Lucille's age equivalents were below 3 years on Daily Living Skills and below 2 years on Communication and Socialization. Both participants were known for their orientation problems and their reliance on staff for reaching relevant destinations within their daily contexts. Both attended a day activity center where they engaged in simple occupational and vocational activities such as assembling or dividing/disassembling two-piece objects, putting away clothes, storing food products/items or other daily material. Nelly had verbalized her interest in participating in the study. Lucille could not do so directly but was reported to start the sessions eagerly. The parents of both participants had signed an informed consent form for the study.

2.2. Settings

Two activity settings were used for each participant, one served as an intervention setting and the other as a generalization setting. The intervention setting, which was the same for the two participants, consisted of three rooms and an entrance/corridor section, which practically constituted a fourth room (for a total area of about 100 m^2). Each of the three regular rooms included two to four destinations, that is, desks with familiar occupational and vocational activities such as those mentioned in the Participants section. The entrance/corridor contained one or two destinations with one or two additional activities. The doors of the rooms were regularly open. The generalization setting included five rooms with nine activity destinations, for an area of about 65 m^2 (Nelly) and a single room with eight activity destinations, for an area of about 100 m^2 (Lucille). The distances that the participants typically traveled to reach the destinations varied between 4 and 17 m.

2.3. Orientation system

The orientation system included a sound source at each destination and a portable, electronic control device. The sources were battery-powered boxes, which contained a transceiver, an optic sensor, an amplified MP3 player with USB pen drive connection, and a pen drive. The pen drive contained recordings of (a) the orientation cues (i.e., combinations of the participant's name with one or two other words such as "Over here, Nelly"), and (b) verbal encouragement and verbal approval sentences (e.g., "Take an object, Lucille" or "Next activity, Lucille", and "Great job, Nelly"). The electronic control device (a box of 20 cm × 15 cm × 4 cm that the participants had at their chest) involved a microprocessor with specific software, a transceiver, and six key areas of 6 cm × 7 cm each. The keys corresponded to destinations (activities) that the