**TECHNOLOGY AND OCCUPATION: CONTEMPORARY VIEWPOINTS**

**The Future of Electronic Aids to Daily Living**

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“Computer. Lights on, 50%.” U.S.S. Enterprise Captain Jean-Luc Piccard in the 24th century? Actually, this technology is available today in the form of electronic aids to daily living (EADLs). Formerly known as electronic controls (Bain, 1996; Dickey, 1993), EADLs allow control of many devices in the environment. Technically, environmental controls refer to heating, ventilation, and air conditioning systems (HVAC). The term *environmental controls* also describes methods of controlling allergens in the environment. The name of this category of assistive technology was changed to EADLs several years ago to better define the technology and how it improves independence in the home (Lange, 1998). This term emphasizes the occupation the technology facilitates rather than the products themselves.

Of assistive technology devices, environmental controls traditionally have been the least funded by third-party payers. The name change has improved funding as payers begin to view this technology as being designed to promote independence in occupation instead of as glorified remote controls for the television set. Similar to many interventions used in occupational therapy practice, little study has documented empirical success of these types of technologies. Rigby et al. (2001) recently examined one aspect of EADL success with a focused population, but this study is only one of few. More studies like theirs must be performed to shift our confidence from intuitive support to more evidenced-based practice.

**What Can the Technology Do Now?**

At this time, EADLs are capable of scheduling, controlling, or monitoring

- audiovisual equipment, including TVs, VCRs, cable, satellite, and stereo systems;
- HVAC systems;
- interior lights (on-off, bright-dim), including ceiling lights;
- motion detector lights (interior, exterior) for security and for lighting upon arriving home;
- motion detector lights that turn on upon entry into a room;
- light sensors that automatically turn on lights when it gets dark;
- ceiling fans;
- appliances (on-off control);
- microwave ovens with sensors that automatically cook any type of food to appropriate doneness;
- appliances with built-in infrared control (i.e., microwave ovens, blenders, alarm clocks, gas fireplaces, Christmas tree lights);
- refrigerators that scan bar codes on food items passed in front of a sensor, compile a shopping list, and send the list via the Internet for at-home delivery;
- telephones;
- intercoms;
- toys (switch-adapted, battery-operated toys; voice-controlled toys);
- e-books (electronic devices that hold the text of one to many books);
- door openers with optional sensors to open doors automatically upon approach;
- electronic door locks;
- bed controllers;
- toilets with remote control auto lid opener, seat warmer, and bidet;
- page turners;
- motorized drapes;
- electronic window openers;
- security systems (remote cameras, alarms);
- sensors that monitor water temperature to prevent scalding;
- controls to select water temperature and water pressure for individual faucets;
- pool cleaners;
- sprinkler systems;
- robotic lawn mowers;
- monitoring systems (sensors that notify when the mail has arrived or when someone is in the driveway);
- weather-monitoring sensors;
- smart pet feeders that automatically feed at programmed intervals (also available for aquariums and outdoor ponds);
- smart pet doors that only allow the pet to enter the home; and
- animal repellers that spray water.

**Home Automation**

Much of this technology has been developed without users with disabilities in mind. Home automation products automate as many features in the home as possible for convenience, security, and energy savings. Home automation is becoming increasingly popular, which drives down prices and improves availability (i.e., Home Depot, rather than specialty catalog), and now is being built into new homes and offices. EADLs often adapt existing home automation technology, providing control of these features. People use home automation equipment by pushing small buttons (whether on a remote control, a wall-mounted keypad, or a computer) or by voice. This technology even can be controlled over the telephone by voice or keypad. EADLs are designed to pro-
provide alternative access to devices in the environment. This alternative access includes switch control; voice control; or control through other assistive technology, such as a communication device or computer. EADLs also provide device control not often addressed by typical home automation, such as hospital beds.

Functional Tasks
Aids to daily living, such as built-up spoon handles or zipper pulls, are intended to increase independence in self-care (dressing, hygiene, bathing, toileting). EADLs also are intended to increase independence in daily living tasks. As our world and our homes continue to become more technical, persons with disabilities need a means for independent control of this part of their lives. EADLs facilitate performance across several categories of function:

- **Communication**: Communicating over distance with others (telephones, intercoms)
- **Education**: Keeping informed and keeping up with current events (audiovisual equipment, page turners)
- **Leisure**: Directing leisure activities independently (audiovisual equipment, telephone, adaptive toys)
- **Household management**: Managing household functions that otherwise would be limited by motor or sensory impairments (lights, appliances, HVAC, window and drape openers, sprinkler systems, automated pet management systems); ensuring security for self, family, and home (security and monitoring systems, door); and ensuring safety in an emergency (telephone, door)
- **Self-care**: Managing independently weight shifts in bed for pressure relief and comfort (bed control) and water temperature for bathing or washing (antiscald temperature sensors)

