

# DEVELOPMENT OF UNIFORM STANDARDS FOR COGNITIVE TECHNOLOGIES

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## ABSTRACT

Many consumer technologies augment memory, organization, and social relationships. Phone numbers stored on cell phones, search features for email messages, and even smoke alarms are heavily used aspects of contemporary life. Unfortunately, many of these tools are not designed to be usable by a population that could benefit greatly from them—those who have difficulty learning, processing, remembering, communicating, or making decisions. This project focuses on developing design standards and guidelines for people with cognitive impairment. The design principles used for developing these criteria will also benefit children, aging adults, those who speak a foreign language, and those who prefer easy-to-use technologies.

## BACKGROUND

There are approximately 23 million Americans who have some form of cognitive impairment from conditions such as Alzheimer's, attention disorder, cerebral palsy, Down syndrome, learning disability, Parkinson's disease, stroke, and/or traumatic brain injury [1]. People with cognitive impairment face significant obstacles in their ability to achieve their full potential in life, whether at home, school, work, or play [2]. Until recently, this population has largely gone unrecognized by accessibility initiatives in the high-tech industry. While designers have extensive guidelines to reach consumers with sensory and mobility impairments, there is limited information on designing for people with cognitive impairment. Meanwhile, the assistive technology industry's cognitive work has focused on products for people with the most severe limitations in communication. Numerous existing technologies, however, can work with slight modification or customization to meet the

exceptionally wide range of needs experienced by people with cognitive impairment. Recently, cognitive accessibility work for Internet resources has begun through such organizations as Fluid, AEGIS, and the Raising the Floor initiative. In addition, Japan has extensive standards for product design that can best serve an aging population. The goal of this project is to support and extend such model efforts.

## METHODS

### Review of Existing Standards

Existing, relevant standards from the Japanese Standards Association (JSA) and the International Standards Organization (ISO)/IEC JTC 1 Special Working Group on Accessibility were reviewed. Other guidelines and articles identifying user needs and design possibilities were also reviewed.

### Formation of RESNA Standards Committee

A standards committee was formed through RESNA: the RESNA Standards Committee for Cognitive Technologies. Membership recruitment was organized at pertinent conferences such as the Coleman Conference, ATIA, and RESNA. An outreach effort was made to organizations with expertise and interest in cognitive impairment.

### Product Survey

Surveys on a variety of household products and computer and web features have been disseminated to obtain input from those who have a cognitive impairment and those who have a professional or caregiver interest in those with cognitive impairment. IRB approval was obtained from the University of Colorado's Human Research Committee.

## Consumer Reporting System

A draft Consumer Reporting System was developed that can define objective measures of a product's ease of use. Pertinent literature was reviewed, a list of objective criteria was developed, and feedback from the product surveys was compiled.

### **RESULTS**

#### Review of Existing Standards Results

Three ISO and JSA Standards were reviewed for application to people with cognitive impairment:

- ISO/IEC PDTR 29138: The User Needs Summary and Guidance on User Need Mapping
- JIS X 8341-2: Guidelines for older persons and persons with disabilities — Information and communications equipment, software and services — Part 2: Information processing equipment
- JIS X 8341-4: Guidelines for older persons and persons with disabilities — Information and communications equipment, software and services — Part 4: Telecommunications equipment

While these documents were excellent at identifying user needs, they require objective methods of measurement to be of greater value to manufacturers.

Other sources that were utilized were *The Accessibility Imperative: Implications of the Convention on the Rights of Persons with Disabilities for Information and Communication Technologies* (G3ICT, 2007); *The Engineering Handbook of Smart Technology for Aging, Disability, and Independence* (Wiley-Interscience, 2008); the Nordic Guidelines for Computer Accessibility; Section 508 standards; the Trace User Problems and Needs Summary; WCAG 2.0; and *Web Accessibility for Older Users: A Literature Review* from W3C.

#### Formation of RESNA Standards Committee Results

A standards committee was proposed to the RESNA Assistive Technology Board and accepted in June 2010. This committee

oversees standards for ease-of-use evaluations and rating systems for a wide array of personal devices. These include:

- Computer software programs such as screen readers, word processing, and drawing programs
- Consumer electronics such as cell phones, laptops, and digital music players
- Internet access to resources such as email, social networking, and popular sites
- Consumer products and household appliances such as stoves and smoke alarms

Committee membership will maintain a balance between users, manufacturers, and experts (researchers, clinicians, and educators). A roundtable meeting for membership recruitment was held at the Coleman Conference in October 2010. Future roundtable meetings are scheduled at the ATIA Conference in January 2011 and at the RESNA Conference in June 2011.

Personal invitations to participate were sent to two dozen organizations and individuals. The outreach effort extends to associations that represent people with cognitive impairment, regardless of their programs with technology, as well as to key technology organizations, such as the Consumer Electronics Associations, regardless of their previous attention to the needs of people with cognitive impairment. It also includes the handful of organizations who have combined attention to technology and the needs of people with cognitive impairment—such as the Trace Center, Fluid, Raising the Floor, G3ICT, and the Japanese Standards Association.

#### Product Survey Results

Surveys on a variety of household products and computer and web features were disseminated to obtain input from those who have a cognitive impairment and those who have a professional or caregiver interest in those with cognitive impairment. A survey developed to find out which products are most important to start testing for people with cognitive impairment resulted in 38 responses (3 caregivers, 11 clinicians, 11 researchers, 12 disability advocates, and 1 not reported)

(Table 1). One participant only provided commentary without ranking any of the survey categories. Participants were asked if a particular product should be studied “now” or “later” to avoid the complex decision-making required for a Likert Scale.

Table 1: Product Ranked as Important to Address Now: n=37

Common Products Used for Activities of Daily Living	Participants Responding Now
Cell phones	37
Transportation issues (bus routes/schedules)	34
Microwaves	30
Fire extinguishers	27
Televisions	26
Portable music players	26
<b>Computer Programs/Software/Hardware</b>	
Visibility of information on the screen	32
Connecting to the Internet	31
Email programs	31
Understanding the information presented	31
Calendaring programs	30
Using physical controls (keyboard, mouse)	29
Web browsers	29
Screen readers	29
Figuring out how to do things	28
Errors and recovery	27

In addition, 30 out of 38 participants were committed to participating further in this research project on some level from evaluating the reporting system to participating in the project advisory board.

The Ease-of-Use product survey targeting cognitive disabilities was distributed through the RESNA e-blast, the Georgia Tech CATEA database, the NCPAD newsletter, and on the ACM listserv. An announcement about both the caregiver and user surveys was distributed in an ATIA newsletter and distributed at the Tenth Annual Coleman Institute Conference.

## Consumer Reporting System Results

A Consumer Reporting System was drafted that can define measures of a product’s complexity, memory demands, motor control demands, prompts, and other features of importance to people with cognitive impairment. Some of the features to be measured include the number of layers for key functions, error notification and recovery, customization for timed functions, lifespan and automated update policies, reading level, security/privacy features, actuation force and fine motor movements, shape and size, font and contrast, battery life, and ease of recharging.

### Simple Camera (disposable film)

#### Cognitive Result: A

- No excess programs
- Reliable center focus
- Simple one click button to take a picture
- Larger button size
- Easy to grasp shape
- Loud “click” tones
- Traditional look-through viewer



Figure 1: Simple Camera- Result A

### Complex Camera (digital single lens reflex)

#### Cognitive Result: M

- Multi-level menus
- Custom menus
- Heavy, large shape
- Interchangeable lenses
- Multiple program functions
- Multiple buttons, wheels, switches
- Requires more knowledge to operate
- Traditional look-through viewer



Figure 2: Complex Camera- Result M

A comprehensive list of criteria common to consumer technologies and of importance to people with cognitive impairment was developed and includes approximately 200 items. Table 2 illustrates entries for two of these. The categories, design issues, user needs, and measurements were culled from related standards, manufacturer’s cognitive accessibility considerations, published

guidelines, readability/clear language guidelines, and the literature. This list is under constant revision and refinement by the project team.

The initial criteria categories were designed to focus the work on objectively measurable elements: connections, customer service and support, customization opportunities, documentation and labeling, durability, input; features; operation and navigation; outputs, packaging, physical characteristics, power and other requirements, portability, price, and standards that apply. The criteria within these categories were coordinated with the design issue, user needs, and measurements as identified from other standards, guidelines, the literature, and product testing at the University of Colorado's Assistive Technology Partners' AT product testing lab.

Table 2: Sample Entries of Consumer Technology Criteria

Category	Outputs	Inputs
Group	Output function	Keyboard
Subgroup	Alerts	Key
Design Issue	Option for alert messages present until dismissed	Force required to push or turn button/knob/icon should not exceed 5 pounds (22.2 N) (Section 508, 1194.23 k-2)
User Need Category	Timing	Motor assistance, Durability
Measurement	Yes or No	Pounds/ Newtons
User Need	Warnings and similar alert messages must remain stable long enough to be discovered by the user (Nordic Guidelines, 8.2)	Unintentional pushing or difficulty pushing

The final product will guide designers and manufacturers. It will also present consumer information in a way that can match product features to user needs. A web-based repository for the data is likely, and the project team is considering tools to add user commentary to such a site.

## CONCLUSIONS

The results of this project, survey output, reports, criteria lists, experts identified, etc., will be used to start testing the ease of use of products identified as important for people with cognitive impairment. The reports and standards developed by this project address a broad range of household products, consumer electronics, Internet resources, and software applications. This set of standards will help guide manufacturers to produce more universally designed products that better meet everyone's needs. The benefits of standardization include:

- Increased usability
- Informed consumers
- Educated technology developers
- International consistency
- Expanded markets

This reporting system will help give consumers of all abilities more knowledge in choosing products that best meet their needs, similar to how food fact labels help consumer make better nutritional choices. This project is producing much needed data for a population that often gets overlooked. This groundwork will enhance future research in this area. It is also anticipated that increased ease of use will benefit all consumers.

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## REFERENCES

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