The Future

**The Next Few Years**
Current EADLs primarily were designed for persons with spinal cord injuries and without cognitive or sensory (primarily visual) limitations. Most switch-accessed EADLs require good vision, reading, and mastery of written English (Lange, 1999a). Voice-accessed EADLs require consistent, clear speech and can be demanding cognitively, particularly if vision or reading is limited (Lange, 1999b). Most EADLs require good memory and sequencing skills. I anticipate that EADLs will be developed to address both issues. Possible solutions include increased use of auditory scanning to accommodate visual or reading limitations and memory requirements, graphics to accommodate reading and other cognitive limitations, and macros to limit required sequencing. Voice recognition continues to improve in accuracy and may accommodate persons with less consistent or articulate speech.

I also anticipate that EADLs will have access methods other than switch scanning and voice. Other areas of assistive technology, such as power wheelchairs and computers, offer a much broader variety of access methods that is not yet available for EADLs. These areas include improved direct access options, such as enlarged keypads with buttons that require little or no activation pressure for persons with decreased fine motor skills or persons who use mouth sticks or head pointers. Several audiovisual remote controls offer large buttons now. Several touch pads with larger keys are also available for X-10 and IR control; however, they are very expensive. Alternative access may include mouse control, which would allow the user to access the EADL with any computer mouse, including head controlled and many other styles. Microwave ovens are being developed to read a bar code on packaged foods to determine the appropriate power level and time to cook the item.

**Five to 25 Years From Now**
This technology changes so quickly that projecting future trends is very challenging. These changes may occur much sooner than 5 years from now, yet these areas are ones that I believe are most needy of long-term change.

Equity. Currently, a gap in price, availability, and features exists between home automation products and EADLs. As the technology continues to improve, this gap will close, particularly for persons able to use voice access.

Voice quality. More and more, home automation products use voice control. As a result, the quality of voice recognition continues to improve, and the price continues to drop.

Built-in features. As home automation continues to grow in popularity, more homes, businesses, and schools will have built-in home automation systems that can be readily adapted for persons with disabilities.

The future also will allow independence in occupations generally not addressed by EADLs currently, including increased independence in basic self-care tasks such as transfers, cooking, feeding, dressing, bathing, and toileting.

Transfers. Clients can now operate some personal lifts if they have sufficient motor control to attach a sling and operate a control panel. Lifts in the future will not require slings or direct access to control. Lifts will be able to move among rooms in the house and up or down to any required height and surface.

Cooking. We already live in a world of fast food and microwave ovens. Clients will be able to choose from a variety of meals that will be automatically moved from the refrigerator or freezer to a cooking appliance, cooked by sensor to the correct temperature, and delivered to the eating location. Feeding for persons with severe motor limitations will require robotics that far exceed the clunky and expensive options currently available.

Dressing. Closet doors will open automatically. Clothes will move on a track in front of the client for selection. The clothes then will be moved out of the closet.

Bathing. Existing technology to activate, regulate, and halt water flow, pressure, and temperature will be readily available to all. Clients will be able to choose shower, bath, or whirlpool; choose room temperature; and choose whether to have bubbles!

Toileting. Clients will be able to control their own lift for placement on a toilet that supports their positioning, toileting, and hygiene needs. After toileting, a bidet and blow dryer would function automatically or on command.

Merging of technologies. For these dreams to become a reality, the world
will continue its technological progress until activities of daily living and EADLs are seen as one area. Robotics will become commonplace in the home and will interface with EADLs. Our world will exceed the technology shown on television shows like “Star Trek” in ways that allow persons with disabilities equal access to the tasks that make up our lives.

The future will require increased collaboration among occupational therapists, researchers, and manufacturers to ensure that product development addresses the needs of persons with physical, cognitive, and sensory limitations. Occupational therapists will continue to be a primary source for evaluations to match individuals with EADLs to maximize occupational capabilities.

Conclusion

Even now, a blending exists among the categories of aids to daily living, EADLs, robotics, computers, and other adaptive equipment and will continue in the future as technologies share from one another. Aids to daily living always have been used for increasing independence in self-care tasks. Assistive technology has been used to increase independence in the areas of mobility, communication, education, and vocation. EADLs merge the areas of aids to daily living and assistive technology to further independence in daily living to areas never previously addressed. ▲

References


Other Resources


